## Standardized Bycatch Reporting Methodology

An Omnibus Amendment to the Fishery Management Plans of the Mid-Atlantic and New England Regional Fishery Management Councils

March 2015

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Amendment 5 to the Atlantic Bluefish Fishery Management Plan (FMP);
Amendment 6 to the Atlantic Herring FMP;
Amendment 4 to the Atlantic Salmon FMP;
Amendment 16 to the Atlantic Sea Scallop FMP;
Amendment 4 to the Deep-Sea Red Crab FMP;
Amendment 15 to the Mackerel, Squid, and Butterfish FMP;
Amendment 7 to the Monkfish FMP;
Amendment 20 to the Northeast Multispecies FMP;
Amendment 4 to the Northeast Skate Complex FMP;
Amendment 4 to the Spiny Dogfish FMP;
Amendment 17 to the Summer Flounder, Scup, and Black Sea Bass FMP;
Amendment 15 to the Surfclam and Ocean Quahog FMP; and
Amendment 4 to the Tilefish FMP

Including a
Final Environmental Assessment, a Regulatory Flexibility Act Assessment, and a Regulatory Impact Review

March 2015

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Draft EA Prepared: October 2013
Draft EA Adopted by MAFMC: April 2014
Draft EA Adopted by NEFMC: April 2014
Final EA Submitted to NMFS: March 2015

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## Executive Summary

This is an omnibus amendment to the fishery management plans (FMPs) of the Mid-Atlantic and New England Fishery Management Councils. This omnibus amendment was developed to address the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) to include, in all FMPs, a standardized bycatch reporting methodology (SBRM). A public review draft was prepared to provide the public an opportunity to review the alternatives being considered by the Councils and NOAA's National Marine Fisheries Service (NMFS) and to comment on the document and/or the actions proposed by the Councils and NMFS. Following the formal public review phase, the Councils selected preferred alternatives and revisions were made to the document to reflect the Council's preferred alternatives and to address and respond to the comments provided by the public.

The purpose of the amendment is to: Explain the methods and processes by which bycatch is currently monitored and assessed for Greater Atlantic Region fisheries; determine whether these methods and processes need to be modified and/or supplemented; establish standards of precision for bycatch estimation for all Greater Atlantic Region fisheries; and, thereby, document the SBRM established for all fisheries managed through the FMPs of the Greater Atlantic Region. An objective of the SBRM is to establish, maintain, and utilize biological sampling programs designed to minimize bias to the extent practicable, thus promoting accuracy while maintaining sufficiently high levels of precision. The scope of the amendment is limited to those fisheries that are prosecuted in the Federal waters of the Greater Atlantic Region and managed through an FMP developed by either the Mid-Atlantic or New England Council.

There are 13 FMPs to be amended through this action, and these FMPs address fisheries for 40 species. Five FMPs were developed by the Mid-Atlantic Council, six by the New England Council, and two were developed jointly by both Councils. Many of these FMPs have a long history dating back to the time the Magnuson-Stevens Act was first enacted, while others are relatively new and have only been in place for a few years. There have been a variety of amendments, framework adjustments, and other actions to modify the management measures implemented under these FMPs.

Although management measures are typically developed and implemented on an FMP-by-FMP basis, from the perspective of developing a bycatch reporting system, there is overlap among the FMPs and the fisheries that occur in New England and the MidAtlantic that could result in redundant and wasteful requirements if each FMP is addressed independently. For example, New England vessels using extra-large mesh gillnets catch monkfish, skates, and Northeast multispecies, often on the same fishing trip, and, therefore, most participants in this fishery must operate according to the regulations implemented under three different FMPs. To distinguish between the management units identified in individual FMPs and the fisheries that operate under the aegis of one or more FMPs, the SBRM is designed around "fishing modes" defined by the type of fishing gear used and the area from which the vessels depart. There are 56
fishing modes defined in the SBRM, some of which further subdivide a fishery by the mesh size of the gear used (for gillnets and otter trawls), or by the type of permit and access area program (for sea scallop dredges). Although there are differences among the modes, the participants in these fishing modes fish throughout the Gulf of Maine, Georges Bank, and the Mid-Atlantic Bight, and land their catch across a large number of fishing ports from the Outer Banks of North Carolina to Downeast Maine.

Information related to discards in a fishery can be collected and monitored in a variety of ways, but the primary sources of information on discards are at-sea fishery observers, recreational fisheries surveys, and fishing vessel trip reports (FVTRs). Information gained from primary sources on fishery discards is used in conjunction with information from fishery independent surveys, seafood dealer purchase reports, and FVTRs to conduct stock assessments and provide scientific advice to fishery managers. Although their application is generally quite limited, supplemental information on discards and fisheries can be obtained from industry-based surveys, study fleets, and alternate monitoring platforms. In addition to these sources of information, there are several new and developing technologies that could one day be used to collect information related to discards, and these include electronic video monitoring, image capture and processing, and other specialized monitoring programs.

Generally, an SBRM can be viewed as the combination of sampling design, data collection procedures, and analyses used to estimate bycatch in multiple fisheries. The SBRM provides a structured approach for evaluating the effectiveness of the allocation of fisheries observer effort across multiple fisheries to monitor a large number of species. Several specific analyses are conducted to calculate a measure of the variance associated with the data collected by fisheries observers and to determine the most appropriate fisheries observer coverage levels and the optimal allocation of observer effort across the fisheries in order to minimize the variance to the degree practicable. Given a target level of data precision desired by fisheries scientists and managers, fisheries observer coverage levels can be calculated that would be expected to provide data of the desired precision. Both precision and accuracy are addressed in analyses conducted using observer data and to determine the appropriateness of the data for use in stock assessments and by fishery managers.

Greater Atlantic Region fisheries were stratified into 39 fishing modes and discard rates of 60 species/species groups of fish, sea turtles, marine mammals, and sea birds were examined using 2004 Northeast Fisheries Observer Program (NEFOP) and FVTR data. Data from 2004 were used because 2004 was the most recent year for which complete data were available at the time the 2007 SBRM Omnibus Amendment and associated analysis was initiated. Two ratio estimators were used: Discard-to-daysabsent (d/da) and discard-to-kept ( $\mathrm{d} / \mathrm{k}$ ) pounds of all species. Three computational methods were employed to derive these ratio estimates: A separate ratio method; a combined ratio method; and a simple expansion method. In general, estimation of total discards was comparable for each ratio estimator and method. The analysis of ratio estimates was published and reviewed at the time of the 2007 SBRM Omnibus Amendment. Since that time additional fishing modes have been identified and incorporated into the SBRM process. The validity of this analysis is not dependent on a
specific year's catch data. Therefore, it was unnecessary to duplicate this work for this new amendment document and the analysis used in the 2007 SBRM Omnibus Amendment has been retained. Analyses to refine and improve discard estimations that was conducted after the 2007 SBRM Omnibus Amendment are included and discussed in this amendment. Throughout this document, landings data have been updated where appropriate to characterize the current condition of the fishery.

The precision associated with all six estimates for each fleet and species/species group combination was examined. Again, precision levels were comparable for each estimator and method. In the end, the combined ratio method was selected using discard-to-kept pounds. Data for kept pounds are more easily verified than data for days absent, and the combined ratio method better utilized information associated with kept pounds. A coefficient of variation (CV) of 30 percent was selected as a standard level of precision based upon the recommendation of the National Working Group on Bycatch. The number of observed sea days (and trips) necessary to achieve a CV of 30 percent for species was derived for each fishing mode and species/species group combination. The total estimated number of sea days necessary to achieve a 30 percent CV in 2004, would have exceeded 71,000 days, but this amount can be substantially reduced through the application of several "importance filters." Analyses were performed to evaluate potential sources of bias in the 2004 NEFOP data in order to characterize the accuracy of the data. In general, there was no evidence of a systematic bias in the amount of kept pounds, trip duration, or area fished between the NEFOP and FVTR data, indicating that the data are sufficiently accurate. Additional analyses of potential sources of bias in observer data have been conducted since the 2007 SBRM Omnibus Amendment, and continue to find no evidence of a systematic bias in these data.

To meet the purpose and need for this amendment, the Councils considered alternatives for seven principal components of the SBRM: (1) Bycatch reporting and monitoring mechanisms; (2) analytical techniques and allocation of fisheries observer effort; (3) a performance standard for the SBRM; (4) an SBRM reporting and review process; (5) framework adjustment provisions; (6) a process to prioritize the observer coverage allocations calculated based on the SBRM; and (7) provisions to allow industryfunded observers and/or observer set-aside programs. In addition to the status quo bycatch reporting and monitoring mechanisms, the Councils considered whether to implement electronic video monitoring to supplement or replace at-sea fisheries observers. The Councils considered four alternatives relative to the process used to determine the appropriate allocation of fisheries observer effort: The pre-2007 SBRM Omnibus Amendment process; the integrated allocation approach; the integrated allocation approach with importance filters (the status quo since adoption of the 2007 SBRM Omnibus Amendment); and an alternative that would establish the target observer coverage levels at 20 percent for fisheries that catch common species and 50 percent for fisheries that catch rare species.

Currently, there is no formal SBRM performance standard, so in addition to the status quo, the Councils considered adoption of a coefficient of variance (CV) of 30 percent of the total discards as the performance standard for the SBRM. Although there is currently no required process to provide periodic evaluations of the effectiveness of the

SBRM, the Councils considered requiring specific information to be provided at regular intervals for all of the subject FMPs. In addition, the Councils considered incorporating elements of the SBRM into the framework adjustment and annual specification provisions of each FMP.

To clearly and effectively prioritize the observer coverage allocations based on the SBRM, the Councils are considered alternatives for two different aspects of this prioritization process. The Councils considered two alternatives for how to determine whether the available Federal budget is insufficient to fully implement the SBRM across all fishing modes: The status quo, and identifying specific SBRM funding sources. The Councils considered three alternatives for a prioritization process to distribute the available observer sea days if resources are limiting: Consultation with the Councils, a reduction to all fleets proportional to the funding shortfall, or an approach that uses an iterative process to use the penultimate cell for each fleet. In the unlikely event that Federal funding is so restricted in a given year that there are not enough observer sea days to achieve the minimum pilot coverage in each fleet, the Councils considered three alternatives for allocating the available coverage: Prioritizing fleets ad-hoc, reducing the shortfall by sequentially eliminating coverage in fleets which have the highest minimum coverage days, and reducing the shortfall by sequentially eliminating coverage in fleets that had the highest ratio of minimum pilot coverage to actual days fished in the previous year. In anticipation of future management actions, the Councils also considered creating a framework for industry-funded observer programs including the development of observer set-aside programs.

The preferred alternatives (shaded) of the Mid-Atlantic and New England Councils are identified below.

| SBRM Element | Alternatives Under Consideration |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1. Bycatch Reporting and Monitoring Mechanisms | Status quo |  |  |  | Implement electronic video monitoring |  |  |
| 2. Analytical Techniques and Allocation of Observers | $\begin{gathered} \text { Pre-2007 } \\ \text { SBRM } \\ \text { Amendment } \end{gathered}$ |  | Integrated allocation approach |  | Integrated allocation approach w/ importance filter |  | Minimum percent observer coverage |
| 3. SBRM Performance Standard | No performance standard |  |  |  | Establish a CV standard |  |  |
| 4. SBRM Review/ Reporting Process | Status quo |  |  | Specify an SBRM review process |  | Require periodic discard reports |  |
| 5. Framework Adjustment Provisions | Status quo | Framework adjustment |  | Frameworks and annual adjustments |  | Frameworks and annual adjustments excluding fishing modes |  |
| 6. Prioritization Process |  |  |  |  |  |  |  |
| 6.1 Funding trigger | Status quo |  |  | Identify specific SBRM funding sources |  |  |  |
| 6.2 Reallocation | Council consultation |  |  | Proportional adjustment |  | Penultimate Cell Approach |  |
| 6.3 Less than Minimum Pilot Coverage | Ad hoc prioritization |  |  | Remove fleets with high MPC |  | Remove fleets with high MPC to days absent ratio |  |
| 7. Industry-Funded Observer Programs | Status quo |  |  | Observer provider approval |  | Framework provisions |  |

Consideration of the potential and expected environmental impacts of the alternatives described in this amendment illustrates that, because this amendment is focused entirely on the procedural elements (i.e., the methodology) associated with the development and implementation of an SBRM, there are no direct, indirect, or cumulative effects expected on biological resources (including fishery resources, protected resources, or other non-fishery resources), or on the physical environment (including essential fish habitat) for any of the alternatives, and there are no expected socio-economic effects associated with any of the preferred alternatives. Economic impacts on fishing vessel permit holders associated with the non-preferred alternative to implement electronic video monitoring could be substantial, as the cost to purchase, install, and maintain these systems is still quite high.

## List of Acronyms and Abbreviations

| ABC | Acceptable Biological Catch |
| :---: | :---: |
| ACCSP | Atlantic Coastal Cooperative Statistics Program |
| ACFCMA | Atlantic Coastal Fishery Cooperative Management Act |
| ACL | Annual Catch Limit |
| AM | Accountability Measure |
| APA | Administrative Procedure Act |
| APAIS | Access Point Angler Intercept Survey |
| ASMFC | Atlantic States Marine Fisheries Commission |
| CEQ | Council of Environmental Quality |
| CFDBS | Commercial Fisheries Database System |
| CV | Coefficient of Variation |
| CZMA | Coastal Zone Management Act |
| d/da | Discard-to-days-absent ratio |
| d/e | Discard-to-effort ratio |
| d/k | Discard-to-kept ratio |
| DAS | Days-at-sea |
| EA | Environmental Assessment |
| EEZ | Exclusive Economic Zone |
| EFH | Essential Fish Habitat |
| EO | Executive Order |
| ESA | Endangered Species Act |
| eVTR | Electronic Fishing Vessel Trip Report |
| FMP | Fishery Management Plan |
| FOIA | Freedom of Information Act |
| FONSI | Finding Of No Significant Impact |
| FVTR | Fishing Vessel Trip Report |
| GAM | Generalized Additive Model |
| GARFO | Greater Atlantic Regional Fisheries Office (formerly NERO) |
| GPS | Global Positioning System |
| IBS | Industry-Based Survey |
| ICNAF | International Commission for the Northwest Atlantic Fisheries |
| IFQ | Individual Fishing Quota |
| IQA | Information Quality Act (also known as the Data Quality Act or DQA) |


| IRFA | Initial Regulatory Flexibility Analysis |
| :--- | :--- |
| ITQ | Individual Transferable Quota |
| km | Kilometer |
| lb | Pounds |
| MA | Mid-Atlantic |
| MAFMC | Mid-Atlantic Fishery Management Council |
| MMPA | Marine Mammal Protection Act |
| MRIP | Marine Recreational Information Program |
| MRFSS | Marine Recreational Fisheries Statistics Survey |
| MSR | Master Site Register |
| NAFO | Northwest Atlantic Fisheries Organization |
| NASCO | North Atlantic Salmon Conservation Organization |
| NE | New England |
| NEAMAP | Northeast Area Monitoring and Assessment Program |
| NEFMC | New England Fishery Management Council |
| NEFOP | Northeast Fisheries Observer Program |
| NEFSC | Northeast Fisheries Science Center |
| NEPA | National Environmental Policy Act |
| NERO | Northeast Regional Office (renamed GARFO in 2014) |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NRC | National Research Council of the National Academies of Science |
| NWGB | National Working Group on Bycatch |
| OLE | NOAA Office of Law Enforcement |
| PRA | Paperwork Reduction Act |
| PREE | Preliminary Regulatory Economic Evaluation |
| PSP | Paralytic Shellfish Poisoning |
| QA/QC | Quality Assurance/Quality Control Assessment Workshop/Stock Assessment Review Committee |
| RFA | Regulatory Flexibility Act |
| RIR | Regulatory Impact Review |
| SAFE | Stock Assessment and Fishery Evaluation |
| SAFIS | Standard Atlantic Fisheries Information System |
| SAP | Special Acess Program |
| Stock | NAR |


| SBRM | Standardized Bycatch Reporting Methodology |
| :--- | :--- |
| SFCPO | State-Federal Constituent Programs Office |
| SSC | Scientific and Statistical Committee |
| TAC | Total Allowable Catch |
| TAL | Total Allowable Landings |
| U.S. | United States |
| USFWS | United States Fish and Wildlife Service |
| VEC | Valued Ecosystem Component |
| VMS | Vessel Monitoring System |

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# Chapter 1 I ntroduction and Background 

### 1.1 Introduction

This document amends the fishery management plans (FMPs) of the Greater Atlantic Region developed according to the provisions of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) under the jurisdiction afforded by the Magnuson-Stevens Act to the Mid-Atlantic and New England Fishery Management Councils (Councils). These FMPs (see Table 1) were developed by the Councils in the years since the original Fishery Conservation and Management Act was enacted in 1976, and represent the primary means by which commercial and recreational fishing activities are managed in the Federal waters of the U.S. Exclusive Economic Zone (EEZ).

The fisheries of the Greater Atlantic Region represent a wide variety of target species, fishing operations, and public interests. In many of these fisheries, some proportion of the fish that are caught are not kept to be sold or consumed, but are instead returned to the ocean (discarded). These discards are also known as bycatch, and the Magnuson-Stevens Act directs the Councils and NMFS to address bycatch in all FMPs. This amendment will examine, for these Greater Atlantic Region fisheries, how information on bycatch is collected and assessed, explore alternative methods of collecting information on bycatch, and consider whether any changes to current methods are warranted.

Although this amendment has been prepared primarily in response to the requirements of the Magnuson-Stevens Act, it also addresses the requirements of the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), the Regulatory Flexibility Act (RFA), the Paperwork Reduction Act (PRA), the Coastal Zone Management Act (CZMA), Executive Orders (EO) 12866 and 13132, the Administrative Procedure Act (APA), and the Information Quality Act (IQA, also known as the Data Quality Act, or DQA). These other applicable laws and directives help ensure that, in developing a fishery management action, the Councils and NMFS fully consider the expected impacts the action may have on the marine environment, living marine resources, and human communities. This integrated amendment document contains all elements of an FMP amendment, an Environmental Assessment (EA), a Regulatory Impact Review (RIR), and a Regulatory Flexibility Assessment.

### 1.2 The Magnuson-Stevens Act, National Standard 9, and the Required Provisions

In 1996, President Clinton signed into law the Sustainable Fisheries Act that, among other things, added three new National Standards to address fishing communities,
bycatch, and safety at sea, put additional emphasis on conserving fish stocks, and added provisions related to essential fish habitat (EFH). The Sustainable Fisheries Act amendments to the Magnuson-Stevens Act included defining the term "bycatch," adding National Standard 9 to require bycatch to be minimized to the extent practicable, and requiring FMPs to establish a standardized bycatch reporting methodology (SBRM) to assess bycatch.

The Magnuson-Stevens Act now defines bycatch as "fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards." The Magnuson-Stevens Act expands upon this to say "[bycatch] does not include fish released alive under a recreational catch and release fishery management program." Also, the Magnuson-Stevens Act defines fish as "finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds." Thus, under the Magnuson-Stevens Act, the term bycatch includes all regulatory and economic discards of finfish, shellfish and other invertebrates, sea turtles, marine plants, corals, etc., but does not include marine mammals or seabirds.

National Standard 9 states that "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." Section 303(a) identifies the required provisions of any FMP prepared by a Council or NMFS (acting on behalf of the Secretary of Commerce) and includes (at § 303(a)(11)) the requirement to "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 focus of this amendment is on the requirement to establish an SBRM for each fishery managed under a Mid-Atlantic or New England Council FMP.

In January 2007, President Bush signed the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (Magnuson-Stevens Reauthorization Act) into law. This Act reauthorized the Magnuson-Stevens Act and, among other things, requires the use of annual catch limits and accountability measures to prevent overfishing, provides for widespread market-based fishery management through limited access privilege programs, strengthens the role of science in decision-making, and calls for increased international cooperation. Although the Magnuson-Stevens Reauthorization Act touches on many aspects of fisheries management, nothing in the Act changes the SBRM provisions of the Magnuson-Stevens Act, or any of the associated provisions relevant to this amendment (National Standard 9, definitions of bycatch and fish).

### 1.3 Statement of the Problem

For most, if not all, fisheries, some proportion of discards die as a result of being caught and/or being discarded. The mortality rate of discarded catch is not known for many resource species and can vary under different conditions. Bycatch can affect fisheries and fishery resources in several important ways: (1) Uncertainty related to the
amount and mortality of discards increases the uncertainty associated with stock assessments, diminishing managers' ability to accurately set and achieve optimum yield from a fishery; (2) time spent sorting and discarding unwanted catch reduces the efficiency of fisheries; and (3) mortality of discarded fishery resources precludes other, more valuable, uses of those resources (as future landings, prey for other species, etc.).

In some fisheries, catch rates of unwanted fish, or the mortality rates of discarded fish, may be sufficiently low that bycatch problems are minimal. In other fisheries, however, if both the catch rates of unwanted fish and the mortality of the discards are sufficiently high, bycatch problems may warrant significant management attention. The first step in understanding the scope and extent of any bycatch problems that may be associated with a fishery is to establish the means by which information on bycatch in the fishery can be collected. Scientists and managers must be able to ensure that the bycatch information collection program is adequately reliable and accurate to identify and address the relevant scientific and management needs (e.g., that the lack of information on bycatch and bycatch mortality does not compromise the ability to conduct stock assessments on which to base management decisions). Therefore, the primary purpose of bycatch reporting and monitoring is to collect information that can be used reliably as the basis for making sound fisheries management decisions.

### 1.4 Purpose and Need

This amendment is needed to ensure that all FMPs of the Greater Atlantic Region, developed under the jurisdiction of the New England and Mid-Atlantic Councils, comply with the SBRM requirements of the Magnuson-Stevens Act. The purpose of this amendment is to:
(1) Explain the methods and processes by which bycatch is currently monitored and assessed for Greater Atlantic Region fisheries;
(2) Determine whether these methods and processes need to be modified and/or supplemented;
(3) Establish standards of precision for bycatch estimation for all Greater Atlantic Region fisheries; and, thereby,
(4) Document the SBRMs established for all fisheries managed through the FMPs of the Greater Atlantic Region.

The scope of this amendment is limited to those fisheries that are prosecuted in the Federal waters of the Greater Atlantic Region and managed through an FMP developed by either the Mid-Atlantic or the New England Council (see Table 1). This amendment does not address fisheries managed through an FMP developed by any other regional fishery management council, the Highly Migratory Species branch of NMFS, the Atlantic States Marine Fisheries Commission (ASMFC) (except those joint FMPs established by both the ASMFC and either the Mid-Atlantic or New England Council), or
under the aegis of the Atlantic Coastal Fishery Cooperative Management Act (ACFCMA) (including American lobster and northern shrimp).

It is an objective of the SBRM to be implemented through this amendment that the resulting biological sampling programs be designed to minimize bias to the extent practicable, thus promoting the accuracy of the data, while maintaining a high level of precision. ${ }^{1}$ Although throughout this document the Northeast Fisheries Observer Program (NEFOP) will be repeatedly referenced as the primary source of discard data on which the SBRM is based, the purpose and need (objectives) of this amendment should not be confused with the objectives of the Observer Program. The objectives of the Observer Program are broad and extend well beyond the scope of this amendment, including: Estimating takes of species protected under the Marine Mammal Protection Act and/or the Endangered Species Act; collecting biological information about fisheries catches; monitoring experiments and experimental fishing; learning about the economics of fishing; measuring fishing gear performance and characteristics; monitoring international fishing in U.S. waters; and maintaining links between scientists, managers, and fishermen. The objectives of the SBRM Omnibus Amendment, however, are quite specific to meeting the SBRM-related provisions of the Magnuson-Stevens Act. For more information about the objectives and operations of the NEFOP, see the Fisheries Observer Program Manual (NEFSC 2013a) and the Biological Sampling Manual (NEFSC 2013b).

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## SBRM Omnibus Amendment

| FMP | Managed Species |
| :---: | :---: |
| Atlantic Bluefish | Atlantic bluefish (Pomatomus saltrix) |
| Atlantic Herring | Atlantic herring (Clupea harengus) |
| Atlantic Salmon | Atlantic salmon (Salmo salar) |
| Deep-Sea Red Crab | deep-sea red crab (Chaceon quinquedens) |
| Mackerel, Squid, and Butterfish | Atlantic mackerel (Scomber scombrus) longfin squid (Doryteuthis pealeii) shortfin squid (Illex illecebrosus) butterfish (Peprilus triacanthus) |
| Monkfish | monkfish (Lophius americanus) |
| Northeast Multispecies | LARGE-MESH <br> American plaice (Hippoglossoides platessoides) <br> Atlantic cod (Gadus morhua) <br> Atlantic halibut (Hippoglossus hippoglossus) <br> haddock (Melanogrammus aeglefinus) <br> ocean pout (Zoarces americanus) <br> pollock (Pollachius virens) <br> redfish (Sebastes faciatus) <br> white hake (Urophycis tenuis) <br> windowpane (Scopthalmus aquosus) <br> winter flounder (Pseudopleuronectes americanus) <br> witch flounder (Glyptocephalus cynoglossus) <br> yellowtail flounder (Limanda ferruginea) <br> Atlantic wolfish (Anarhichas lupus) <br> SMALL-MESH <br> offshore hake (Merluccius albidus) <br> red hake (Urophycis chuss) <br> silver hake/whiting (Merluccius bilinearis) |
| Northeast Skate Complex | barndoor skate (Dipturus laevis) clearnose skate (Raja eglanteria) little skate (Leucoraja erinacea) rosette skate (Leucoraja garmani) smooth skate (Malacoraja senta) thorny skate (Amblyraja radiata) winter skate (Leucoraja ocellata) |
| Sea Scallop | Atlantic sea scallop (Placopecten magellanicus) |
| Spiny Dogfish | spiny dogfish (Squalus acanthias) |
| Summer Flounder, Scup, Black Sea Bass | black sea bass (Centropristis striata) scup (Stenotomus chrysops) summer flounder (Paralichthys dentatus) |
| Surfclam and Ocean Quahog | Atlantic surfclam (Spisula solidissima) ocean quahog (Arctica islandica) |
| Tilefish | golden tilefish (Lopholatilus chamaeleonticeps) |

Table 1. List of affected FMPs and managed species.

### 1.5 Issues to be Resolved

## What is the reason this amendment is being developed?

In 2003, the New England Council submitted to NMFS (acting on behalf of the Secretary of Commerce) Amendment 13 to the Northeast Multispecies FMP and, separately, Amendment 10 and Framework Adjustment 16 to the Atlantic Sea Scallop FMP. Both amendments and the framework adjustment proposed substantial changes to the management structures for the groundfish and sea scallop fisheries, including new areas closed to fishing, changes to and reductions in allowable fishing days-at-sea (DAS), and new fishing gear requirements, among other things. Both amendments and the framework adjustment were approved in 2004, and plaintiffs Oceana, the Conservation Law Foundation, and the Natural Resources Defense Council filed suit in the U.S. District Court for the District of Columbia challenging several aspects of Amendment 13. Oceana also later filed suit challenging several aspects of Amendment 10 and Framework 16. In both suits, the Court found the SBRM elements of the amendments and the framework to be inconsistent with the provisions of the Magnuson-Stevens Act.

In Oceana, Inc., et al., v. Donald L. Evans, et al., challenging Amendment 13 (Oceana v. Evans I), the Court found that the amendment failed to fully evaluate reporting methodologies to assess bycatch, did not mandate an SBRM, and failed to respond to potentially important scientific evidence. In Oceana, Inc., v. Donald L. Evans, et al., challenging Amendment 10 and Framework 16 (Oceana v. Evans II), the Court similarly found that the amendment and framework did not fully evaluate reporting methodologies, did not sufficiently address potentially important scientific evidence, and did not mandate a methodology for bycatch monitoring. In both cases, the Court remanded to the Secretary for further action the SBRM aspects of Amendment 13 and Amendment 10.

In order to comply with the two Court orders, NMFS and the New England Council were required therefore to amend the Northeast Multispecies and Atlantic Sea Scallop FMPs to ensure they comply with the SBRM provisions of the MagnusonStevens Act. Because many bycatch reporting and monitoring methods apply to and are interrelated with all Greater Atlantic Region fisheries, and because some of the weaknesses in the SBRM aspects of Amendment 13 and Amendment 10 may exist in other Greater Atlantic Region FMPs, NMFS and both Councils agreed to amend all Greater Atlantic Region FMPs in one "omnibus" amendment.

After the 2007 SBRM Omnibus Amendment was implemented, a legal challenge was filed (Oceana v Locke). The U.S. District Court initially found in favor of the Government on all counts. However, that ruling was appealed by the plaintiffs, and the U.S. Court of Appeals issued an opinion that found fault with one element of the amendment, the "prioritization process." In its decision, the Court found that NMFS had too much discretion when determining if there were sufficient resources available to fund the SBRM and too much discretion in how the available observer sea days would be reallocated. The Court ordered the amendment be vacated and remanded to the agency
for further proceedings. To comply with this Court order, both Councils and NMFS agreed to develop an omnibus amendment based on the extensive work already completed for the 2007 amendment, which also addressed the Court's concerns regarding the prioritization process.

What is meant by a "standardized" bycatch reporting methodology?
Although the Magnuson-Stevens Act includes the requirement for an SBRM, it does not define or explain what is meant by a "standardized" reporting methodology. The NOAA Office of General Counsel provided additional guidance on this issue by explaining that the provision does not require regional or national standardization, but rather that the requirement applies to each FMP for the fishery managed under it (NOAA Office of General Counsel 1997). The methodology used could, therefore, vary from one gear type to another, as long as the bycatch reports yield compatible data. For example, under one FMP, a dock intercept interview survey may be the most appropriate methodology to collect bycatch data in a shore-side recreational fishery, while an at-sea observer program may be the most appropriate methodology used to collect bycatch data from commercial fishing vessels. Under this definition, as long as the bycatch data reporting/collection is standardized for each reporting/collection method (i.e., the dock intercept survey is done the same way for all participants in the relevant fishery), then the Magnuson-Stevens Act requirement for an SBRM would be satisfied.

## What types of discards are we concerned with?

Fish are discarded for a variety of reasons. Some fish are discarded because the regulations prohibit their retention under all circumstances (e.g., barndoor skates), other fish are discarded because they are smaller than the regulated minimum size (e.g., summer flounder smaller than 14 inches), and some fish are discarded because a possession limit for one species has already been reached but fishing has continued for other species. In other cases, some fish are discarded because there is no market for that species (e.g., sculpin), other fish are discarded because they have low economic/market value relative to other fish the fishermen would rather catch and land (e.g., small skates for the bait market versus large skates for the wing market), and some fish are discarded (particularly by recreational fishermen) simply because they are less desirable than the target species. Fish that are discarded consistent with regulations are called regulatory discards, while fish that are discarded based on economic decisions or personal choices made by the fisherman are called economic discards. Both types of discards represent bycatch that must be accounted for, and all bycatch reporting methods considered in this amendment must address both types. Where practicable, it is useful for the bycatch reporting mechanism to indicate the reason for the discards (regulatory or economic).

What is the focus of this amendment?
While it is important to understand the distinction between regulatory and economic discards, and to account for the reason behind the discards to the extent practicable in the bycatch reporting, the reasons fish are discarded and, therefore, measures that could be used to reduce discards, are not the focus of this amendment. The
reasons for discards will not be addressed in detail in this amendment, other than to ensure that the resulting bycatch reporting methods are appropriate and sufficiently sensitive to capture information on both types of discards. Section 303(a)(11) of the Magnuson-Stevens Act addresses both the requirement to establish an SBRM for each FMP and the requirement to include conservation and management measures to minimize bycatch and bycatch mortality to the extent practicable, but this amendment is focused solely on the former requirement. Although these two issues are related, in the ruling on Oceana v. Evans I, the D.C. Circuit Court held that "the only part of Amendment 13 [to the Northeast Multispecies FMP] remanded to the Secretary concerns the bycatch reporting methodology" and also concluded that "this provision is severable from the balance of the Amendment." Therefore, the focus of this amendment is limited to the SBRM provision of the Magnuson-Stevens Act. Any further action(s) that may be warranted to address bycatch reduction in one or more of the subject FMPs will be the subject of separate action by the Mid-Atlantic and/or New England Councils and NMFS.

Will this amendment address the reporting of protected species caught as bycatch?

As noted above, the Magnuson-Stevens Act specifically excludes marine mammals and seabirds from its definitions of fish and bycatch, but includes sea turtles. Thus, for the purposes of this amendment, the SBRM discussed herein will not specifically address reporting methodologies for marine mammals or seabirds. However, NMFS has similar obligations under the MMPA and ESA, so where these obligations are interrelated with the provisions of the Magnuson-Stevens Act, this amendment will identify existing methods used to identify, report, and monitor interactions with marine mammals and seabirds. Because sea turtles are specifically included in the MagnusonStevens Act definitions of fish and bycatch, this amendment will address the reporting and monitoring of sea turtles caught as bycatch in the subject fisheries.

### 1.6 Structure of the Amendment

This document amends all existing Greater Atlantic Region FMPs that have been developed by either the Mid-Atlantic or the New England Council. This amendment is focused on identifying, evaluating, and, where appropriate, strengthening the SBRM that applies to all relevant fisheries in the Greater Atlantic Region. In order to present the information contained in this "omnibus" amendment in as clear a manner as possible, the amendment is organized as follows.

Chapter 2 is organized by FMP, and provides a brief overview of each Greater Atlantic Region FMP amended herein. This overview describes the history and management structure associated with the FMP, characterizes where and when the fisheries managed under the FMP primarily take place, identifies the relationship of the primary fishery(ies) to other fisheries in the region, identifies the proportion of catch associated with the recreational and commercial fishery(ies) managed under the FMP, and identifies the primary ports associated the fishery(ies). This chapter also identifies the fishing gears that are used to catch the relevant species and further identifies the primary fishing modes used in the fishery(ies). This last section is intended to serve as a
bridge between the consideration of an FMP as the operational unit for MagnusonStevens Act compliance and the primary fishing modes as the operational unit for an SBRM.

Chapter 2 is the only one organized by FMP. Chapter 3 introduces the concept of the fishing mode, which, for the purposes of this amendment, is defined as a category of fishing activity (gear- and/or area-based) that can be used to distinguish the common elements of one fishery from those of another. Whereas a single FMP may cover multiple fisheries with substantial differences among them that would affect the design of the most effective SBRM for that FMP, a fishing mode would share many of the relevant characteristics that can be exploited to design an SBRM to be as effective as possible. For example, the Mid-Atlantic Council’s Summer Flounder, Scup, and Black Sea Bass FMP encompasses a large-mesh otter trawl commercial fishery (for summer flounder, scup, and, to some degree, black sea bass), a handline/rod and reel commercial fishery (for black sea bass and, to a lesser extent, scup), a commercial pot fishery (for black sea bass), and a variety of recreational fisheries. Other than the target species, these fisheries have more in common with other fisheries that employ the same gear types and occur in the same areas than with each other, and this is true for many FMPs. For example, the Atlantic mackerel pair trawl fishery shares more traits with the Atlantic herring pair trawl fishery than with the squid fisheries, which themselves share many traits with the silver hake fishery managed under the Northeast Multispecies FMP. In some cases, a fishing mode may represent only one FMP, which itself is limited to only one fishing mode (the crab pot/trap fishery and the Deep-Sea Red Crab FMP is an example). In most other cases, however, each fishing mode incorporates subset fisheries managed under multiple FMPs, such as the New England gillnet mode, which includes subset fisheries managed under the Northeast Multispecies, Monkfish, and Northeast Skate FMPs (by "subset," we mean that each of these FMPs is also represented in other fishing modes).

The development of an SBRM must consider how, where, and when it is most appropriate to collect information on and monitor bycatch occurring in a fishery, and the most effective SBRM will be designed at the appropriate operational level. Thus, the organization of this amendment reflects this objective and focuses on fishing modes rather than on the subject FMPs. Chapter 3 describes the fishing modes that are the focus of the rest of the amendment. This chapter identifies the various species caught in each fishing mode, linking back to the description of the FMPs in chapter 2.

Chapter 4 introduces a variety of bycatch reporting and monitoring mechanisms that have been or are being employed in various fisheries around the U.S. and around the world. This chapter does not evaluate the efficacy of these mechanisms (this is done in a later chapter), but simply serves to provide background information and to establish that there are a variety of techniques that can be used to collect this information.

Chapter 5 addresses the analytical components of an SBRM to describe how assessments are done once data are collected and how bycatch data are used to determine the appropriate allocation of at-sea observer effort. The chapter discusses the concepts of precision and accuracy and identifies various problems that can affect the precision and accuracy of bycatch estimates. This chapter focuses largely, but not exclusively, on data
collected by at-sea observers, and explains the various techniques that are used to maximize precision and minimize bias.

Chapter 6 identifies the specific management alternatives, including the proposed action, considered by the Councils. This chapter presents alternatives regarding setting a bycatch reporting standard for each fishery, and describes the processes that are to be used to determine whether the standards are being met. This chapter also describes briefly the alternatives that were considered but rejected from further analysis.

Chapter 7 presents the expected environmental consequences of the alternatives considered by the Councils. This chapter describes the affected environment, the impacts associated with the preferred alternative and the other alternatives, and the expected cumulative effects associated with the action.

Chapter 8 describes the relationship of this action to all other applicable laws and directives, including NEPA, the RFA, the CZMA, the ESA, and the MMPA. This chapter documents compliance with these other laws and directives, and includes a Finding of No Significant Impact (FONSI) statement, an assessment under the RFA, and an RIR. Chapter 9 presents a glossary of terms used in this amendment, and chapter 10 lists all the reference materials cited in the amendment. In addition to the main amendment document, there are several appendices.

This structure was selected in order to avoid the duplication and redundancy that would result from maintaining an FMP-based structure throughout the whole amendment. Some degree of duplication is unavoidable in a document such as this, given the many subject FMPs and the multiple legal requirements that apply to its development.

### 1.7 Proposed Action

The Councils propose management measures and provisions such that, upon implementation of the SBRM Omnibus Amendment to all Greater Atlantic Region FMPs, the following elements would comprise the SBRM, as more fully described in chapters 4,5 , and 6 :

1. Bycatch reporting and monitoring mechanisms - This element addresses the methods by which data and information on discards occurring in Greater Atlantic Region fisheries are collected and obtained. The amendment proposes to maintain the status quo. The SBRM shall employ sampling designs developed to minimize bias to the maximum extent practicable. The NEFOP shall serve as the primary mechanism to obtain data on discards in all commercial fisheries managed under one or more of the subject FMPs. All subject FMPs shall continue to require vessels permitted to participate in said fisheries to carry an at-sea observer upon request, and all data obtained by the NEFOP under this SBRM shall be collected according to the techniques and protocols established and detailed in the Fisheries Observer Program Manual (NEFSC 2013a) and the Biological Sampling Manual (NEFSC 2013b). Data collected by the NEFOP shall include, but not be limited to, the following items:

Vessel name, hull number, and permit number; date/time sailed; date/time landed; steam time; crew size; home port; port landed; dealer name; fishing vessel trip report (FVTR) serial number; gear type(s) used; number/amount of gear; number of hauls; weather; location of each haul (beginning and ending latitude and longitude); species caught; disposition (kept/discarded); reason for discards; and weight of catch. ${ }^{2}$ These data shall be collected on all species of biological organisms caught by the fishing vessel and brought on board, including species managed under the subject FMPs but also including species of non-managed fish, invertebrates, and marine plants. ${ }^{3}$ To obtain information on discards occurring in recreational fisheries subject to a Greater Atlantic Region FMP, the SBRM shall fully incorporate, to the extent practicable and appropriate for the Region, all surveys and data collection mechanisms implemented by NMFS and affected states as part of the Marine Recreational Information Program (MRIP).
2. Analytical techniques and allocation of at-sea fisheries observers - This element addresses the methods by which the data obtained through the mechanisms included above are analyzed and utilized to determine the appropriate allocation of at-sea observers across the subject fishing modes. The amendment proposes to maintain the status quo. The 2007 SBRM Omnibus Amendment substantially expanded and refined observer allocation methods in the Region to fully incorporate all managed species and all relevant fishing gear types in the Region. Since the 2007 SBRM Amendment was vacated, these improved methods have been maintained, and so represent the current status quo. By maintaining the status quo, at-sea fisheries observers shall, to the maximum extent possible and subject to available resources, be allocated and assigned to fishing vessels according to the procedures established through this amendment, as described in chapter 5 to the amendment and in Rago et al. (2005) and Wigley et al. (2007). All appropriate filters identified in chapters 5 and 6 shall be applied to the results of the analysis to determine the observer coverage levels needed to achieve the objectives of the SBRM.
3. SBRM performance standard - The amendment proposes to ensure that the data collected under the SBRM are sufficient to produce a coefficient of variation (CV) of no more than 30 percent, in order to ensure that the effectiveness of the SBRM can be measured, tracked, and utilized to effectively allocate the appropriate number of observer sea days. Each year, the Regional Administrator and the Science and Research Director shall allocate sufficient atsea observer coverage to the applicable fisheries in order to achieve a level of precision (measured as the CV ) no greater than 30 percent for each applicable species and/or species group, subject to the use of the filters noted above and described in chapters 5 and 6.
${ }^{2}$ For detailed lists of the data elements collected by NEFOP observers, by type of fishing trip, see the Fisheries Observer Program Manual (NEFSC 2013a).
${ }^{3}$ For a complete list of the species for which the above listed data elements are collected, see Appendix O of the Fisheries Observer Program Manual (NEFSC 2013a).
4. SBRM review and reporting process - The amendment proposes to require an annual report on discards occurring in Greater Atlantic Region fisheries to be prepared by NMFS and provided to the Councils, and also to require a report every 3 years that evaluates the effectiveness of the SBRM. Every 3 years, the Regional Administrator and the Science and Research Director shall appoint appropriate staff to work with staff appointed by the Executive Directors of the Councils to obtain and review available data on discards and to prepare a report assessing the effectiveness of the SBRM. This report would provide the following information: (1) A review of the recent levels of observer coverage in each applicable fishing mode; (2) a review of recent observed encounters with each species in each fishery (or by gear type for turtles), and a summary of observed discards by weight; (3) a review of the CV of the discard information collected for each fishery; (4) a review of recent estimates of the total amount of discards associated with each fishing mode (these estimates may differ from estimates generated and used in stock assessments, as different methods and stratification may be used in each case); (5) an evaluation of the effectiveness of the SBRM at meeting the performance standard for each fishery; (6) a description of the methods used to calculate the reported CVs and to determine observer coverage levels, if the methods used are different from those described and evaluated in this amendment; (7) an updated assessment of potential sources of bias in the sampling program and analyses of accuracy; and (8) an evaluation of the implications of the discard information collected under the SBRM. Once per annum, the Science and Research Director shall present to the Councils a report on catch and discards occurring in Greater Atlantic Region fisheries, as reported to the NEFOP by at-sea fisheries observers. This annual discard report shall include summaries of the trips observed, fishing modes in the relevant time period, funding issues and other related issues and developments, and projections of coverage across fisheries for upcoming time period. More detailed information would be provided in tables and figures that addressed: The number of observer trips and sea days scheduled that were accomplished for each fishing mode and quarter, as well as the number of trips and sea days of industry activity; the kept weight from unobserved quarters and statistical areas summarized by fishing mode; the amount kept and estimated discards of each species by fishing mode; and the relationship between sample size and precision for relevant fishing.
5. Framework adjustment and/or annual specification provisions - The amendment proposes a measure to enable the Councils to make changes to certain elements of the SBRM through framework adjustments and/or annual specification packages rather than full FMP amendments. All subject FMPs shall provide for an efficient process to modify aspects of the SBRM, as relates to each specific FMP, should the need arise and the appropriate Council determine that a change to the SBRM is warranted and needed to address a contemporary management or scientific issue. Depending on the provisions of each FMP, changes to the SBRM may be effected either through a framework adjustment to the FMP or through annual or periodic specifications. Such changes to the SBRM may include modifications to the CV-based performance standard, the means by
which discard data are collected/obtained in the fishery, or reporting on discards or the SBRM. Such changes may also include the establishment of a requirement for industry-funded observers and/or observer set-aside provisions. The amendment further proposes that changes to the stratification (modes) used as the basis for SBRM-related analyses can be made without requiring formal Council action to ensure that the SBRM stratification accurately reflects changes in the fishing operations.
6. Prioritization process - The amendment proposes a formulaic process to address prioritization of at-sea observer coverage allocations, if the expected funding resources necessary may not be available. NMFS will identify specific funding sources to be used to fund coverage under the SBRM each year. If this funding in a given year is sufficient to fully implement the observer coverage levels estimated to achieve the target CV-based performance standard, then no further prioritization would be necessary that year. If the funding available through these specified sources is not sufficient to fully implement the estimated observer coverage levels in a given year, then an additional prioritization process would be used to determine how the available observer sea days would be allocated across the fisheries. If the available funding is deemed to be not sufficient, but is more than the amount needed to achieve the minimum pilot coverage on all fleets, a process referred to as the Penultimate Cell Approach will be utilized to prioritize coverage across the various agency-funded fishing modes such that the fewest number of fishing mode and species group combinations have a CV that is higher than the CV-based performance standard. If the available funding for SBRM observers in a given year is so restricted that the minimum pilot coverage for each fleet could not be achieved, a formulaic process would be used to eliminate coverage on fleets that had the highest ratio of minimum pilot coverage days to actual days absent from port, as reported by FVTRs from the previous year, until the shortfall in minimum pilot coverage days is removed. Details of these formulaic prioritization processes are described in Chapter 6 and Appendix H.
7. Industry-funded observers and observer set-aside program provisions - The amendment proposes to implement consistent, cross-cutting observer service provider approval and certification procedures and to enable the Councils to implement either a requirement for industry-funded observers and/or an observer set-aside program through a framework adjustment rather than an FMP amendment.

This amendment proposes no additional actions other than those summarized above and described in chapter 6 of this document. No other regulatory changes or management actions are proposed or intended to be implemented at this time. Any further actions or
changes to management measures would require an additional action (i.e., annual specifications, framework adjustment, or amendment) by a Council.

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## Description of the Fisheries

All of the FMP summaries below incorporate data from the seafood dealer purchase report database, from 2007-2011, inclusive. For some FMPs, the fishing year is offset from the calendar year, and starts on March 1 (Sea Scallops and Deep-Sea Red Crab), May 1 (Northeast Multispecies, Spiny Dogfish, and Skates), or on November 1 (Tilefish). For ease of analysis and consistency of presentation, the landings data for these FMPs are summarized based on calendar year, not fishing year.

### 2.1 Atlantic Bluefish FMP

Bluefish is a migratory pelagic species found in most temperate and tropical marine waters throughout the world. Along the U.S. Atlantic coast, bluefish commonly are found in estuarine and continental shelf waters. Bluefish are a schooling species that migrate in response to seasonal changes, moving north and inshore during spring and south and offshore in the late autumn. The Atlantic bluefish fishery exploits what is considered to be a single stock of fish.

The Mid-Atlantic Council began developing the Atlantic Bluefish FMP in 1979 in response to a petition by concerned fishermen reacting to developments in international markets for bluefish. The final FMP was adopted as a joint plan between the Council and the ASMFC in 1989. The FMP was approved and implemented in 1990. Amendment 1 to the FMP was developed in response to the Sustainable Fisheries Act amendments to the Magnuson-Stevens Act and implemented in 2000. Amendment 2 to the FMP was the 2007 SBRM Omnibus Amendment. In order to come into compliance with the revised Magnuson-Stevens Act, the Mid-Atlantic Council developed an Annual Catch Limit (ACL) and Accountability Measure (AM) Omnibus Amendment for all of its FMPs. The ACL/AM Omnibus Amendment (Amendment 3 to Atlantic Bluefish FMP) implemented ACLs and AMs for this fishery.

The FMP established a state-by-state commercial quota system and a coastwide recreational harvest limit. The Council and the ASMFC decide annually on a total allowable landings (TAL) level, that is divided between the commercial and recreational sectors (the commercial quota is further allocated to the states from Maine through Florida based on percentage shares specified in the FMP). The FMP calls for 83 percent of the TAL to be allocated to the recreational sector and 17 percent allocated to the commercial sector, but provides for a transfer of quota to the commercial sector from the recreational sector within certain limits. The Bluefish FMP is the only Greater Atlantic Region FMP that allocates specific quota to the states of South Carolina, Georgia, and Florida.

Amendment 1 to the FMP established a plan to rebuild the stock within 9 years through a gradual reduction in fishing mortality rate. The bluefish stock was declared to be rebuilt in 2009. In recent years, commercial catch has ranged from 7.0 million lb in

2007 down to 5.1 million lb in 2011, and recreational catch has ranged from 21.7 million lb in 2007 down to 11.5 million lb in 2011 (see Table 2). The major ports associated with bluefish are listed in Table 3.

The primary gear types used in the commercial fisheries that land bluefish include gillnets, rod and reel, and otter trawls, although there are small localized fisheries, such as the beach seine fishery that operates along the Outer Banks of North Carolina that also catch bluefish. Many of these fisheries do not fish exclusively for bluefish, but target a combination of species including croaker, mullet, Spanish mackerel, spot, striped bass, and weakfish. Recreational fishing, which dominates the catch of bluefish, is almost exclusively rod and reel, and includes shoreside recreational anglers, party/charter boats, and private recreational boats. There is a lot of seasonality to both the commercial and recreational fisheries for bluefish due to the migratory nature of the species.

|  | Commercial Landings | Recreational Landings |
| :---: | :---: | :---: |
| 2007 | $7,006,000$ | $21,690,000$ |
| 2008 | $5,718,000$ | $19,672,000$ |
| 2009 | $6,469,000$ | $14,513,000$ |
| 2010 | $6,968,000$ | $16,194,000$ |
| 2011 | $5,077,000$ | $11,499,000$ |

Table 2. Recent commercial and recreational landings (lb) of bluefish.

| Primary Ports | Commercial <br> Landings | Ex-vessel Value of <br> Landings |
| :--- | :---: | :---: |
| Wanchese, NC | $1,585,400$ | $\$ 620,400$ |
| Long Beach/Barnegat Light, NJ | 665,200 | $\$ 296,400$ |
| Point Judith, RI | 290,600 | $\$ 118,600$ |
| Hampton Bays, NY | 277,000 | $\$ 169,800$ |
| Montauk, NY | 272,000 | $\$ 169,200$ |
| Belford, NJ | $*$ | $\$ *$ |
| Hatteras, NC | 237,600 | $\$ 69,200$ |

Table 3. Primary ports associated with the bluefish fishery (values are averaged for 2007-2011). *Data excluded for confidentiality.

### 2.2 Atlantic Herring FMP

Atlantic herring are distributed along the Atlantic coast from North Carolina to the Canadian Maritime provinces. Schooling, or the formation of large aggregations for feeding and migration, is characteristic of herring species. This behavior begins as early as the onset of metamorphosis during larval development. Although herring schools are sometimes visible at the water's surface during the day, they typically undertake diurnal vertical migrations, sinking to the seafloor during the day and rising to the surface after dusk. Schools of adult herring make extensive migrations to areas where they feed, spawn, and overwinter.

Atlantic sea herring stocks were first managed in 1972 through the International Commission for the Northwest Atlantic Fisheries (ICNAF), ${ }^{4}$ which regulated the highseas international fishery. Upon implementation of the original Magnuson Fishery Conservation and Management Act in 1976, the New England Council developed an FMP for herring. This FMP was implemented in late 1978; however, the FMP was withdrawn in 1982 due to concerns over the lack of enforcement of state waters quotas. In 1996, the Council began development of a new FMP for herring that was intended to closely coordinate Federal management with that of the ASMFC. This FMP was implemented in 2000.

The Atlantic Herring FMP established total allowable catches (TACs) for each of four management areas in the Gulf of Maine and Georges Bank. This FMP established requirements for vessel, dealer, and processor permits, as well as reporting requirements and restrictions on the size of vessels that can catch herring. Amendment 1 to the FMP was completed in 2006 and implemented a limited access qualification program, changes to management areas, and improved monitoring of catch. Amendment 2 to the FMP was part of the 2007 SBRM Omnibus Amendment. In 2011, Amendment 4 implemented a process for establishing ACLs and AMs in the herring fishery and brought the Herring FMP into compliance with the recently reauthorized Magnuson-Stevens Act.

Although some herring are caught incidentally in recreational fisheries for Atlantic mackerel and silver hake, this is limited to coastal New Jersey, and almost all herring are caught for commercial purposes. There are two primary uses of commercially-caught herring: As bait (in either the tuna fishery or the lobster fishery) or as a food fish. Other than tuna vessels catching their own herring to use as bait, almost all herring is caught with either mid-water trawls (single and paired) or purse seines. The majority of herring landings are made with mid-water trawls; purse seines accounted for approximately one-fifth of landings from 2000-2004.

While herring is caught over a wide range, there are seasonal patterns to the fishery. During the winter months (December-March), the fishery is most active in the coastal waters south of New England, as adult herring move into this area. The fishery generally moves offshore and into the Gulf of Maine as spring approaches, and by late

[^1]summer or early fall, the fishery concentrates on the coastal waters of Maine, New Hampshire, and Massachusetts as herring move into these areas prior to spawning. The Georges Bank fishery is most active in summer and early fall. Table 4 lists recent landings, and Table 5 identifies the major herring ports.

|  | Commercial Landings | Recreational Landings |
| :---: | :---: | :---: |
| 2007 | $163,049,000$ | 139,000 |
| 2008 | $174,400,000$ | 113,000 |
| 2009 | $224,558,000$ | 55,000 |
| 2010 | $144,915,000$ | 46,000 |
| 2011 | $177,165,000$ | 58,000 |

Table 4. Recent commercial and recreational landings (lb) of herring.

| Primary Ports | Commercial Landings | Ex-vessel Value of Landings |
| :--- | :---: | :---: |
| Gloucester, MA | $51,077,600$ | $\$ 6,051,600$ |
| New Bedford, MA | $34,077,600$ | $\$ 2,671,400$ |
| Portland, ME | $28,329,600$ | $\$ 3,764,200$ |
| Rockland, ME | $27,384,600$ | $\$ 3,562,800$ |
| Cape May, NJ | $*$ | $\$ *$ |
| Stonington, ME | $5,955,600$ | $\$ 772,200$ |
| Point Judith, RI | $4,160,000$ | $\$ 424,800$ |
| Prospect Harbor, ME | $3,179,200$ | $\$ 388,400$ |

Table 5. Primary ports associated with the herring fishery (values are averaged for 2007-2011). *Data excluded for confidentiality.

### 2.3 Atlantic Salmon FMP

Atlantic salmon are a migratory anadromous fish with a complex life history, going through several distinct phases marked by changes in physiology and behavior. Spawning and juvenile development of Atlantic salmon occur in fresh water New England streams, with adults undergoing a highly migratory life on the open ocean and returning to fresh water to reproduce. North American origin Atlantic salmon are either from migratory stocks, undergoing long ocean migrations, or resident stocks, with more limited ocean migrations. Northern Canadian stocks are residential, while New England stocks tend to be migratory, traveling vast distances across open ocean to feeding grounds off the coast of southwestern Greenland and later returning to their New England spawning grounds. Although rivers from Maine to Connecticut once supported healthy populations of Atlantic salmon, native Atlantic salmon have since become extirpated in all but a portion of Maine supporting the remaining Gulf of Maine Distinct Population Segment.

The New England Council developed an FMP for Atlantic salmon that was implemented by NMFS in 1988. The FMP established explicit U.S. management authority over all Atlantic salmon of U.S. origin. The plan was intended to complement state management programs in coastal and inland waters and Federal management authority on the high seas (conferred to the U.S. as a signatory nation to the North Atlantic Salmon Conservation Organization).

The FMP prohibits possession of Atlantic salmon and any directed or incidental (bycatch) commercial fishery for Atlantic salmon in Federal waters. The Council's Atlantic salmon plan strengthens the efforts of local groups, such as the Connecticut River Atlantic Salmon Commission, that are working towards the restoration of salmon stocks in New England river systems. The first change to the Atlantic Salmon FMP, Amendment 1, was implemented in 1999 to designate essential fish habitat and provide for a framework adjustment mechanism related to aquaculture. Amendment 2 to this FMP was the 2007 SBRM Omnibus Amendment.

The Atlantic salmon fishery expanded during the late 1800s from a reported 183 weirs and nets capturing 7,320 salmon in 1867, to 230 weirs and 36 gillnets capturing over 10,016 salmon in 1880 . The catch peaked in 1889 with over 17,000 salmon and began a steady decline during the 20th century, with landings falling to as low as 40 salmon in 1947 (Collette and Klein-MacPhee 2002). Because no reporting requirements were established for the fishery, landings data are incomplete. In 1989, all state and Federal commercial salmon fisheries in New England were closed by law. Recreational fishing for sea-run Atlantic salmon is currently prohibited in all New England States. A small local fishery is ongoing for captive reared domestic Atlantic salmon released into select rivers in Connecticut and New Hampshire, these fisheries are individually regulated by each State. In spite of the decline of wild salmon populations, Atlantic salmon remains an important fishery resource in New England through the development of fish farming efforts (aquaculture and mariculture). Salmon mariculture is especially important in Maine, where harvest of farmed Atlantic salmon typically averages between 10 to 12 million pounds and reached almost 25 million pounds in 2010.

### 2.4 Atlantic Sea Scallop FMP

The Atlantic sea scallop is a bivalve mollusk that is highly valued for the meat in the large adductor muscle that holds the top and bottom portions of the shell together. Sea scallops are semi-mobile, bottom dwelling organisms. They are most abundant on coarse sand, gravel, and cobble. Mature females are highly fecund and produce millions of eggs during the late summer and autumn months. The Atlantic sea scallop is managed as a single unit throughout its range in United States waters. Five stock components are recognized: The Gulf of Maine; eastern Georges Bank; the Great South Channel; the New York Bight; and the waters adjacent to Delaware, Maryland, and Virginia.

The Atlantic Sea Scallop FMP, prepared by the New England Council, was implemented in 1982 to restore adult scallop stocks and reduce year-to-year fluctuations in stock abundance caused by variation in recruitment. Amendments 4 and 7 significantly reduced fishing effort by limiting access to the resource, instituting DAS
allocations (limiting the number of days a vessel is allowed to fish for scallops each year), implementing gear restrictions to improve escapement of small scallops and finfish, and limiting crew size. Area closures in New England and the Mid-Atlantic and above-average recruitment have resulted in increased scallop biomass both within and outside of the groundfish closed areas.

One of the foundations of the Scallop FMP is its area rotational management programs, established in 2004 under Amendment 10. Under this program, areas are defined and closed and reopened to fishing on a rotational basis, depending on the condition and size of the scallop resource in the areas. As a result of Amendment 10, controls on scallop effort differ depending on whether a fishing trip occurs in an access area or in an open area. Vessels either fish in access areas under allocated trips, or in open areas under DAS. Amendment 12 was the 2007 SBRM Omnibus Amendment, and Amendment 13 permanently re-activated the industry funded observer program in the same year. Amendment 11, implemented in 2008, included measures to control capacity and mortality in the general category scallop fishery. Primary measures included a limited entry program for general category vessels, as well as other permit provisions including an individual fishing quota program (IFQ). The most recent amendment, Amendment 15, introduced annual catch limits and accountability measures to the Scallop FMP in 2011, as required by the Magnuson-Stevens Act. Various frameworks have set annual or biennial scallop specifications and have included a variety of other management measures aimed at improving the effectiveness of the various aspects of scallop fishery management.

Under current regulations, the scallop fleet can be differentiated by vessel permit category: Limited access vessels that are subject to area-specific DAS controls and trip allocations; and limited access general category vessels that are not subject to DAS controls, but are subject to a possession limit per fishing trip. There are three types of limited access general category permits: Individual fishing quota (IFQ) permits with a possession limit of 600 lb per trip; Northern Gulf of Maine permits with a possession limit of 200 lb per trip; and incidental permits with a possession limit of 40 lb . per trip. The limited access and limited access general category scallop fleets receives a total allocation of 94.5 percent and 5 percent, respectively, of the scallop fishery's ACL, with the remaining 0.5 percent allocated to IFQ permits on vessels that have both limited access general category IFQ and limited access scallop permits. There are no open access permits in this fishery.

Another unique aspect of the Scallop is its industry-funded observer program. Every year, 1 percent of the ACL allocated to the scallop fishery is set-aside to be used as compensation for limited access or limited access general category IFQ vessels that are assigned an observer in open or access areas. If a limited access vessel is assigned an observer while fishing on an open area DAS trip, it will accrue DAS at a reduced rate for the trip. For limited access vessels on access area trips, and IFQ vessels on any trip, vessels receive additional scallop catch above the possession limit on observed trips in order to pay for the observer. If the set-aside is exhausted in a given fishing year, vessel owners must continue to pay for observers assigned to their vessel without receiving any compensation. NMFS sets the compensation rates (i.e., the appropriate scallop lb/trip for
each observed trip) at the start of each fishing year based on that year's observer set-aside allocation and closely monitors the set-aside usage each year to avoid fully harvesting it whenever possible.

Scallops are harvested primarily through the use of scallop dredges and trawls. In recent years (2007-2011), almost 98 percent of all scallop landings are by dredge vessels. During the 2007-2011 fishing years, trawl vessels landed another 1-2 percent, with other gear types contributing only trace amounts of scallop landings.

The Atlantic sea scallop fishery is rebuilt to sustainable levels, following declines in fishing mortality from effort reductions, gear restrictions, and closed areas, combined with above average recruitment in some areas and in multiple years since 1999. Revenues from commercial scallop landings for New England and Mid-Atlantic states in the year 2000 were estimated at $\$ 161$ million. Increased landings since the early 2000’s were made possible by an increase in scallop biomass and favorable recruitment. In recent years, total commercial landings have remained relatively constant while revenue has increased by over 50 percent (see Table 6). The majority of limited access vessels are based in Massachusetts, Virginia, New Jersey, and North Carolina, and the primary scallop ports are located in New Bedford, MA, Cape May, NJ, and Newport News, VA (see Table 7).

|  | Commercial Landings (Ib) | Ex-vessel Value |
| :---: | :---: | :---: |
| 2007 | $58,521,000$ | $\$ 386,468,000$ |
| 2008 | $53,388,000$ | $\$ 370,117,000$ |
| 2009 | $57,714,000$ | $\$ 373,735,000$ |
| 2010 | $57,058,000$ | $\$ 450,808,000$ |
| 2011 | $58,838,000$ | $\$ 580,527,000$ |

Table 6. Recent commercial landings of Atlantic sea scallops.

| Primary Ports | Commercial Landings (Ib) | Ex-vessel Value of Landings |
| :--- | :---: | :---: |
| New Bedford, MA | $28,502,000$ | $\$ 220,117,000$ |
| Cape May, NJ | $8,081,400$ | $\$ 59,567,000$ |
| Newport News, VA | $5,339,600$ | $\$ 38,535,400$ |
| Long Beach/Barnegat Light, NJ | $2,365,600$ | $\$ 18,781,400$ |
| Seaford, VA | $*$ | $\$ *$ |
| Hampton, VA | $*$ | $\$^{*}$ |

Table 7. Primary ports associated with the sea scallop fishery (values are averaged for 2007-2011). *Data excluded for confidentiality.

### 2.5 Deep-Sea Red Crab FMP

The deep-sea red crab is a deep-water brachyuran crab that occurs in a patchy distribution on the continental shelf and slope from Nova Scotia to Florida. Though the species is found primarily within a 200-1800 meter depth band along the continental shelf and slope, red crabs have also been located in some deep-water canyons along the coast and can also be found in the Gulf of Maine. Preferred depth depends, in part, on the characteristics of individual crabs. Young crabs dwell in considerably deeper water than adults and males are typically found deeper than females. The red crab is a slow-growing species that may not spawn annually. It is long-lived, with some individuals surviving for up to 15 years. These characteristics make it particularly susceptible to depletion by overfishing.

There has been a small directed fishery off the coast of New England and in the Mid-Atlantic for deep-sea red crab since the early 1970s. Though the size and intensity of this fishery has fluctuated, it has remained consistently small relative to more prominent New England fisheries such as groundfish, sea scallops, and lobster. Landings increased substantially after 1994, when implementation of Amendment 5 to the Northeast Multispecies FMP may have led some fishing effort to redirect onto "underexploited" fishery resources such as red crab.

In 1999, at the request of members of the red crab fishing industry, the New England Council began development of an FMP to prevent overfishing of the red crab resource and address a threat of overcapitalization of the red crab fishery. A control date was established in 2000 to discourage "speculative entry," or rapid entry of new vessels into the fishery and, in 2001, NMFS implemented emergency regulations to prevent overfishing of the resource during the time the FMP was being developed. The FMP was implemented in 2002. The primary management control was to establish a limited access permit program for qualifying vessels with documented history in the fishery. Other measures implemented under the FMP included DAS limits, trip limits, gear restrictions,
and limits on processing crabs at sea. Framework Adjustment 1 provided for a 3-year, rather than annual, specification-setting process. Amendment 3 was implemented in 2011 to bring the FMP into compliance with the revised Magnuson-Stevens Act by implementing annual catch limits and accountability measures. Amendment 3 also revised the management measures, by eliminating DAS and the vessel trip limit. The directed, limited access red crab fishery is a male-only fishery, that is currently managed with a "hard" quota (i.e., the fishery is closed when the quota is reached), gear restrictions, and limits on processing crabs at sea.

Although there is an open access permit category, the small possession limit of 500 lb per trip has kept this sector of the fishery very small. The directed red crab fishery is limited to using parlor-less crab pots, and is considered to have little, if any, incidental catch of other species. There is no known recreational fishery for deep-sea red crab. Landings of red crab varied somewhat before the implementation of the FMP, but have stabilized since (see Table 8). All vessels with limited access permits now fish out of Fall River, MA.

|  | Commercial Landings <br> (Ib) | Ex-vessel Value |
| :---: | :---: | :---: |
| 2007 | $2,650,000$ | $\$ 2,615,000$ |
| 2008 | $2,744,000$ | $\$ 3,153,000$ |
| 2009 | $2,188,000$ | $\$ 2,140,000$ |
| 2010 | $3,124,000$ | $\$ 3,060,000$ |
| 2011 | $3,598,000$ | $\$ 3,488,000$ |

Table 8. Recent commercial landings of deep-sea red crabs.

### 2.6 Mackerel, Squid, and Butterfish FMP

Atlantic mackerel, Illex and longfin squids, and butterfish are all schooling pelagic species that range from at least the Gulf of St. Lawrence south to at least Cape Lookout, NC. ${ }^{5}$ Butterfish and the two squids are fast-growing, short-lived species, while Atlantic mackerel grows more slowly and lives several years longer. All four species are most abundant from Georges Bank to Cape Hatteras, NC, and follow seasonal migration patterns based largely on water temperature. Longfin inshore squid was previously referred to as Loligo squid. Due to a recent change in the scientific name of longfin inshore squid from Loligo pealeii to Doryteuthis (Amerigo) pealeii, the common name '"longfin squid’' is now used in all official documents to avoid confusion.

[^2]The FMP was developed by the Mid-Atlantic Council and was implemented in 1983. Early amendments to the FMP changed permit and reporting requirements, the fishing year, quota adjustment mechanisms, foreign fishing and joint venture provisions, and implemented limited access systems for butterfish and the two squid fisheries. In recent years, amendments have been implemented to rebuild the butterfish stock and address bycatch in the longfin squid fishery (Amendment 10, in 2010), limit access in the mackerel fishery (Amendment 11, in 2011), and establish ACLs and AMs for the mackerel and butterfish fisheries (Amendment 13, in 2012). Amendment 12 to this FMP was the 2007 SBRM Omnibus Amendment. Amendment 14 was adopted to improve monitoring in the mackerel, squid, and butterfish fisheries and reduce river herring and shad bycatch, and Amendment 17 was the Omnibus Recreational Accountability Measures Amendment. Amendments that are currently under development would consider adding river herrings and shads as stocks in the Mackerel, Squid, and Butterfish FMP, and address interactions with deep-sea corals.

The mackerel, squid, and butterfish fisheries are all managed by directly controlling harvest. The directed mackerel fishery can be closed when landings are projected to reach 95 percent of the total domestic harvest. The mackerel incidental catch fishery can be closed when landings are projected to reach 100 percent of the total domestic harvest. The directed longfin squid fishery is managed via trimester quota allocations and the directed fishery is closed when 90 percent of the trimester quota allocations or 95 percent of the total domestic harvest is projected to be landed. There is also a cap on butterfish discards in the longfin squid fishery that is allocated by trimester, and closes the longfin squid fishery to directed harvest once it has been exceeded. The directed Illex fishery closes when 95 percent of the total domestic harvest is projected to be landed. Finally, butterfish is managed using a phased system. The system triggers butterfish possession limit reductions at different points to ensure quota is available for directed harvest throughout the fishing year. During closures of the directed longfin squid, Illex, or butterfish fisheries, incidental catch fisheries for these species are permitted.

Although 1.5 percent of butterfish landed from 2007-2011 were reported as caught with gillnets, and trace amount of these species were reported as caught with a variety of fishing gears, more than 98 percent of reported landings of all four species during this period were caught with otter trawls (midwater and bottom). Management measures implemented under this FMP restrict only the commercial fishing sectors, although there is a recreational fishery for Atlantic mackerel.

Fishing for Atlantic mackerel occurs year-round, although most fishing activity occurs from January through April. The Illex squid fishery occurs largely from June through October, although this can vary somewhat from year to year. In some years, the longfin squid fishery remains relatively consistent throughout the year, but in most years, landings peak during October through April. Butterfish are landed year-round, with no apparent seasonal patterns. Table 9 lists the estimated recreational landings of Atlantic mackerel from 2007-2011. Table 10 and Table 11 identify the recent landings, ex-vessel value, and primary ports for these fisheries.

|  | Recreational Landings (lb) |
| :---: | :---: |
| 2007 | $1,287,000$ |
| 2008 | $1,726,000$ |
| 2009 | $1,330,000$ |
| 2010 | $1,672,000$ |
| 2011 | $2,056,000$ |

Table 9. Recreational landings of Atlantic mackerel.

|  | Atlantic mackerel |  | Butterfish |  | Illex squid |  | Loligo squid |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Commercial Landings (1,000 lb) | $\begin{aligned} & \text { Ex-vessel } \\ & \text { Value } \\ & \mathbf{( \$ 1 , 0 0 0 )} \end{aligned}$ | Commercial Landings (1,000 lb) | $\begin{aligned} & \text { Ex-vessel } \\ & \text { Value } \\ & \mathbf{( \$ 1 , 0 0 0 )} \end{aligned}$ | Commercial Landings (1,000 lb) | $\begin{aligned} & \text { Ex-vessel } \\ & \text { Value } \\ & \mathbf{( \$ 1 , 0 0 0 )} \end{aligned}$ | Commercial Landings (1,000 lb) | $\begin{aligned} & \text { Ex-vessel } \\ & \text { Value } \\ & (\$ 1,000) \end{aligned}$ |
| 2007 | 56,321 | \$6,603 | 1,496 | \$1,088 | 19,890 | \$3,863 | 27,236 | \$23,240 |
| 2008 | 47,934 | \$6,316 | 996 | \$758 | 35,054 | \$8,346 | 25,125 | \$23,460 |
| 2009 | 49,900 | \$7,978 | 958 | \$611 | 40,606 | \$9,667 | 20,517 | \$18,313 |
| 2010 | 21,775 | \$3,179 | 1,269 | \$829 | 34,887 | \$10,758 | 14,875 | \$15,366 |
| 2011 | 1,170 | \$356 | 1,463 | \$1,124 | 41,440 | \$18,832 | 21,046 | \$24,131 |

Table 10. Recent commercial landings in the Atlantic mackerel, butterfish, and squid fisheries.

| Atlantic mackerel |  | Butterfish |  | Illex squid |  | Longfin squid |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Primary Ports | Ex-vessel Value | Primary Ports | Ex-vessel Value | Primary Ports | Ex-vessel Value | Primary Ports | Ex-vessel Value |
| North Kingstown, RI | \$* | Point Judith, RI | \$270,000 | Cape May, NJ | \$5,013,000 | Point Judith, RI | \$7,742,000 |
| Gloucester, MA | \$1,200,400 | Montauk, NY | \$211,400 | North Kingstown, RI | \$* | Montauk, NY | \$3,203,600 |
| New Bedford, MA | \$1,163,200 | North Kingstown, RI | \$54,600 | Hampton, VA | \$* | North Kingstown, RI | \$2,727,400 |
| Cape May, NJ | \$743,800 | New Bedford, MA | \$44,400 | Point Judith, RI | \$129,600 | Cape May, NJ | \$2,114,600 |
| Fall River, MA | \$277,000 | Hampton Bays, NY | \$35,400 | Wanchese, NC | \$127,400 | Hampton Bays, NY | \$1,430,800 |

Table 11. Primary ports associated with the Atlantic mackerel, butterfish, and squid fisheries (values are averaged for 2007-2011). *Data excluded for confidentiality.

### 2.7 Monkfish FMP

The monkfish (also known as goosefish) is a member of the anglerfish family Lophiidae, fishes distinguished by an appendage on the head known as the illicium which has a fleshy end (esca) that acts as a lure to attract prey to within range of its large mouth. Monkfish have a large, bony head and are harvested for their livers and the tender meat in their tails. The species is distributed widely throughout the Northwest Atlantic, from the northern Gulf of St. Lawrence to Cape Hatteras, NC, and is known to inhabit waters from the tide-line to depths as great at 840 meters across a wide range of temperatures.

Adults have been found on a variety of substrate types including hard sand, gravel, broken shell, and soft mud. Spawning occurs in May and June from Cape Hatteras to southern New England. Mature females, which are slightly larger than males, produce a non-adhesive, mucoid egg raft or veil which can reach 20-40 feet in length and $1 / 2-5$ feet in width. During spawning, this large mass of eggs can account for up to 50 percent of a female's body mass. Monkfish are managed as two stocks, a northern stock from Maine to Cape Cod, MA, and a southern stock from Cape Cod to North Carolina.

During the early 1990s, fishermen and dealers in the monkfish fishery addressed both the New England and Mid-Atlantic Councils with concerns about the increasing amount of small fish being landed, the increasing frequency of gear conflicts between monkfish vessels and those in other fisheries, and the expanding directed trawl fishery. In response, the Councils developed a joint FMP that was implemented in 1999. The FMP was designed to stop overfishing and rebuild the stocks through a number of measures, including: 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.

Reported landings of monkfish increased dramatically from the late 1970s until the mid-1990s and have remained high (see Table 12). Burgeoning markets for monkfish tails and livers in the 1980s allowed fishermen to fish profitably for monkfish, landing increasingly smaller monkfish as the stocks became depleted. Since the implementation of the FMP, however, vessels are more commonly landing large, whole monkfish for export to Asian markets. Revenues have generally increased since the mid-1980s and the relative value of monkfish is currently at its highest point since 1996 (see Table 12 and Table 13).

|  | Commercial Landings <br> (Ib) | Ex-vessel Value |
| :---: | :---: | :---: |
| 2007 | $14,440,000$ | $\$ 28,797,000$ |
| 2008 | $13,013,000$ | $\$ 27,195,000$ |
| 2009 | $10,392,000$ | $\$ 19,513,000$ |
| 2010 | $8,790,000$ | $\$ 18,985,000$ |
| 2011 | $10,672,000$ | $\$ 26,333,000$ |

Table 12. Recent commercial landings of monkfish.

| Primary Ports | Commercial Landings | Ex-vessel Value of Landings |
| :--- | :---: | :---: |
| New Bedford, MA | $2,244,400$ | $\$ 5,407,600$ |
| Long Beach/Barnegat Light, NJ | $1,360,600$ | $\$ 2,343,800$ |
| Gloucester, MA | $1,205,000$ | $\$ 3,569,000$ |
| Point Judith, RI | 886,200 | $\$ 1,972,600$ |
| Boston, MA | 603,400 | $\$ 1,777,800$ |
| Chatham, MA | 580,200 | $\$ 908,400$ |
| Montauk, NY | 501,800 | $\$ 801,000$ |
| Little Compton, RI | 468,200 | $\$ 679,200$ |
| Point Pleasant, NJ | 392,200 | $\$ 628,000$ |

Table 13. Primary ports associated with the monkfish fishery (values are averaged for 2007-2011).
The majority of commercial landings are made using gillnets (67 percent) with another 26 percent landed by otter trawls (according to the fishing vessel trip report (FVTR) database, 2007-2011). Scallop dredges also catch monkfish, but in much smaller amounts ( 7 percent of reported landings, 2007-2011). No other gear types account for more than trace landings of monkfish. There is no recreational component to this fishery.

The Monkfish FMP has been modified by three amendments and 7 framework adjustment actions since 1999. Amendments have implemented more substantial changes to the FMP, while framework adjustments implement less substantive revisions to existing measures, or specify annual catch levels. Amendment 1 implemented the EFH provisions of the Magnuson-Stevens Act in 1999. Amendment 2, implemented in 2005, included restrictions on otter trawls in certain areas, made the minimum fish size consistent in all areas, closed two offshore canyons to monkfish fishing, created a monkfish research DAS set-aside program, and created new permit categories for fishing
in designated areas, among other measures. Amendment 3 was the 2007 SBRM Omnibus Amendment. In 2011, Amendment 5 implemented a process to establish acceptable biological catch amounts and annual catch limits, along with accountability measures to prevent overfishing if such catch limits are exceeded, to bring the FMP into compliance with the Magnuson-Stevens Reauthorization Act. Framework adjustments have generally specified appropriate fishing measures (DAS and trip limits) for each management area to achieve, but not exceed annual catch targets.

### 2.8 Northeast Multispecies FMP

Sixteen species of groundfish are managed under this FMP (see Table 1). Thirteen species are managed as part of the large-mesh complex, based on fish size and type of gear used to harvest the fish, and three species are included in this FMP as the small-mesh complex but are managed under a separate small-mesh multispecies program. While these sixteen groundfish species exhibit unique body types, behaviors, and habitat preferences, all are demersal, living near the bottom and feeding on benthic organisms. Groundfish are found throughout New England waters, from the Gulf of Maine to southern New England.

In 1977, the New England Council's first groundfish FMP, including only cod, haddock, and yellowtail flounder, was implemented. This plan was primarily developed by NMFS and its individual species quotas were a continuation of the ICNAF quotabased management system. Although the quotas did reduce the catch of these species, the system had a number of serious flaws. Because there was no limit on the number of participants, the number of vessels increased dramatically as the stocks improved between 1977 and 1980. The increasing number of vessels caught the quota in less time causing the fishery to be closed more frequently and for longer periods of time. The quotas forced vessels to catch fish as fast as possible to get the largest possible share before the fishery was closed (known as a "derby" fishery). In 1977, the Gulf of Maine cod quota was taken in 5 months and the Georges Bank quota was caught in 6 months.

The Council implemented a system of individual vessel trip limits that helped to prevent long closures that disrupted market supplies. This action was also intended to mitigate the derby fishery, which caused safety concerns, and to give small boats a greater chance to catch a share of fish proportional to their traditional participation levels. Limits were set for each species and stock area for each of three vessel categories. Because of problems associated with data reliability, enforcement, and equity among the vessel sectors, the Council eliminated the quota-based management system when it adopted the Interim Groundfish FMP in 1982. This plan replaced the catch quotas with minimum fish size and codend mesh size regulations for Georges Bank and the Gulf of Maine. It also allowed small-mesh fishing to continue throughout the Gulf of Maine. Closed areas intended to protect spawning haddock were left in place.

What we now consider the Northeast Multispecies FMP was implemented in 1986. It was the first plan in the world to set biological targets in terms of maximum spawning potential. This mechanism allows the Council to meet its biological objectives either by increasing the age-at-first capture (size of fish caught) or by controlling fishing
mortality. The plan also greatly expanded the number of species included in the management unit. In its first year, the plan set minimum fish sizes for some species and changed minimum fish sizes for others. The plan also enlarged one of the haddock spawning closed areas, Area I, and established a large closed area off of southern New England to protect spawning yellowtail and to help reduce fishing mortality. The Exempted Fisheries Program substantially reduced the area and time period available for small-mesh fishing in the Gulf of Maine.

In 1987, the Council adopted Amendment 1 to the FMP, which decreased the area for the silver hake exempted fishery, increased the large-mesh area to include some important yellowtail flounder grounds to the south, and tightened existing mesh size regulations and regulations for the southern New England yellowtail flounder area. Amendment 2 eliminated a scheduled increase in codend mesh size, and implemented the following measures: (1) Trip bycatch limits and stricter non-reporting penalties in the Exempted Fisheries Program; (2) increased some minimum fish sizes; (3) established a seasonal large-mesh area on Nantucket Shoals to protect cod; (4) applied mesh size regulations to the whole nets rather than only to the codend; (5) set all recreational minimum sizes to be consistent with commercial minimum sizes; and (6) excluded trawlers from Closed Area II during the closure to improve enforcement of the closure.

Amendment 3, implemented in 1989, established the Flexible Area Action System. Its purpose was to enable the Council and NMFS to respond quickly to protect large concentrations of juvenile, sub-legal (smaller than the minimum legal size) and spawning fish. Amendment 4 was implemented in 1991 and added more restrictions to the Exempted Fisheries Program; established a procedure for the Council to make recommendations for modifying northern shrimp gear to reduce the bycatch of groundfish; expanded the management unit to include silver hake, ocean pout, and red hake; established management measures for the Cultivator Shoals silver hake fishery; further tightened restrictions on the carrying of small mesh while fishing in the Regulated Mesh Area; and established a minimum mesh size in the southern New England yellowtail flounder area.

Amendment 5 was implemented in 1994 to address the overfishing of principal groundfish stocks that occurred in the late 1980s and early 1990s and reflected a significant turning point in the management of the Northeast multispecies fishery. Amendment 5 established a moratorium on new vessel permits during the rebuilding period (creating the current limited access permit system based on history in the fishery), implemented a DAS effort reduction program (the first of its kind), added additional mesh size restrictions, and also included interim gillnet regulations to reduce harbor porpoise bycatch, a mandatory vessel trip reporting system for landings, a prohibition on pair-trawling, a requirement for a finfish excluder device for shrimp fishery, changed some minimum fish sizes, and expanded the size of Closed Area II. Amendment 6 followed shortly after to implement additional haddock conservation measures.

Amendment 7, implemented in 1996, accelerated the DAS effort reduction program established in Amendment 5, eliminated significant exemptions from the current effort control program, provided incentives to fish exclusively with mesh larger than the
minimum required, broadened the area closures to protect juvenile and spawning fish, and increased the haddock possession limit. It established a rebuilding program for Georges Bank and Southern New England yellowtail flounder, Georges Bank and Gulf of Maine cod, and Georges Bank haddock based primarily on DAS controls, area closures, and minimum mesh size. Additionally, the amendment changed existing permit categories and initiated several new ones, including an open access multispecies permit for limited access sea scallop vessels. Amendment 7 also created a program for reviewing the management measures annually and making changes to the regulations through the framework adjustment process to insure that plan goals would be met.

Amendment 8 was implemented to address gear conflict issues between the mobile gear participants of the groundfish and scallop fisheries and the fixed gear participants of the lobster fishery. Amendment 9 established new status determination criteria (overfishing definitions) and set optimum yield for twelve groundfish species to bring the plan into compliance with the Sustainable Fisheries Act. Amendment 9 also added Atlantic halibut to the FMP’s management unit. Amendment 10, known as the "consistency amendment," was developed to make the vessel upgrading and replacement provisions consistent across all New England and Mid-Atlantic Council FMPs. Amendment 11 addressed the Sustainable Fisheries Act EFH requirements. Amendment 12 addressed the Sustainable Fisheries Act requirements for silver hake, red hake, and offshore hake through a separate small-mesh multispecies management program implemented in 2000.

In addition to the amendments implemented prior to Amendment 13, the FMP was modified through a number of framework adjustments designed to achieve the Amendment 7 fishing mortality targets or to fulfill the requirement for annual adjustments to management measures. Several joint frameworks with the Sea Scallop FMP were implemented to provide scallop vessels access to the groundfish closed areas. Frameworks 32, 35, 37, and 38 instituted additional changes to management of the smallmesh fishery, including several new small-mesh gear exemption areas and elimination of default rebuilding measures.

The Council began work in Amendment 13 in February 1999. The purpose for this amendment included a need to develop rebuilding programs to meet the Amendment 9 status determination criteria and to address problems identified with the effort control program (DAS). After this amendment was begun, the Council submitted Framework 33 to meet the Amendment 7 requirement for an annual adjustment to the FMP. This framework was implemented May 1, 2000. On May 19, 2000, a coalition of conservation organizations challenged Framework 33 alleging that it failed to implement programs necessary to rebuild groundfish stocks to the Amendment 9 targets and did not meet bycatch requirements of the Magnuson-Stevens Act (Conservation Law Foundation et al. v. Evans et al.). The Court found in favor of the plaintiffs on December 28, 2001. After a series of negotiations among various parties, interim measures were adopted by the Court in 2002 and NMFS was instructed to submit a management plan that complied with the Magnuson-Stevens Act. Amendment 13-already in development-was recognized as the most appropriate vehicle to meet the Court's requirement.

Amendment 13 was implemented in 2004, and included several new management features. The amendment classified multispecies DAS into three categories (unrestricted A DAS, restricted use B DAS, and C DAS, which cannot be used at this time); enables the Council to create/allow "special access programs" (SAPs) ${ }^{6}$ for healthy stocks, such as Georges Bank haddock; allows sectors of the groundfish fishing industry to develop their own sector allocation plan; includes an adaptive approach for rebuilding groundfish stocks that requires biennial adjustments to management measures; and implements several provisions of the U.S./Canada Resource Sharing Understanding. ${ }^{7}$ Since Amendment 13 was implemented, several framework adjustments have been developed to modify, fully implement, and/or comply with various provisions of Amendment 13. Several environmental groups challenged Amendment 13, claiming that the rebuilding programs did not comply with the Magnuson-Stevens Act, the management measures would be ineffective, an SBRM was not included, and the amendment did not consider a sufficiently broad range of alternatives. The Court upheld the amendment with the exception of the reference to the SBRM.

Amendment 16 was implemented May 1, 2010 and provided major changes in the realm of groundfish management. Notably, it greatly expanded the sector program and implemented Annual Catch Limits in compliance with 2006 revisions to the MagnusonStevens Act. As a result of this amendment, about 95 percent of the fishery chose to operate in a form of cooperative referred to as a sector, subject to strict limits on catch. These vessels are not subject to trip limit or days-at-sea controls. This management system drastically changed the way the fishery operates. At the time of its implementation, Amendment 16 was expected to reduce bycatch as it reduces regulatory discards. Possession of some species was prohibited to reduce catches (ocean pout, windowpane flounder, wolffish, SNE/MA winter flounder). The amendment also included a host of mortality reduction measures for "common pool" (i.e. non-sector) vessels and the recreational component of the fishery.

The New England Council developed Amendment 19 with the initial goal of bringing the small-mesh multispecies portion of the NE Multispecies FMP into compliance with the ACL and AM requirements of the reauthorized Magnuson-Stevens Act. However, development of Amendment 19 was delayed for several reasons, so NMFS implemented ACLs and AMs for the small-mesh multispecies in 2012 through a Secretarial Amendment. The Council continued development of Amendment 19 in order to adopt the ACL framework used by the Secretarial Amendment, as well as to modify

[^3]other management measures for the small-mesh multispecies fishery. The management measures in the Secretarial Amendment and Amendment 19 include an incidental trip limit trigger to prevent the ACL from being exceeded, a year-round trip limit for red hake, and the potential to implement a quarterly quota system in the southern area, should landings increase rapidly. Because these species are caught incidentally in many fisheries, landings are never prohibited if a quota is projected to be reached, just reduced to an incidental limit to discourage directed fishing. In general, the small-mesh multispecies portion of the fishery is managed using mesh-size dependent trip limits for whiting (silver and offshore hake, combined), area restrictions on small-mesh, and a new year-round trip limit for red hake.

The NE Multispecies FMP has been modified through a number of framework adjustments designed to achieve fishing mortality targets or to fulfill the requirement for annual adjustments to management measures. Several joint frameworks with the Atlantic Scallop FMP were implemented to provide scallop vessels access to the groundfish closed areas. Frameworks 32, 35, 37, and 38 each instituted additional changes to management of the small-mesh fishery, including several new small-mesh gear exemption areas and elimination of default rebuilding measures.

There are a variety of fishing gears used in the commercial groundfish fishery. Otter trawls are the primary gear type used for all species in both the large-mesh and small-mesh complexes and flatfish and silver hake are caught almost exclusively with otter trawls. Based on FVTR data for 2007-2011, gillnets contribute substantial amounts of Atlantic cod, pollock, redfish, and white hake. Other gears identified in the FVTR data associated with landings of groundfish include handlines, longlines, and fish pots. Recreational fishing for groundfish is focused primarily Atlantic cod, pollock, haddock, red hake, and winter flounder. Recreational fishing is conducted by shore-based anglers and anglers with private boats, as well as by anglers aboard party/charter vessels. See below for recent commercial and recreational landings of large-mesh (Table 14) and small-mesh (Table 16) multispecies, aggregated across the complexes. Table 15 and Table 17 identify the primary ports associated with the large-mesh and small-mesh multispecies complexes, respectively, along with the average recent landings and exvessel values for each of the primary ports.

|  | Commercial Landings | Recreational Landings $^{8}$ |
| :---: | :---: | :---: |
| 2007 | $57,403,000$ | $5,407,000$ |
| 2008 | $67,286,000$ | $6,841,000$ |
| 2009 | $62,854,000$ | $5,900,000$ |
| 2010 | $62,166,000$ | $7,498,000$ |
| 2011 | $63,164,000$ | $8,044,000$ |

Table 14. Recent commercial and recreational landings (lb) of large-mesh multispecies (aggregated).

| Primary Ports | Commercial Landings | Ex-vessel Value of Landings |
| :--- | :---: | :---: |
| Gloucester, MA | $21,434,000$ | $\$ 27,510,000$ |
| New Bedford, MA | $18,053,000$ | $\$ 25,869,000$ |
| Boston, MA | $7,631,000$ | $\$ 9,290,000$ |
| Portland, ME | $5,010,000$ | $\$ 6,324,000$ |
| Chatham, MA | $1,925,000$ | $\$ 2,797,000$ |

Table 15. Primary ports associated with the large-mesh multispecies fishery (values are aggregated and averaged for 2007-2011).

|  | Commercial Landings | Recreational Landings |
| :---: | :---: | :---: |
| 2007 | $15,762,000$ | 44,000 |
| 2008 | $15,026,000$ | 188,000 |
| 2009 | $17,790,000$ | 326,000 |
| 2010 | $19,017,000$ | 237,000 |
| 2011 | $18,330,000$ | 257,000 |

Table 16. Recent commercial and recreational landings of small-mesh multispecies (aggregated).

[^4]| Primary Ports | Commercial Landings | Ex-vessel Value of Landings |
| :--- | :---: | :---: |
| New Bedford, MA | $4,594,000$ | $\$ 2,596,000$ |
| Point Judith, RI | $3,856,000$ | $\$ 1,861,000$ |
| Montauk, NY | $2,962,000$ | $\$ 1,996,000$ |
| New London, CT | 899,000 | $\$ 600,000$ |
| Gloucester, MA | 657,000 | $\$ 418,000$ |

Table 17. Primary ports associated with the small-mesh multispecies fishery (values are aggregated and averaged for 2007-2011).

### 2.9 Northeast Skate FMP

There are seven species included in the Northeast skate complex: Barndoor skate, clearnose skate, little skate, rosette skate, smooth skate, thorny skate, and winter skate. The Northeast skate complex is distributed along the coast of the northeastern United States from near the tide line to depths exceeding 700 meters. Within the complex, the ranges of the individual species vary. The center of distribution for little and winter skates is Georges Bank and southern New England. Barndoor skate is most common in the offshore Gulf of Maine, on Georges Bank, and in southern New England. Thorny and smooth skates are commonly found in the Gulf of Maine. Clearnose and rosette skates have a more southern distribution, and are found in southern New England and the Chesapeake Bight. Skates are not known to undertake large-scale migrations, but they do move seasonally in response to changes in water temperature, moving offshore in summer and early autumn and returning inshore during winter and spring.

A Northeast Skate Complex FMP was developed by the New England Council and was implemented in 2003. The regulations implementing the FMP require the Council to monitor the status of the subject skates and the fishery on an annual basis. The initial regulations under the FMP included the following: Permit requirements for vessels possessing skates and dealers purchasing skates; reporting requirements; a possession limit for skate wings; an exemption from the wing possession limit for vessels fishing only for skates for the bait market; and prohibitions on the possession of smooth skates from or in the Gulf of Maine, and barndoor and thorny skates throughout their range. The original FMP also incorporated a baseline of management measures implemented under other FMPs (Northeast Multispecies, Sea Scallops, and Monkfish) that directly or indirectly control fishing effort on skates. Any proposed changes to these FMPs that could result in an increase in fishing effort on skates were required to first undergo a "skate baseline review" to determine whether, and to what degree, the change may have an impact on skate conservation. The FMP was developed, in part, to collect more complete and accurate information on the catch and disposition of skates in Northeast fisheries, at the species level. Stock assessments and efforts to manage fishing mortality have been hampered by a lack of species-specific catch information. The first amendment to the Skate FMP was the 2007 SBRM Omnibus Amendment.

Amendment 3 to the Skate FMP was implemented in 2010, to establish ACLs and AMs for the skate complex as required by the re-authorized Magnuson-Stevens Act, and to implement measures to rebuild overfished skate stocks. Amendment 3 implemented a stock complex ACL for skates, but created separate landing quotas for the skate wing and bait fisheries, and reduced the skate wing and bait possession limits. The skate bait fishery annual total allowable landings were divided into three separate seasonal quotas to maintain year-round supply of bait. AMs would be triggered if the total allowable landings or ACL were exceeded. Amendment 3 also replaced the skate baseline review with annual review and specification procedures. Framework Adjustment 1 to the Skate FMP was subsequently implemented in 2011, to further reduce the skate wing possession limits, and adjust the in-season trigger of the incidental possession limit. Skates are harvested for two very different commercial markets-one market supplies whole skates to be used as bait in the lobster fishery, and one market supplies skate wings for human consumption. The skate bait fishery is a directed fishery and is more traditional, involving vessels primarily from southern New England ports that target a combination of little skates (>90 percent) and, to a much lesser extent, juvenile winter skates (<10 percent). The vessels supplying skates for the bait market tend to make dedicated trips targeting skates and land large quantities of skates per trip.

The skate wing fishery developed in the 1990s when skates were promoted as "underutilized species," and fishermen shifted effort from groundfish and other fisheries to skates and spiny dogfish. The wing fishery is largely an incidental catch fishery that involves vessels that also participate in the groundfish and/or monkfish fisheries. Although some vessels will make trips specifically targeting winter skates for the wing market, most skates caught for this market are retained by vessels engaged in other fisheries. Most skates are caught using an otter trawl (according to the FVTR) database for 2007-2011, almost 65 percent of landings were from an otter trawl), although gillnets are also used (the remaining 35 percent of 2007-2011 landings were from gillnets). Small amounts of landings are associated with hook and line gear and scallop dredges.

Even though skates are now managed under a Federal FMP, reported landings remain incomplete at the species level. Although some skates are caught by recreational fishermen, recreational landings of skates are negligible both in the context of all recreational fisheries and in the context of the overall skate fisheries. Thus, Table 18 reports recent commercial landings and the ex-vessel value of skates aggregated across all species. Table 19 identifies the primary ports associated with the skate fishery.

|  | Commercial Landings <br> (Ib) | Ex-vessel Value |
| :---: | :---: | :---: |
| 2007 | $24,752,000$ | $\$ 8,686,000$ |
| 2008 | $24,945,000$ | $\$ 7,224,000$ |
| 2009 | $23,977,000$ | $\$ 6,780,000$ |
| 2010 | $23,583,000$ | $\$ 7,508,000$ |
| 2011 | $22,165,000$ | $\$ 7,640,000$ |

Table 18. Recent commercial landings of skates (aggregated).

| Primary Ports | Commercial Landings (Ib) | Ex-vessel Value of Landings |
| :--- | :---: | :---: |
| New Bedford, MA | $6,691,000$ | $\$ 2,952,000$ |
| Point Judith, RI | $5,605,000$ | $\$ 927,000$ |
| Chatham, MA | $2,880,000$ | $\$ 1,388,000$ |
| Newport, RI | $2,098,000$ | $\$ 344,000$ |
| Fall River, MA | $1,070,000$ | $\$ 121,000$ |

Table 19. Primary ports associated with the skate fishery (2007-2011 values are averaged).

### 2.10 Spiny Dogfish FMP

Spiny dogfish are the most abundant sharks in the western North Atlantic, and range from Labrador to Florida, although they are most abundant from Nova Scotia to Cape Hatteras, North Carolina. Spiny dogfish are highly migratory, often traveling in large troops, and they move northward in the spring and summer and southward in the fall and winter. Spiny dogfish are known to be opportunistic predators, consuming whatever prey are readily abundant in their environment, including pelagic and benthic invertebrates and fishes. Although dogfish have a varied diet, most of what they eat are invertebrates (ctenophores in particular) and a recent study of 40,000 stomachs found that less than 1 percent of their diet was composed of principal groundfish species (Link et al. 2002).

In spite of their large numbers and opportunistic feeding, spiny dogfish, like many elasmobranches, suffer from several reproductive constraints. Females may take 7-12 years to reach maturity, growing more than one-third larger than their mature male counterparts before becoming sexually mature. Fertilization and egg development are internal, and gestation takes roughly 2 years, resulting in litters that usually average 6-7
dogfish "pups." As a result of these factors (long time to maturity, long gestation periods, and low fecundity), spiny dogfish are vulnerable to overfishing, particularly if fishing activities focus on the largest individuals, which are almost all mature females.

As a result of increased fishing pressure, spiny dogfish were classified as overfished in 1998. The Mid-Atlantic and New England Councils jointly developed an FMP for spiny dogfish. This plan was partially approved in 1999 and implemented in 2000 and the management measures included an overall commercial quota, allocated into two semiannual periods; restrictive trip limits; a prohibition on finning; an annual quota adjustment process; and permit and reporting requirements. The Atlantic States Marine Fisheries Commission implements complementary management measures for spiny dogfish in state waters. The most significant effect of the original FMP measures was the elimination of the directed dogfish fishery in Federal waters. ${ }^{9}$ Framework Adjustment 1 to the FMP, implemented in 2006, provided for a multi-year, rather than annual, specification-setting process. Framework Adjustment 2, implemented in 2009, adjusted the FMP to allow for more efficient implementation of new scientific information on stock status and biological reference points. The spiny dogfish stock was officially declared to be rebuilt in 2010, and commercial quotas have been significantly increased in recent years. Amendment 1 to the Spiny Dogfish FMP was the 2007 SBRM Omnibus Amendment. Amendment 2 was implemented in 2011 to bring the FMP into compliance with the revised Magnuson-Stevens Act by implementing annual catch limits and accountability measures.

By far most spiny dogfish landings are the result of commercial fishing activities, as reported recreational landings comprise less than 2 percent of the total catch. Sink gillnets, bottom longlines, and bottom otter trawls are the primary commercial fishing gears that catch spiny dogfish and these three gear types accounted for 97 percent of all dogfish landed in 2007-2011. Over the last several years, commercial landings ranged from 6.6 million lb in 2007 up to as 20.9 million lb in 2011 (see Table 20). For fishing years 2007-2011 combined, the Massachusetts ports had the most commercial landings ( 42.5 percent), with another 19 percent made in Virginia, and 10 percent in New Hampshire. Table 21 identifies the primary ports of spiny dogfish landings from 2007 to 2011.

[^5] followed suit to implement restrictive trip limits and eliminate the directed dogfish fishery.

|  | Commercial Landings <br> (lb) | Ex-vessel Value |
| :---: | :---: | :---: |
| 2007 | $6,628,000$ | $\$ 1,387,000$ |
| 2008 | $9,051,000$ | $\$ 2,242,000$ |
| 2009 | $11,666,000$ | $\$ 2,543,000$ |
| 2010 | $12,139,000$ | $\$ 2,478,000$ |
| 2011 | $20,900,000$ | $\$ 4,544,000$ |

Table 20. Recent commercial landings of spiny dogfish.

| Primary Ports | Commercial Landings (lb) | Ex-vessel Value of Landings |
| :--- | :---: | :---: |
| Gloucester, MA | $1,904,200$ | $\$ 418,800$ |
| Chatham, MA | $1,465,400$ | $\$ 298,600$ |
| Virginia Beach, VA | $*$ | $\$^{*}$ |
| Hatteras, NC | 450,200 | $\$ 66,200$ |
| Seabrook, NH | $*$ | $\$^{*}$ |
| Lynnhaven, VA | $*$ | $\$ *$ |
| Long Beach/Barnegat Light, NJ | 403,200 | $\$ 87,000$ |
| New Bedford, MA | 391,800 | $\$ 111,200$ |

Table 21. Primary ports associated with the spiny dogfish fishery (values averaged for 2007-2011). *Data excluded for confidentiality.

### 2.11 Summer Flounder, Scup, and Black Sea Bass FMP

Summer flounder, scup, and black sea bass are three demersal finfish species that occur primarily in the Middle Atlantic Bight from Cape Cod, MA, to Cape Hatteras, NC. ${ }^{10}$ All three species exhibit seasonal movement or migration patterns. Summer flounder move inshore to shallow coastal and estuarine waters during warmer months and move offshore during colder months. Scup is a schooling species that undertakes extensive migrations between the coastal waters in the summer and outer continental shelf waters in the winter. Black sea bass are most often found in association with structured habitats, and they migrate offshore and to the south as waters cool in the fall, returning north and inshore to coastal areas and bays as waters warm in the spring.

[^6]The FMP was developed by the Mid-Atlantic Council, initially just for summer flounder, and approved by the Secretary of Commerce in 1988. This original Summer Flounder FMP was based largely on the ASMFC plan. The first major amendment, Amendment 2, was implemented in 1993 and it established much of the current management regime, including 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. Amendments 4 through 7 made relatively minor adjustments to the management program.

Although initially intended to be separate FMPs, work on the development of the Scup FMP and the Black Sea Bass FMP was folded into the Summer Flounder FMP, which was broadened to incorporate management measures for scup and black sea bass through Amendments 8 and 9, respectively. These amendments included management measures for scup and black sea bass such as commercial quotas and quota periods, commercial fishing gear requirements, minimum fish size limits, recreational harvest limits, and permit and reporting requirements. Both amendments were implemented in 1996. Amendments 10 and 11 made relatively minor changes to the management systems for these fisheries, including removing the sunset provisions related to the limited access (moratorium) permits, gear requirements, and to achieve consistency among all Mid-Atlantic and New England Council FMPs regarding vessel replacement and upgrade provisions.

Amendment 12 was developed to bring the FMP into compliance with the provisions of the Sustainable Fisheries Act. This amendment included revised 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 relatively minor changes to management measures to be implemented through a streamlined process. Amendment 12 was implemented in 1999, although not all of the elements of the amendment were approved by NMFS. In particular, the EFH provisions for all three species and the rebuilding program for scup were not approved.

Implemented in 2003, Amendment 13 focused primarily on the commercial black sea bass fishery, although it also served to bring the FMP into compliance with the Sustainable Fisheries Act regarding the EFH requirements for all three species. The most significant change to the commercial black sea bass fishery eliminated the quarterly quota system, replaced with an annual coastwide quota. This change provided a framework for the ASMFC to allocate the annual quota on a state-by-state basis.

Amendment 14 to the FMP, implemented in 2007, addressed the requirement to establish a rebuilding program for scup, which was declared in 2005 to be overfished. Scup was declared rebuilt as of 2009, and is no longer under a rebuilding plan. An upcoming amendment (Amendment 18) is planned to address a wide range of issues associated with the management of scup (including the commercial/recreational split and the allocation of commercial scup quota among the three quota periods, among other issues). Amendment 17 has been initiated, but not yet completed, to discuss the potential for the black sea bass recreational fishery to be managed using conservation equivalency

In order to come into compliance with the revised Magnuson-Stevens Act, the Mid-Atlantic Council developed an omnibus amendment for all of its FMPs. The ACL/AM Omnibus Amendment (Amendment 15 to the Summer Flounder, Scup, and Black Sea Bass FMP) implemented ACLs and AMs for these three fisheries. Amendment 16 to the FMP was the 2007 SBRM Omnibus Amendment.

For each of these three species, an annual acceptable biological catch (ABC) is established by the Council. The ABC is then divided, using percentages identified in the FMP ${ }^{11}$, into a commercial ACL and a recreational ACL. The Council then sets corresponding annual catch targets (ACT) for each fishing sector. The commercial quota and recreational harvest limit are the amount of landings remaining after deducting discards from the respective ACTs. The commercial fisheries for all three species are managed through a combination of limited access (moratorium) fishing vessel permits, annual quotas that result in closures of the fisheries upon reaching the quota, gear restrictions, and minimum fish sizes. The summer flounder and black sea bass commercial quotas are managed on an annual basis, but the scup commercial quota is sub-divided into three quota periods (Winter I, Summer, and Winter II); although the black sea bass and scup quotas are managed on a coastwide basis, the summer flounder quota is managed on a state-by-state basis. ${ }^{12}$ The annual specifications for these three fisheries may be set each year or for up to 3 years in advance.

The recreational fisheries are not subject to a "hard" quota, but instead are subject to a set of management measures designed to constrain catch to a target level. Management measures used include minimum fish sizes, bag (possession) limits, and fishing seasons. AMs for the recreational fisheries include a pound-for-pound payback of any overage of the ACL. ${ }^{13}$ Party/charter vessels operating in Federal waters are required to obtain Federal permits. Coastwide management measures are established for the black sea bass and scup recreational fisheries operating in Federal waters, but for summer flounder, the states have the option to develop state-by-state measures that, in sum, would achieve the equivalent level of conservation as would the coastwide measures. All decisions regarding annual quotas and management measures for these commercial and recreational fisheries are made in conjunction with the ASMFC.

All three of these species support significant recreational as well as commercial fisheries. On average, commercial landings over the last several years accounted for slightly more than half to two-thirds of the total landings of summer flounder and scup, while black sea bass recreational landings typically exceed commercial landings (see Table 22). The primary gears used in the commercial fisheries for these species vary.

[^7]Based on fishing vessel trip report data from 2007-2011, summer flounder are caught almost exclusively ( 95 percent) with bottom otter trawls; scup are caught primarily ( 92 percent) with bottom otter trawls, but handlines/rod and reel combined with pots, traps, and weirs accounted for another 6 percent; and black sea bass are caught in roughly equal amounts by bottom otter trawls ( 47 percent), and pots and traps ( 46 percent), and to a much lesser extent by handlines/rod and reel ( 5 percent), . Recreational fishing for these species is enjoyed by shore-based anglers, private recreational boat anglers, and anglers on party and charter vessels. Table 22 and Table 23 identify the recent commercial and recreational landings as well as the primary ports and ex-vessel value of the commercial fishery.

|  | Summer Flounder |  | Scup |  | Black Sea Bass |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Commercial Landings | Recreational Landings | Commercial Landings | Recreational Landings | Commercial Landings | Recreational Landings |
| 2007 | 10,037,000 | 9,257,000 | 9,284,000 | 4,594,000 | 2,286,157 | 2,641,000 |
| 2008 | 9,213,000 | 8,151,000 | 5,225,000 | 3,763,000 | 1,930,425 | 2,402,000 |
| 2009 | 11,052,000 | 6,023,000 | 8,204,000 | 3,221,000 | 1,168,873 | 2,781,000 |
| 2010 | 13,386,000 | 5,122,000 | 10,415,000 | 5,980,000 | 1,733,355 | 3,719,000 |
| 2011 | 16,569,000 | 5,963,000 | 15,032,000 | 3,663,000 | 1,688,820 | 1,544,000 |

Table 22. Recent commercial and recreational landings in the summer flounder, scup, and black sea bass fisheries.

| Summer Flounder |  | Scup |  |  | Black Sea Bass |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Primary Ports | Ex-vessel Value | Primary Ports | Ex-vessel Value | Primary Ports | Ex-vessel Value |  |
| Point Judith, RI | $\$ 4,051,000$ | Point Judith, RI | $\$ 1,764,000$ | Point Judith, RI | $\$ 433,000$ |  |
| Point Pleasant, NJ | $\$ 1,635,000$ | Montauk, NY | $\$ 1,078,000$ | Ocean City, MD | $\$ 417,000$ |  |
| Wanchese, NC | $\$ 1,633,000$ | Point Pleasant, NJ | $\$ 562,000$ | Cape May, NJ | $\$ 403,000$ |  |
| Newport News, VA | $\$ 1,544,000$ | Little Compton, RI | $\$ 485,000$ | Point Pleasant, NJ | $\$ 313,000$ |  |
| Montauk, NY | $\$ 1,530,000$ | New Bedford, MA | $\$ 437,000$ | Montauk, NY | $\$ 295,000$ |  |
| Hampton, VA | $\$ 1,469,000$ | Hampton Bays, NY | $\$ 382,000$ | New Bedford, MA | $\$ 233,000$ |  |

Table 23. Primary ports associated with the summer flounder, scup, and black sea bass commercial fisheries (values are averaged for 2007-2011).

### 2.12 Surfclam and Ocean Quahog FMP

The Atlantic surfclam and ocean quahog are both bivalve mollusks that are found in continental shelf waters from Cape Hatteras, NC, north to the Gulf of St. Lawrence/Newfoundland. Major concentrations of surfclams are found on Georges Bank, south of Cape Cod, off Long Island, southern New Jersey, and the Delmarva Peninsula. The greatest concentrations of ocean quahogs are fished in offshore waters south of Nantucket to the Delmarva Peninsula. In general, surfclams are found in water shallower than that in which ocean quahogs are found.

The Mid-Atlantic Council developed the FMP in the mid 1970's (it was the first FMP the Council developed) and the FMP was implemented in 1977. Initially, the FMP instituted a moratorium on participation in the surfclam fishery, while a more detailed limited entry system could be developed, and established quarterly quotas for surfclams and an annual quota for ocean quahogs. The first several amendments dealt mostly with the duration of the management measures and permit moratorium (made indefinite in Amendment 3), reporting requirements, management areas (Amendment 2 divided the surfclam portion of the management unit into the New England and Mid-Atlantic areas) minimum size limits, cage tags, and quota period issues.

Amendment 8 to the FMP, implemented in 1990, established an individual transferable quota (ITQ) system for the fisheries. The fishing vessel owners that received allocation under the ITQ system were those whose vessels had reported landings under the mandatory logbook requirement in place since 1978. The initial allocation was based on the vessel's average historical catch and vessel size, calculated as a percentage of historical quota allocations. Quota shareholders are allowed to purchase, sell, or lease quota to and from other shareholders. This amendment also merged the Mid-Atlantic and New England management areas back into a single management area.

Amendment 9 revised the overfishing definitions, and Amendment 10 incorporated management measures for the Maine "mahogany clam." ${ }^{14}$ Amendment 11 represented the "consistency amendment" to bring all New England and Mid-Atlantic Council FMPs into consistency in regards to vessel replacement and upgrade provisions. Amendment 12 was intended to bring the FMP into compliance with the provisions of the Sustainable Fisheries Act, and included revisions to overfishing definitions, the designation of EFH, a provision allowing framework adjustments to the FMP, and a requirement for an operator permit. Amendment 13 rectified aspects of Amendment 12 that were not approved (surfclam overfishing definition and an analysis of the impacts of fishing on EFH), and included provision for multiple year quota setting. A framework adjustment in 2007 implemented a requirement to use VMS for all vessels participating in the surfclam or ocean quahog fisheries. Amendment 14 to this FMP was the 2007

[^8]SBRM Omnibus Amendment, and Amendment 16 was the 2011 ACL/AM Omnibus Amendment.

Both species live in the sediment and are not vulnerable to most types of fishing gears. Almost 100 percent of landings are associated with the hydraulic clam dredge, although the relatively small Maine fishery uses the so-called "dry" dredge. Landings of surfclams and ocean quahogs from recreational fishing are negligible. Table 24 identifies the recent commercial landings and ex-vessel value of both species, and Table 25 identifies the primary ports of landings for both species.

Waters of the Gulf of Maine and Georges Bank are subject to intermittent harmful algal blooms, or "red tide," caused by the dinoflagellate Alexandrium fundyense, which produces a toxin known to cause paralytic shellfish poisoning (PSP) in people consuming contaminated clams. Because of a history of harmful algal blooms and limited testing in the area, eastern Georges Bank has been closed to the harvest of clams since 1990. In 2013 a portion of Georges Bank was opened for the harvest of surfclams and ocean quahog by vessels using a new PSP testing protocol. Other areas in the Gulf of Maine and western Georges Bank have been closed since 2005 due to an outbreak of $A$. fundyense in these areas.

|  | Atlantic Surfclam |  | Ocean Quahog |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Commercial <br> Landings (Ib) | Ex-vessel <br> Value | Commercial <br> Landings (Ib) | Ex-vessel <br> Value |
| 2007 | $66,152,000$ | $\$ 41,032,000$ | $34,688,000$ | $\$ 20,607,000$ |
| 2008 | $61,177,000$ | $\$ 39,440,000$ | $34,354,000$ | $\$ 20,353,000$ |
| 2009 | $50,644,000$ | $\$ 34,050,000$ | $34,909,000$ | $\$ 21,919,000$ |
| 2010 | $44,043,000$ | $\$ 30,240,000$ | $36,072,000$ | $\$ 23,185,000$ |
| 2011 | $43,888,000$ | $\$ 29,732,000$ | $31,771,000$ | $\$ 22,095,000$ |

Table 24. Recent commercial landings and ex-vessel values in the surfclam and ocean quahog fisheries.

| Atlantic Surfclam |  |  |  |  | Ocean Quahog |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Primary Ports | Landings <br> $(\mathbf{l b})$ | Ex-vessel <br> Value | Primary Ports | Landings <br> $(\mathbf{l b})$ | Ex-vessel <br> Value |  |
| Atlantic City, NJ | $28,600,000$ | $\$ 18,184,000$ | New Bedford, MA | $*$ | $\$^{*}$ |  |
| Ocean City, MD | $4,916,000$ | $\$ 3,119,000$ | Pt Pleasant, NJ | $*$ | $\$^{*}$ |  |
| New Bedford, MA | $3,454,000$ | $\$ 2,786,000$ | Atlantic City, NJ | $3,828,000$ | $\$ 2,614,000$ |  |
| Pt Pleasant, NJ | $5,081,000$ | $\$ 2,568,000$ | Jonesport, ME | 553,000 | $\$ 1,787,000$ |  |
| Oceanside, NY | $2,201,000$ | $\$ 1,603,000$ | Ocean City, MD | $2,123,000$ | $\$ 1,681,000$ |  |

Table 25. Primary ports associated with the surfclam and ocean quahog commercial fisheries (values are averaged for 2007-2011). *Data excluded for confidentiality.

### 2.13 Tilefish FMP

The golden tilefish is the largest and longest lived of all the tilefish species, and in U.S. waters ranges from Georges Bank to Key West, FL, and throughout the Gulf of Mexico. Golden tilefish occupy a fairly restrictive band along the outer continental shelf and are most abundant in depths of 100-240 meters. Temperature may also constrain their range, as they are most abundant near the $15^{\circ} \mathrm{C}$ isotherm. Although this species occupies a variety of habitats, it is somewhat unique in that they create and modify existing vertical burrows in the sediment as their dominant habitat in U.S. waters.

The Tilefish FMP was developed by the Mid-Atlantic Council to implement management measures for the tilefish fishery north of the Virginia/North Carolina border intended to address the overfished status of the species. ${ }^{15}$ The FMP was implemented in 2001, and in the FMP's short existence it has been the subject of two legal challenges. Natural Resources Defense Council v. Evans (2001) challenged the essential fish habitat provisions of the FMP, and Hadaja v. Evans (2001) challenged the ban on trawl gear and the permit category designations. The latter temporarily voided the limited access permit categories in the FMP.

Amendment 1 to the Tilefish FMP, implemented in 2009, eliminated the limited access permit categories and adopted an IFQ program. Initially, thirteen allocation holders received quota share based primarily on historical participation in the fishery. Any vessel is required to have an open access permit in order to land tilefish. The open access permit alone authorizes a vessel to land tilefish under a 500 lb per trip incidental possession limit. If the vessel is authorized to land under tilefish an IFQ allocation permit, it is exempt from the possession limit. Each year, 95 percent of the total allowable landings are allocated to the IFQ fishery. The remaining 5 percent is allocated

[^9]to the incidental fishery. If landings in the incidental fishery reach or exceed the amount allocated, the incidental fishery would be shut down for the remainder of the fishing year. Amendment 2 was the 2007 SBRM Omnibus Amendment, and Amendment 3 was the 2011 ACL/AM Omnibus Amendment.

The commercial tilefish fishery is relatively small, with only a dozen vessels participating in the IFQ fishery. Tilefish are primarily caught with bottom longlines (98 percent of landings reported in the fishing vessel trip report database from 2007-2011), and approximately 1.8 percent of landings are associated with bottom otter trawls. There is a minimal recreational fishery for this species, with less than $8,300 \mathrm{lb}$ landed annually for the last 30 years and in only two years since 2000 does the MRIP database report trips with tilefish as the primary target species. Table 26 and Table 27 identify the recent commercial landings as well as the primary ports and ex-vessel value of the commercial fishery.

|  | Commercial Landings <br> (lb) | Ex-vessel Value |
| :---: | :---: | :---: |
| 2007 | $1,514,000$ | $\$ 4,493,000$ |
| 2008 | $1,491,000$ | $\$ 4,279,000$ |
| 2009 | $1,748,000$ | $\$ 4,202,000$ |
| 2010 | $1,865,000$ | $\$ 5,183,000$ |
| 2011 | $1,750,000$ | $\$ 5,633,000$ |

Table 26. Recent commercial landings of golden tilefish.

| Primary Ports | Commercial Landings <br> (Ib) | Ex-vessel Value of Landings |
| :--- | :---: | :---: |
| Montauk, NY | $1,132,000$ | $\$ 3,273,000$ |
| Long Beach/Barnegat Light, NJ | 321,000 | $\$ 880,000$ |
| Hampton Bays, NY | 170,000 | $\$ 505,000$ |
| Point Judith, RI | 17,000 | $\$ 28,000$ |
| Shinnecock, NY | 4,000 | $\$ 12,000$ |

Table 27. Primary ports for the golden tilefish fishery (values are averaged for 2007-2011).

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## Description of Fishing Modes

As described in chapters 1 and 2, an FMP is the operational unit used for managing a fishery (or collection of fisheries) that targets the species specifically addressed in the FMP. For example, regulations promulgated under the Summer Flounder, Scup, and Black Sea Bass FMP address commercial and recreational fishing activities along the Atlantic coast of the U.S. that, although they use different gear types, share the characteristic of targeting summer flounder, scup, and/or black sea bass. Thus, the minimum fish size for summer flounder landed by commercial vessels is 14 inches, regardless of whether a fish is caught with an otter trawl, a gillnet, or on hook and line. Similarly, the total allowable catch for black sea bass applies jointly to the commercial and recreational fishing sectors, also without regard to the fishing gear used.

While the FMP works very well as the operational unit for devising and implementing fishing regulations, it is not the most efficient or appropriate operational unit for devising and implementing an SBRM. The most efficient designs for collecting information on and monitoring discards occurring in a fishery recognize and incorporate the unique characteristics of each fishery. The way in which the fishing takes place affects the mechanisms that may be appropriate for collecting relevant bycatch information. Thus, there are information collection tools more appropriate for shore-side recreational fisheries, and other tools more appropriate for offshore commercial fisheries. There are tools appropriate for collecting basic information on discards in a fishery for use in a stock assessment that may not be the most appropriate for real-time monitoring of bycatch against a bycatch quota.

Another factor pertinent to determining the most appropriate operational unit for an SBRM is the efficiencies gained by capitalizing on shared characteristics and overlaps in catch among several fisheries. For example, commercial fishing vessels operating out of New England ports that use gillnets often target, and catch, monkfish, skates, and some groundfish species. Even though monkfish, skates, and groundfish fishing regulations are implemented under three separate FMPs, in many cases the same vessels are catching and landing these species. It would be inefficient to develop three separate bycatch sampling strategies and protocols to implement on these vessels. Instead, the goal would be to develop an SBRM that most effectively captures the discards associated with the New England gillnet fishery. Thus, the operational unit for an SBRM is the fishing "mode," where a fishing mode is defined according to the fishing gear used and the area from which the vessels depart, rather than by FMP. If a vessel fishes with more than one gear type, it could be represented in more than one fishing mode.

Because the fishing mode is a more appropriate operational unit for the SBRM than the FMP, the expected biological, physical, and socio-economic impacts associated with this amendment are not analyzed at the level of the FMP, but are more broadly considered across the range of fishing modes directly or indirectly affected by this amendment. This chapter will identify and describe the fishing modes that serve as the basis for describing and evaluating the SBRM to be implemented under the subject

FMPs. Each relevant combination of area ${ }^{16}$ and fishing gear type is described below, and the description includes an overview of the fishery, the species landed in the fishery, and a reference to the pertinent FMPs that regulate the fishing activity. With the exception of the clam dredge, Ruhle Otter Trawl, and Haddock Separator Otter Trawl fisheries, the information summarized in the following sections was derived from FVTR data from 2007-2011, inclusive, to provide a 5-year snapshot to characterize the recent activity in each fishing mode that would most likely be relevant to the SBRM Omnibus Amendment. For a summary reference of the information presented, see Table 28Error! Reference source not found. at the end of the chapter.

Note that for some fishing modes, substantial fishing effort occurs in state waters by vessels that do not hold any Federal fishing permits and are, therefore, not required to submit Federal trips reports on their fishing activity. Vessels that hold no Federal permits other than for American lobster are also not required to submit Federal trip reports. Because trip reports required under Federal fishing permits are the sole source of information used to develop the summary characterizations below, the information presented below will be incomplete for the fishing modes with substantial participation by vessels with state permits only. Most notably, this applies to Mid-Atlantic crab pots, fish pots, and lobster pots, along with New England lobster pots. The lack of a reporting requirement in the Federal lobster regulations ( 50 CFR part 697) results in incomplete data on lobster fishing activities, even in Federal waters.

### 3.1 Clam Dredge Fishery

As noted above, the clam dredge fishery is the only fishing mode for which FVTR data were not the sole source of information used to develop the following fishing activity characterization. The regulations at 50 CFR 648.7(b) exempt vessel owners and operators fishing under a Federal surfclam or ocean quahog permit from the requirement to submit the FVTR required of most other Federal permit holders, except when landing other species besides surfclams and/or ocean quahogs. Instead, the regulations require these permit holders to submit a separate surfclam and ocean quahog log report. The data collected from the surfclam and ocean quahog log reports are maintained separately from the FVTR data, and these data are organized slightly differently, making them difficult to integrate into the FVTR data.

Data from the surfclam and ocean quahog log reports for 2007-2011, inclusive, are summarized below to provide a 5-year snapshot of the fishing activities of vessels using clam dredges. Due to complications associated with the database, landings information is not organized based on the port of departure (New England vs. MidAtlantic), but is instead presented for the whole Greater Atlantic Region. Area fished and total landings information has been separated by regions and is presented below. This information focuses on landings of surfclam and ocean quahogs only. Supplemental

[^10]information derived from the FVTR database provides information on the relative landings of other species by participating vessels.

Over the 5-year period of 2007-2011, the number of participants in this fishing mode was consistent, with an average of 66 vessels each year. On average, these vessels made between 65 and 78 fishing trips per year. Fishing trips lasted less than 1 day, on average, and although the majority of trips were less than 1 day in duration, longer trips of up to 4 days did occur. As indicated above, surfclams and ocean quahogs are the only species recorded in the primary clam log report database, and ocean quahogs accounted for just over half ( 56 percent) of the cumulative landings of these species over the 5 -year period. Clam dredge vessels landed almost 3.4 million bushels of ocean quahogs and over 2.5 million bushels of surfclams per year, on average. ${ }^{17}$

The majority of clam dredge landings come into two New Jersey ports (Atlantic City and Point Pleasant, together accounting for 53 percent of average annual landings). Atlantic City ( 2.1 million bushels per year, on average) and Point Pleasant ( 1.2 million bushels per year, on average) have traditionally been the two primary ports for this fishing mode, but New Bedford, MA, has recently experienced an increase in landings with over 1.9 million bushels per year, on average (for 31 percent of total landings). Ocean City, MD, receives a smaller share (505,000 bushels), but still accounts for 8.2 percent of total annual landings. Although there have been up to 16 separate ports of landing in this fishing mode in any 1 year, these four ports account for over 92 percent of total landings.

### 3.1.1 New England

In addition to landings of surfclams and ocean quahogs reported on the clam log reports, vessels using clam dredges reported landings of other species on the FVTR. In each year from 2007-2011, there were an average of 15vessels fishing from New England ports that submitted FVTRs (roughly 50 percent of those reporting via the clam log reports). These vessels reported taking between 10 and 30 trips per vessel each year, on average. These trips account for 24.6 percent, on average, of the trips reported via the clam log report, some proportion of which may be separate trips. The species most commonly reported on the FVTR include sea scallops, mussels, hard clams, monkfish, and whelks were also reported during this timeframe. Most of the reported landings were sea scallops, with an average of $163,000 \mathrm{lb}$ per year. Mussels and hard clams landings were much less, only $52,000 \mathrm{lb}$ and $35,000 \mathrm{lb}$ per year, respectively.

Figure 1 displays the top ports and primary fishing areas utilized by participants in this fishing mode. In Figure 1, and in all figures to follow in this chapter, fishing effort in the primary fishing areas is presented by shading in statistical areas according to the average number of "days absent" attributed to each statistical area. The statistical area fished is one of the data elements reported on both the FVTR and the clam log report, and days absent are calculated as the length of each fishing trip. While this is not an absolute

[^11]measure of the fishing time or effort spent in each statistical area (for example, it does not account for steaming time to and from an area), it represents an approximate relative measure of where most of the fishing effort is concentrated.


Figure 1. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England clam dredge fishing mode.

### 3.1.2 Mid-Atlantic

In the Mid-Atlantic region, an average of 34 vessels submitted FVTRs each year from 2007-2011 (roughly the same number of vessels as reporting via the clam log reports). These vessels reported taking between 19 and 30 trips per vessel each year, on average. These trips account for 37 percent, on average, of the trips reported via the clam log report, some proportion of which may be separate trips. The species most commonly reported on the FVTR include sea scallops, blue crabs, croaker, hard clams, horseshoe
crabs, and monkfish, although small amounts of whelks and skates were also reported during this timeframe. Most of the reported landings were sea scallops, with an average of $125,000 \mathrm{lb}$ per year. Blue crab landings were much less, only $33,000 \mathrm{lb}$ and croaker was only $14,600 \mathrm{lb}$ per year.

Figure 2 displays the top ports and primary fishing areas utilized by participants in this fishing mode


Figure 2. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic clam dredge fishing mode.

### 3.2 Crab Pot Fishery

### 3.2.1 New England

The New England crab pot fishing mode is primarily represented by a small, very targeted fishery for deep-sea red crab, although some vessels fish for Jonah or other species of crab. There have been about seven vessels participating in this fishery, on average, over the last 5 years, and each vessel takes an average of 17 trips annually. The majority of fishing trips in this mode (68 percent) were less than a day, likely representing a large number of small, near-shore vessels. Another 21 percent of fishing trips in this mode average between 8 and 12 days in duration, which is more likely to represent vessels fishing for deep-sea red crab.

As noted, red crab is the dominant target species for this fishing mode, with just under 2.5 million lb of landings per year. This represents 92 percent of the total landings by this fishery, although small amounts of whelks (118,200 lb per year), Jonah crab ( $46,500 \mathrm{lb}$ per year), rock crab ( $26,100 \mathrm{lb}$ per year), and American lobster ( $14,000 \mathrm{lb}$ per year) are also landed. During the period from 2007-2011 the principle port for this fishing mode shifted from Fall River, MA (90 percent of mode landings in 2009), to New Bedford, MA, ( 98 percent of mode landings in 2011). Figure 3 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 3. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England crab pot fishing mode.

### 3.2.2 Mid-Atlantic

Much of the crab pot fishing effort in this region cannot be quantified using the FVTR database because of the number of smaller vessels operating in fisheries that do not require a Federal permit. However, development of the deep sea red crab fishery in the Mid-Atlantic has resulted in that species representing 68 percent of the landings of federally permitted vessels participating in the Mid-Atlantic crab pot fishery. Blue crabs comprise over 24 percent of the landings reported by federally permitted vessels. The federally permitted vessels land mostly in Newport News, VA and Engelhard, NC. Figure 4 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 4. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic crab pot fishing mode.

Overall, the Mid-Atlantic crab fishery is the largest fishery in the region-in 2011, for example, over 28 million lb of blue crabs were landed in North Carolina, and blue crab landings from Chesapeake Bay averaged over 80 million lb from 2007-2011. However, most of these landings are made by fishing vessels without any Federal permits fishing in state waters. Thus, this summary is not a complete characterization of the crab pot fishery in the Mid-Atlantic and should be viewed with caution, other than to understand the scope of the fishing effort relevant to the SBRM.

### 3.3 Fish Pot Fishery

### 3.3.1 New England

The New England fish pot fishing mode has generally been a fairly stable fishery for scup and black sea bass with approximately 34 participating vessels each year. These vessels make an average of nearly 20 short (less than a day, on average) fishing trips each year, although longer trips (as long as 11 days) do occur.

Scup is the top species landed by participants in this fishing mode, accounting for almost 46 percent ( $121,000 \mathrm{lb}$ per year) of the total annual landings and black sea bass accounts for another 39 percent ( $102,000 \mathrm{lb}$ per year). Channeled whelk represented another 4 percent ( $11,000 \mathrm{lb}$ per year) of annual landings. The primary port for this fishing more was Little Compton, RI (77,000 lb per year). Point Judith, RI, (44,000 lb per year) and Harwichport, MA (27,000 lb per year) were also important ports for this mode. Figure 5 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 5. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England fish pot fishing mode.

### 3.3.2 Mid-Atlantic

Similar to its New England counterpart, the Mid-Atlantic fish pot fishing mode is primarily a black sea bass fishery, with 64.4 percent of all landings (total landings for this mode average $732,000 \mathrm{lb}$ per year). Participation averaged 65 fishing vessels per year, each taking an average of 22 relatively short fishing trips ( 98 percent of trips were less than a day and the longest trips average only 6 days).

Although over 40 different species are landed each year in this mode, seven species account for 90 percent of all landings by weight. Black sea bass landings, as noted above, predominate, with an average of $472,000 \mathrm{lb}$ per year. Tautog ( $56,000 \mathrm{lb}$ per year), American lobster ( $37,000 \mathrm{lb}$ per year), channeled whelks ( $31,000 \mathrm{lb}$ per year), scup
(21,000 lb per year), eels (20,000 lb per year), and Jonah crab (20,000 lb per year) together comprise 26.7 percent of the total annual landings. Cape May, NJ and Ocean City, MD, are the top ports, each with over $110,000 \mathrm{lb}$ of landings each year ( 15 percent of the total landings). Sea Isle City, NJ, Indian River, DE and Virginia Beach, VA are also primary ports for this mode, and together take in 30 percent of the annual landings. Figure 6 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 6. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic fish pot fishing mode.

### 3.4 Hagfish Pot Fishery

### 3.4.1 New England

Hagfish are not currently the subject of an FMP and there is no Federal vessel permit. Characterizing the New England and Mid-Atlantic hagfish pot fishing modes may be limited by the lack of data from participants who are not required to submit FVTRs because they do not hold a Federal permit with a FVTR requirement. The development of a Hagfish FMP is presently being considered by the New England Council. In 2007, at the request of the New England Council, NMFS implemented an information collection program for hagfish to help the Council determine if future management measures are necessary. Under the information collection program all dealer/processors that purchase hagfish caught from the EEZ must have a federal hagfish permit and submit the required weekly reports of trip-level information for all purchases from fishing vessels.

Hagfish pots are highly selective for the target species, and hagfish represented 95 percent of total landings by this mode. Atlantic herring was another 5 percent of total mode landings. Gloucester, MA was the top port followed by Portland, ME, and Point Judith, RI. Figure 7 displays the top ports and primary fishing areas utilized by participants in this fishing mode who do submit FVTRs.


Figure 7. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England hagfish pot fishing mode.

### 3.4.2 Mid-Atlantic

Landings of the Mid-Atlantic hagfish pot fishery consist of over 99 percent hagfish. The primary port is Newport News, VA with 93 percent of the total mode landings. Figure 8 displays the top ports and primary fishing areas utilized by participants in this fishing mode who do submit FVTRs.


Figure 8. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic hagfish pot fishing mode.

### 3.5 Gillnet Fishery

Within the overall gillnet fishery, there are three mesh size categories used to define the fishing modes for the purposes of the SBRM: Small mesh (less than 5.5 inches); large mesh ( 5.5 inches or greater and less than 8 inches); and extra-large mesh (8 inches and greater). For each mesh size category, the two focus areas (New England and Mid-Atlantic) will be addressed.

### 3.5.1 Small-Mesh Gillnets

### 3.5.1.1 New England

The New England small-mesh gillnet fishery is a fairly small fishing mode, with a relatively small fleet that averaged 12 vessels participating in any one year. For the most part, these vessels have taken no more than one to two trips each per year, with trips averaging less than 1 day in duration.

Total landings of fish for this fishing mode have averaged 43,600 lb, a very small component of the overall groundfish-type fisheries in the Greater Atlantic Region. Top species landed include bluefish (just over $15,000 \mathrm{lb}$ per year, on average), cod (under $7,000 \mathrm{lb}$ per year), sea scallop ( $3,600 \mathrm{lb}$ per year), and scup (just over $3,500 \mathrm{lb}$ per year). The primary port for this fishing mode is Point Judith, RI, with just under 50 percent of landings. Gloucester, New Bedford, and Chatham, MA, were also important ports with just over 30 percent of all landings coming in to these three ports. Figure 9 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 9. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England small-mesh gillnet fishing mode.

### 3.5.1.2 Mid-Atlantic

In contrast, the Mid-Atlantic small-mesh gillnet fishery is a much larger fishing mode, with over 100 participating vessels, on average, and average annual landings of over 4.6 million lb. These vessels together take an average of over 2,600 fishing trips per year (for an average of 24 trips per vessel per year). Trips generally last less than 1 day, but can exceed 10 days in duration. Vessels participating in this fishery primarily land at ports in North Carolina (Wanchese and Hatteras), New Jersey (Barnegat and Long Beach), and Virginia (Virginia Beach and Chincoteague).

Atlantic croaker and bluefish are the primary species landed by participants in this fishing mode, together comprising almost three-quarters of all landings. Landings of
croaker exceeded 2.3 million lb, on average, over the 5-year timeframe examined.
Bluefish landings were just under $980,000 \mathrm{lb}$ per year. Landings of menhaden, spot, and spiny dogfish together averaged another $950,000 \mathrm{lb}$. Figure 10 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 10. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic small-mesh gillnet fishing mode.

### 3.5.2 Large-Mesh Gillnets

### 3.5.2.1 New England

The biggest component of the New England gillnet fishery is the large-mesh gillnet fishing mode. Between 2007 and 2011, an average of 134 vessels participated. These vessels averaged 60 trips each year, landing over 80 different species at over 35
different New England ports. As with other gillnet fisheries, trips averaged less than 1 day in duration, but longer trips, up to 18 days in duration, are also reported.

Total landings of fish in this mode exceeded 15.3 million lb per year, with pollock and cod the primary species. Together, pollock (over 5.3 million lb per year) and cod ( 4.6 million lb per year) accounted for just over 65 percent of total landings, and spiny dogfish (over 3 million lb per year) comprised another 21 percent of total landings for the fishing mode. Most landings were made in Gloucester, MA (over 35 percent), Portland, ME (14 percent), and Chatham, MA (12 percent). Figure 11 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 11. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England large-mesh gillnet fishing mode.
3.5.2.2 Mid-Atlantic

The Mid-Atlantic large-mesh gillnet fishery is smaller than the New England large-mesh gillnet fishery, but remains a substantial fishery nonetheless. An average of 119 vessels participates in this fishing mode each year, making an average of 15 trips each. Average trip duration is less than 1 day, but the longest trips are 13 days or less.

The majority of landings in this fishing mode are of either spiny or smooth dogfish (an average of 1.5 million lb and $800,000 \mathrm{lb}$ per year, respectively). Bluefish are also a substantial component of the landings ( 1.2 million lb per year). Together, these three species comprise 88 percent of the 4.0 million lb in total annual landings. Most landings are made in Barnegat, NJ (18 percent), Wanchese, NC (16 percent) Ocean City, MD (12 percent), or Chincoteague, VA (11 percent). Figure 12 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 12. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic large-mesh gillnet fishing mode.

### 3.5.3 Extra-Large-Mesh Gillnets

### 3.5.3.1 New England

Participation in the New England extra-large mesh gillnet fishery has averaged 108 participating vessels from 2007 through 2011. Over this time, participating vessels made an average of fewer than 33 fishing trips each per year. Trip duration for all participating vessels averaged just under 1 day, with some trips up to 10 to 20 days in duration.

This is a fairly targeted fishing mode, with most landings (over 60 percent) of skate alone. There were over 7.5 million lb of skate landed, on average, between 2007
and 2011. Monkfish represented the second largest component of landings, with 3.2 million lb per year ( 25 percent of total landings). Some Northeast multispecies were also landed, but the primary groundfish species, cod and pollock, together comprised only 7 percent of total landings for this fishing mode. The primary ports for this fishing mode were Chatham, MA (30 percent of total landings) and New Bedford, MA ( 26 percent of total landings). Gloucester, MA, Little Compton, RI, and Point Judith RI, were also important, with just under 24 percent of all landings coming in to these three ports. Figure 13 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 13. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England extra-large-mesh gillnet fishing mode.
3.5.3.2 Mid-Atlantic

Among the gillnet modes, the extra-large mesh gillnet category has the most similarity between the New England and the Mid-Atlantic components. In the MidAtlantic, there was an average of 109 participating fishing vessels that made an average of over 25 trips each per year. Fishing trips averaged less than 1 day, however trips from 10 to 20 days in duration were reported.

The strongest similarity between the two regions for this fishing mode is in species landed, with monkfish and skates being the primary species in the Mid-Atlantic as well. The Mid-Atlantic fishery is more targeted than New England on monkfish, over 69 percent of all landings in this mode (over 3.2 million lb per year) are monkfish. Skates represent another 15 percent of landings, while the rest of the landings are spiny dogfish, striped bass, and bluefish (each under 2 percent).

Three of the top five ports for Mid-Atlantic extra-large mesh gillnet landings are in New Jersey: Barnegat, Long Beach, and Point Pleasant (21 percent, 14 percent, and 11 percent, respectively). Montauk, NY (12 percent), Chincoteague, VA (10 percent), and New London, CT (8 percent) are also important. Figure 14 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 14. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic extra-large-mesh gillnet fishing mode.

### 3.6 Handline and Rod and Reel Fishery

### 3.6.1 New England

The New England handline and rod and reel fishing mode has 258 vessels, on average, reporting via FVTRs per year. On average, participants in this fishing mode take 11 fishing trips per year, and trips averaged less than a day in duration but longer trips, up to 10-15 days, were reported.

This fleet primarily targets cod (29 percent of landings) and spiny dogfish (26 percent of landings), although a number of these vessels target bluefin tuna and striped bass (14.5 percent of landings, each). In spite of the substantial numbers of participants, the amount of cod landed ( 1.1 million lb per year) remains less than one-quarter of the cod landings of the large-mesh gillnet fleet.

The New England handline and rod and reel fleet reports landings at over 90 ports but 78 percent of landings are concentrated at just 5 ports: Chatham, MA ( $246,000 \mathrm{lb}$ per year); Gloucester, MA (159,000 lb per year); Harwichport, MA (88,000 lb per year); Marshfield, MA (43,000 lb per year); and Point Judith, RI (41,000 lb per year). Figure 15 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 15. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England handline/rod and reel fishing mode.

### 3.6.2 Mid-Atlantic

A similarly sized fleet, with over 208 participating vessels per year, the MidAtlantic handline and rod and reel fishing mode shares many functional characteristics with the New England mode, but targets different species. Each participating vessel, on average, made 21 trips per year, landing at 90 ports. Trips generally last less than a day, but trips over 10 days in duration have occurred in most years.

As noted above, the similarities between the New England and Mid-Atlantic modes end when it comes to the species landed. The primary targets of this fishing mode were striped bass (195,000 lb per year, 28 percent of total landings), bluefish (124,000 lb
per year), scup (104,000 lb per year), summer flounder ( $86,000 \mathrm{lb}$ per year), and black sea bass ( $332,000 \mathrm{lb}$ per year). Although over 115 species are landed by participants in this fishery, these five species represent over 82 percent of total landings. Over 56 percent of all landings are made in Montauk, NY, with an average $396,000 \mathrm{lb}$ annually. Virginia Beach, VA, Point Lookout, NY, Island Park, NY, Shinnecock, NY, and Point Pleasant, NJ combine for another 16 percent of total landings for this fishing mode Figure 16 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 16. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic handline/rod and reel fishing mode.

### 3.7 Lobster Pot Fishery

Characterizing the New England and Mid-Atlantic lobster pot fishing modes is limited by the lack of data from many participants who are not required to submit FVTRs because they do not hold a Federal permit with a FVTR requirement.

### 3.7.1 New England

While FVTR information is not available for vessels that hold no Federal permits or no Federal permits other than for lobster, a substantial number of participants in the New England lobster pot fishing mode hold at least one Federal permit with a requirement to submit FVTRs. There are, on average, over 480 participants in the New England lobster pot fishing mode that submit FVTRs each year, and these participants take an average of 64 fishing trips each year. Most fishing trips are under 1 day in duration, although trips lasting 15-20 days do occur each year.

American lobster is the primary species landed in this fishing mode, with an average of nearly 15 million lb landed each year by participants that submit FVTRs. This represents over 63 percent of the total landings by these participants. Jonah crab is also a significant component of this fishing mode, with an average of nearly 8 million lb landed annually. Together, lobster and Jonah crab comprise 97 percent of the total reported landings in this mode. Various crab species (rock, blue, and red, among others) also factor as landings, but in much smaller amounts.

Landings in this fishing mode are fairly spread out among almost 140 ports in New England, and the top 5 ports (Point Judith, RI, New Bedford, MA, Newport, RI, Newington, NH, and Sandwich, MA) together account for 53 percent of the landings made by reporting participants. Point Judith averaged 3.7 million lb (16 percent of the total reported landings) and New Bedford averaged 3.4 million lb ( 15 percent of total reported landings), while the other three each average 1.5-2.0 million lb (6-9 percent of total reported landings). Figure 17 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 17. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England lobster pot fishing mode.

### 3.7.2 Mid-Atlantic

There are many fewer participants in the lobster pot fishing mode that report via FVTRs in the Mid-Atlantic than in New England, as the average number of reporting participants is just over 88 per year. These participants take fewer fishing trips, about 36, per year. Most trips last under 1 day, and the longest trips tend to be between 10 and 15 days in duration.

As expected, American lobster is the primary species landed, although at just over 1 million lb per year, these landings represent a small fraction of the 15 million lb per year landed in New England. Lobsters comprise almost 64 percent of the annual landings, with Jonah crab ( $493,000 \mathrm{lb}$ ) adding another 28 percent of total landings. The
rest of the top five species landed include whelk ( $32,000 \mathrm{lb}$ per year), black sea bass ( $31,000 \mathrm{lb}$ per year), and red crab (24,000 lb per year) and combine for only 5 percent of total landings. Montauk, NY (494,000 lb per year), Point Pleasant, NJ (388,000 lb per year), and Sea Isle City, NJ ( $268,000 \mathrm{lb}$ per year), are the top ports for participants in this fishing mode that report via FVTR. Together these three ports take in over 64 percent of the total reported landings for this mode. Cape May, NJ, and Ocean City, MD, together account for another 12 percent of the reported landings each year. Figure 18 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 18. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic lobster pot fishing mode.

### 3.8 Bottom Longline Fishery

As explained in chapter 5, for the purposes of allocating fishery observer effort within the groundfish fisheries, some New England longline fishing trips are differentiated according to the type of trip (if the trip participates in a SAP). However, this information is not available on the FVTR, and so the following summaries do not specifically address the differences between these types of trips and other longline trips.

### 3.8.1 New England

The number of participants in the New England bottom longline fishing mode has had an average of 73 participating vessels each year. These vessels take an average of 15 fishing trips each per year, each lasting an average of under 1 day, while trips of 10 to 12 days are reported each year.

Haddock (744,000 lb per year), Spiny dogfish ( $634,000 \mathrm{lb}$ per year) and cod (429,000 lb per year) are the primary species landed by participants in this fishing mode, together representing over 93 percent of the total mode landings. The predominant port for the New England bottom longline fleet is Chatham, MA (44 percent), but Gloucester, MA (16 percent) and Harwichport, MA (12 percent) are also very important. Secondary ports include Scituate, MA ( 7.4 percent) and Marshfield, MA ( 5.5 percent). Figure 19 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 19. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England bottom longline fishing mode.

### 3.8.2 Mid-Atlantic

The Mid-Atlantic bottom longline fishery is a much smaller, much more focused fishing mode that primarily targets tilefish. On average, 20 vessels participate each year, making an average of fewer than 9 fishing trips per year. Fishing trips are typically 4-12 days in duration, but trips up to 20 days occur.

As noted, this is a much more focused fishing mode than many others, with 89 percent of landings being golden tilefish. Another 7 percent of total landings consist of swordfish, yellowfin tuna, spiny dogfish, and bigeye tuna, combined. Nearly 64 percent of the landings are made in Montauk, NY (1.1 million lb per year), while Barnegat, NJ, accounts for 16 percent of total landings. Secondary ports include Long Beach, NJ (6.7
percent of landings) and Hampton Bays, NY (5.3 percent of landings). Figure 20 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 20. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic bottom longline fishing mode.

### 3.9 Mid-Water Single and Pair Trawl Fisheries

For the purposes of the development and application of the SBRM, paired and single midwater trawls are considered together in the stratification of observer data and the allocation of observer effort.

### 3.9.1 New England Midwater Single and Pair Trawl

Midwater trawl fisheries are large volume fisheries with relatively few participants. The New England single and pair trawl mode averages 21 active participants each year, and each participant takes, on average, nearly 22 fishing trips per year. Most trips are relatively short, typically 1 to 4 days, but longer trips 10-20 days in duration do occur. The New England midwater trawl fishing mode is an extremely targeted fishery, with over 80 percent of the annual landings from Atlantic herring (nearly 120 million lb per year), and Atlantic mackerel (19 percent, or 28 million lb, per year) generally comprises the remainder. Occasional landings of longfin squid ( $186,000 \mathrm{lb}$ per year), menhaden ( $55,000 \mathrm{lb}$ per year), and haddock ( $41,000 \mathrm{lb}$ per year), but the amounts are negligible compared to the two primary species.

Gloucester, MA, is the top port for this fleet, receiving over 40 percent of the annual landings ( 60 million lb). New Bedford, MA, and Portland, ME, rank second and third, respectively, with 48 million lb ( 32 percent of the total) landed each year in New Bedford, and 19.5 million lb (13 percent) coming in each year to Portland. Rockland, ME, and Fall River, MA, complete the top five ports, with a total of 12.6 million lb ( 8.5 percent of the total) between them. Figure 21 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 21. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England midwater single and pair trawl fishing mode.

### 3.9.2 Mid-Atlantic Midwater Single and Pair Trawl

The Mid-Atlantic midwater single and pair trawl mode is smaller than its New England counterpart. The Mid-Atlantic single and pair trawl mode has averaged just eight vessels per year. Trips are typically 3 to 4 days in duration, and each vessel took, on average, over 5 trips each year. In contrast to the New England midwater trawl fishing mode, for which Atlantic herring is the primary target species, in the MidAtlantic, Atlantic herring and Atlantic mackerel are targeted more evenly.

Nearly 52 percent of all landings by Mid-Atlantic midwater trawls is Atlantic herring, averaging over 5.7 million lb per year. Just over 5.1 million lb per year of Atlantic mackerel (46 percent of total mode landings) are landed by this fleet, and
relatively insignificant amounts of Illex squid, menhaden, and scup are also landed, although these last three species together account for less than 1.5 percent of total annual landings.

Cape May, NJ, the top port for this fishing mode. Figure 22 displays primary fishing areas utilized by participants in this fishing mode.


Figure 22. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic midwater single and pair trawl fishing mode.

### 3.10 Otter Trawl Fishery

Within the overall bottom otter trawl fishery, there are two mesh size categories used to define the fishing modes for the purposes of the SBRM: Small mesh (less than
5.5 inches) and large mesh ( 5.5 inches and greater). For each mesh size category, the two focus areas (New England and Mid-Atlantic) will be addressed. As explained in chapter 5 , for the purposes of allocating fishery observer effort within the groundfish fisheries, some New England large-mesh otter trawl fishing trips are differentiated according to the type of trip (if the trip is to the U.S/Canada management area or uses B-Regular DAS). However, this information is not available on the FVTR and so the following summaries do not specifically address the differences between these types of trips and other largemesh otter trawl trips.

### 3.10.1 Small-Mesh Otter Trawls

### 3.10.1.1 New England

The New England small-mesh otter trawl fishing mode has 148 participants, on average, landing over 50 million lb of fish each year. These vessels take, on average, almost 24 fishing trips per year, and the trips average just under 2 days in duration (although longer trips up to 20-25 days do occur).

Squid comprise the majority of catch for the participants of this fishing mode, with more than 13 million lb and 12 million lb of Longfin and Illex squid, respectively, landed on average each year. Together, these two species account for 51 percent of all landings in this mode. Also very important are silver hake with over 8.7 million lb (17 percent of the total landings), and Atlantic herring with 7.7 million lb (15 percent of the total landings) landed each year. In addition to these four species, Atlantic mackerel (3 million lb ) accounts for another 6 percent of annual landings.

The majority of landings made by participants in this fishing mode come into either North Kingstown or Point Judith, RI. Together, these two Rhode Island ports receive over 38 million lb ( 77 percent) of all small-mesh otter trawl landings in New England each year. New Bedford, MA ( 6 million lb annually), Newport, RI (2 million lb annually), and Gloucester, MA (826,000 lb annually), also constitute major ports for this fishing mode. Figure 23 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 23. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England small-mesh otter trawl fishing mode.

### 3.10.1.2 Mid-Atlantic

There are many similarities between the New England and Mid-Atlantic modes of this fishery - not only in the species landed, but there is also an overlap in the areas fished (see Figure 23 and Figure 24). Participation in the Mid-Atlantic fishing mode averages 170 vessels per year, slightly more than the number of New England participants. On average, each Mid-Atlantic vessel takes almost 24 fishing trips per year, and like the New England mode, trips lasted almost 2 days on average Longer trips up to 15-20 days also occurred.

As in New England, squids comprise the majority (60 percent) of landings, with over 19 million lb of Illex squid and over 9 million lb of Longfin squid landed each year.

Silver hake also comprises a substantial amount of the annual catch, with over 6 million lb . Atlantic croaker ( 4 million lb ) and scup ( 2.6 million lb) account for almost 14 percent of annual landings.

Cape May, NJ, is the top port for this fishing mode, with over 24 million lb of landings ( 50 percent of total landings for this mode) each year. Montauk, NY, takes in another 16 percent of annual landings, with Wanchese, NC (4.3 million lb annually), Shinnecock, NY ( 2.2 million lb annually), and New London, CT (1.7 million lb annually), also accounting for another 17 percent of total landings. Figure 24 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 24. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic small-mesh otter trawl fishing mode.

### 3.10.2 Large-Mesh Otter Trawls

### 3.10.2.1 New England

The New England large-mesh otter trawl fishing mode is the fourth largest mode (behind the New England lobster pot and New England and Mid-Atlantic scallop dredge modes) of all Greater Atlantic Region fisheries, with an average of 293 active participating vessels. In total, the participants in this fishing mode land an average of 64 million lb of fish annually. Each of these participating vessels takes, on average, 35 fishing trips per year, although there is a lot of variability within the mode that correlates to vessel size, areas fished, and DAS available. Fishing trips tend to last $21 / 2$ days each, on average, but there are many vessels that take trips lasting 1 day or less, and other vessels that take longer trips, lasting up to 20days.

In spite of the large-mesh otter trawl mode's association with the groundfish fishery, the top species landed are skates (over 14.8 million lb per year; 23 percent of total landings for the fishing mode). Landings of haddock, Atlantic cod, and pollock average 8-9 million lb per year. Winter flounder landings average 4 million lb per year. Together, these four groundfish species comprise 47 percent of the total landings of the fishing mode.

New Bedford, MA, is the top port for this fishing mode, with over 22 million lb of fish ( 35 percent of the total annual landings) coming in each year. Other important ports include Gloucester, MA ( 22 percent of total landings), Point Judith, RI (14 percent of total landings), and Boston, MA (12 percent of total landings), Figure 25 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 25. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England large-mesh otter trawl fishing mode.

### 3.10.2.2 Mid-Atlantic

With almost 225 vessels participating in this fishing mode each year, the MidAtlantic large-mesh otter trawl fishing mode is smaller than its New England counterpart as total landings average just over 15 million lb per year (just under 25 percent of the landings associated with the New England large-mesh otter trawl fleet). Mid-Atlantic vessels take, on average, 29 1-day fishing trips per year, although trips as long as 17-24 days have been taken in some years.

Summer flounder is the primary species landed, representing almost half—7.4 million lb—of the total annual landings. Skates, scup, sea scallop, and spiny dogfish together account for another 29 percent of the total annual landings. Skate landings
average just over 1.5 million lb per year and scup average almost 1.4 million lb annually, while sea scallop landings average 1.0 million lb and spiny dogfish landings average over $900,000 \mathrm{lb}$. Landings in this fishing mode are fairly evenly divided between a number of ports in New Jersey, New York, North Carolina, and Virginia. Point Pleasant, NJ, Montauk, NY, Wanchese, NC, Shinnecock, NY, and Newport News, VA, and, comprise the top five ports each with over 1.1 million lb (8-10 percent of the total) of landings each year. Figure 26 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 26. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic large-mesh otter trawl fishing mode.

### 3.10.3 Large-Mesh Haddock Separator Otter Trawls

### 3.10.3.1 New England

The haddock separator trawl is a specialized gear designed to exploit fish behavior to preferentially catch haddock over cod when compared to a traditional otter trawl net. Use of a selective gear, such as the haddock separator trawl, has been required in order to fish in some Special Access Programs under the NE Multispecies FMP. This gear is new, and specific gear codes have only recently been added to FVTRs, therefore the catch data provided here are only from 2010 and 2011. Over that time, an annual average of 26 vessels participated in this fishing mode each taking 6 trips, which are typically 5 to 10 days in duration. This fishing mode lands over 4 million lb of fish annually, with over 73 percent of those landings ( 2.9 million lb) being haddock. Other important species in this mode are pollock at 10 percent of landings (nearly 400,000 lb per year) and cod at 5 percent of landings (over $200,000 \mathrm{lb}$ per year). Landings of winter flounder and redfish each average over $100,000 \mathrm{lb}$ annually ( 2.7 percent of total landings).

The primary port for this mode is New Bedford with over 56 percent of landings ( 2.3 million lb per year). Gloucester, MA is also significant at 38 percent ( 1.5 million lb per year), while Boston represents just 5 percent of landings (110,000 lb per year).
Figure 27 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 27. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England large-mesh haddock separator otter trawl fishing mode, 2010-2011.

### 3.10.3.2 Mid Atlantic

Due to the small number of participants in the Mid-Atlantic large-mesh haddock separator otter trawl fishing mode, summary information characterizing fishing effort, landings, ports utilized, and areas fished cannot be reported in order to protect the confidentiality of the data provided by the participants.

### 3.10.4 Large-Mesh Ruhle Otter Trawls

### 3.10.4.1 New England

Like the haddock separator trawl, the Ruhle trawl is a recently developed gear designed to preferentially catch haddock over cod. A gear code specific to the Ruhle trawl was added to FVTRs in 2009, so landings information presented here represents 2009 through 2011. There has been a rapid expansion in the adoption of this gear from 1 vessel in 2009 to 15 vessels in 2011. Trips average just over 4 days, although trips as short as 1 day and up to 12 days have been reported.

This mode has over $400,000 \mathrm{lb}$ of annual landings with over 85 percent consisting of haddock (over 300,000 lb per year). Redfish is 5 percent of landings ( $22,000 \mathrm{lb}$ per year), and cod is less than 4 percent ( $16,000 \mathrm{lb}$ per year). Yellowtail flounder, pollock, and winter flounder each make up less than 2 percent of total mode landings.

The primary port is New Bedford, MA with 75 percent (over 300,000 lb per year) of the $400,000 \mathrm{lb}$ total average landings in this fishery. Point Judith, RI is also a significant port with over $75,000 \mathrm{lb}$ of landings on average ( 17 percent of total mode landings. Gloucester, MA, Seabrook, NH, and Portland, ME have also reported landings, but specific numbers cannot be presented in order to protect the confidentiality of the data provided by the participants. Figure 28 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 28. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England large-mesh Ruhle otter trawl fishing mode, 2009-2011.

### 3.10.4.2 Mid Atlantic

The mid-Atlantic large-mesh Ruhle trawl fishery is smaller than the New England mode of this fishery. An average of only 4 vessels participates in this fishery, taking an average of only 2 trips per year. Trips average less than half a day, but trips as long as 11 days have been reported.

A total of $10,000 \mathrm{lb}$ of fish are landed by this mode annually. The primary species landed is summer flounder, accounting for 40 percent of total mode landings, followed by spiny dogfish ( 30 percent) and Atlantic croaker ( 21 percent). The top ports are all in New Jersey: Barnegat, Belford, and Point Pleasant. However, the number of vessels landing in some ports is small enough that port-specific landings information
cannot be reported to protect the confidentiality of the data provided by the participants. Figure 29 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 29. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic large-mesh Ruhle otter trawl fishing mode 2010-2011.

### 3.11 Purse Seine Fishery

### 3.11.1 New England

The New England purse seine fishing mode primarily targets Atlantic herring. The number of active participants averages just over 17 vessels per year, and each vessel
takes, on average, 19 fishing trips each year. These fishing trips tend to last less than 1 day in duration, although longer trips of up to 9 days occur.

Landings of Atlantic herring average 46.8 million lb per year, second in herring catch after the midwater and single pair trawl mode. The purse seine fishing mode is highly directed, with herring comprising over 87 percent of total annual landings by weight. Menhaden comprise another 12.6 percent ( 6.7 million lb per year) of total mode landings Although the amounts are much smaller, bluefin tuna landings are important, with over $13,000 \mathrm{lb}$ per year. Other species landed include blueback herring ( $5,000 \mathrm{lb}$ per year) and negligible amounts of longfin squid and Atlantic mackerel.

Most of the landings made by vessels participating in this fishing mode come to Maine ports, with Rockland (20.5 million lb per year), Portland ( 9.5 million lb per year), Stonington ( 7.6 million lb per year), and Prospect Harbor ( 3.6 million lb per year) accounting for over 77 percent of the total landings. Another 12 percent ( 6.6 million lb per year) of the total landings come into Gloucester, MA. Figure 30 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 30. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England purse seine fishing mode.

### 3.11.2 Mid-Atlantic

The Mid-Atlantic purse seine mode is the most targeted in its region: Over 99.9 percent of all landings in this mode are menhaden. The six active participating vessels take, on average, 38 fishing trips each year, with most trips lasting less than a $1 / 2$ day. Even the longest trips most years last less than 2 days, although there were 4-day trips reported in 2008 and 2010.

Menhaden landings in this fishery average almost 35 million lb annually. While other species (spiny dogfish, striped bass, silversides, etc.) are occasionally landed, the amounts tend to be limited to a few hundred lb at most in any year. The top ports in this fishery are all in New Jersey. Cape May, NJ is the leading port, receiving over 33 million
lb (95 percent of the total landings) each year. Relatively small amounts are also landed in Belford, Point Pleasant, and Atlantic City, NJ. Figure 31 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 31. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic purse seine fishing mode.

### 3.12 Scallop Dredge Fishery

As explained in chapter 5, for the purposes of allocating fishery observer effort within the overall sea scallop dredge fishery, New England and Mid-Atlantic sea scallop dredge fishing trips are further differentiated according to the type of permit (limited access or general category) and the type of trip (open area or scallop access area). The following sections are not subdivided based on these attributes, but instead provide
summaries consistent with the rest of this chapter. While the differences among these trips (general category vs. limited access and open area vs. access area) are important for allocating observer effort in a representative way across the larger scallop dredge fishery, unlike the gillnet and otter trawl mesh size categories, there are not substantial differences among these trips in the species targeted, areas fished, or ports landed.

### 3.12.1 New England

The New England scallop dredge fishing mode averages over 354 active participating vessels each year. Although the number of annual fishing trips varies with permit category and available DAS, on average these vessels each take over 13 fishing trips per year. While the average trip length for all participating vessels is just over 4 days per trip, much longer trips, up to 25 days, do occur. On average, the participants in this fishing mode land 31.7 million lb of fish each year, of which over 31 million ( 98 percent) are sea scallops. Other than monkfish (nearly $417,000 \mathrm{lb}$ per year), only relatively negligible amounts of Illex squid, mussels, and silver hake, are landed each year.

New Bedford, MA, is the top scallop port in New England, accounting for over 90 percent of the total annual landings for this fishing mode. Fairhaven, MA (over 1.0 million lb per year), Point Judith, RI (359,000 lb per year), Newport, RI (348,000 lb per year), and Chatham, MA ( $300,000 \mathrm{lb}$ per year) also rank in the top five scallop dredge ports in New England. Figure 32 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 32. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England scallop dredge fishing mode.

### 3.12.2 Mid-Atlantic

Only slightly smaller than its New England counterpart in terms of number of participants and the amounts of sea scallops landed, the Mid-Atlantic sea scallop dredge fishing mode has averaged over 342 active vessels from 2007 to 2011, landing almost 25 million lb of fish each year. On average, participating vessels take 22 fishing trips per year, although, as with the New England mode, the number of trips varies among vessels with permit category and available DAS. Trips average 2.5 day in duration, although longer trips 20-30 days in duration occur.

As with the New England mode, sea scallops are the primary target and the top species landed, comprising, on average, 97 percent of the total annual landings by the participating vessels. In addition to scallops, an average of $252,000 \mathrm{lb}$ of monkfish is landed each year, along with small amounts of knobbed whelks and summer flounder (each less than 100,000 lb per year).

Mid-Atlantic scallop dredge vessels utilize several ports for landing their product. Cape May, NJ, is the top port, with an average of 8.3 million lb of landings each year (33 percent of the total landings). Newport News, VA, ranks second with 5.2 million lb of annual landings ( 21 percent of the total), and the City of Seaford, NY ( 2.0 million lb per year), Hampton, VA ( 1.9 million lb per year), and Point Pleasant, NJ ( 1.6 million lb per year), complete the top five ports for this fishing mode. Figure 33 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 33. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic scallop dredge fishing mode.

### 3.13 Scallop Trawl Fishery

### 3.13.1 New England

Compared to the other sea scallop fishing modes in the Northeast, the New England sea scallop trawl mode is relatively small. There are only three participants, on average, each year, each making four fishing trips. Fishing trips average 5 days in length and the longest trips are 12-16 days in duration.

Sea scallops are the top species landed, but these landings average less than $117,000 \mathrm{lb}$ per year (less than 0.1 percent of the sea scallops landed using scallop
dredges). Small amounts of longfin squid, skate, monkfish, and summer flounder are also landed by the participants of this fishing mode, but landings of these fish average less than 600 lb each per year. As with the New England scallop dredge mode, New Bedford, MA, is the top port, with over 97 percent of total scallop trawl landings.
Chatham, MA, Newport, RI, Point Judith, RI, and New Harbor, ME, each account for small amounts of the total landings made by this fishing mode. Figure 34 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 34. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England scallop trawl fishing mode.

### 3.13.2 Mid-Atlantic

Much larger than its New England counterpart, but still smaller than the scallop dredge modes, the Mid-Atlantic scallop trawl fishing mode averages over 33 participating vessels each year. On average, each of these participating vessels takes over 26 fishing trips each year. Trips average just over 1 day in duration, although longer trips of 15-20 days occur.

Unlike other sea scallop fishing modes, scallops account for over 58 percent of the annual landings. In the Mid-Atlantic scallop trawl mode, total annual landings are just over $628,000 \mathrm{lb}$, of which almost $342,000 \mathrm{lb}$ are sea scallops. Other species landed by the participants in this fishing mode include summer flounder ( $98,000 \mathrm{lb}$ per year), blue crab ( $60,000 \mathrm{lb}$ per year), penaeid shrimp ( $30,000 \mathrm{lb}$ per year), and pandalid shrimp ( $22,000 \mathrm{lb}$ per year). Point Lookout, NY, is the top port for this fishing mode, receiving on average almost $97,000 \mathrm{lb}$ of landings each year. Engelhard, NC, and Point Pleasant, NJ each take in $75,000 \mathrm{lb}$ each year. Cape May, NJ, ( $66,000 \mathrm{lb}$ per year) and Freeport, NY, ( $60,000 \mathrm{lb}$ per year) are also important ports in this fishery. Figure 35 displays the top ports and primary fishing areas utilized by participants in this mode.


Figure 35. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic scallop trawl fishing mode.

### 3.14 Scottish Seine Fishery

There have been no FVTRs reporting the use of Scottish seine in either New England or the Mid-Atlantic during 2007-2011. The 2007 SBRM Omnibus Amendment reported limited use of this gear, but could not report summary information for this fishing mode in order to protect the confidentiality of the data provided by the participants. While this gear type has not been reported in recent years, it may be in the future.

### 3.15 Shrimp Trawl

### 3.15.1 New England

The New England shrimp trawl fishing mode includes, on average, 99 participating vessels per year. These vessels take, on average, approximately 25 fishing trips each year, and most fishing trips last less than 1 day, although longer trips occur, up to 11 days in duration.

The primary target for this fishing mode is Northern (pandalid) shrimp, and over 91 percent of the 7 million lb of fish landed, on average, each year in this fishing mode are pandalid shrimp. Unspecified shrimp species and penaeid shrimp comprise another 4 percent of annual landings, so, together, shrimp account for 95 percent of the total landings in this fishing mode. Another 3 percent of total landings are Atlantic herring. The remainder is largely longfin squid and silver hake, although these species each account for less than 1 percent of total annual landings.

The primary ports for this fishing mode are mostly located in Maine, as landings in the top four ports (Portland, South Bristol, Port Clyde, and Cundy’s Harbor, New Harbor) account for 49 percent of the total landings. Half of these ( 24 percent of total landings, 1.7 million lb per year) come in to Portland, ME. Portsmouth, NH, accounts for another 7 percent of total landings. Figure 36 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 36. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England shrimp trawl fishing mode.

### 3.15.2 Mid-Atlantic

The Mid-Atlantic shrimp trawl fishing mode has fewer participants than the New England mode, with an average of 52 vessels participating over the years 2007-2011. These vessels take, on average, just under 10 fishing trips per vessel per year. Fishing trips last, on average, considerably longer than in the New England shrimp trawl mode, with most trips being 4-5 days in duration. The longest trips last 20-30 days.

As with the New England shrimp trawl fishing mode, the primary target for this mode is pandalid shrimp ( 64 percent of total landings), along with penaeid shrimp (6.8 percent of total landings), and mantis shrimp (4 percent of total landings). Combined,
shrimp landings average just over 2 million lb per year, and Illex squid (580,000 lb per year, on average) and king whiting ( $25,000 \mathrm{lb}$ per year, on average) are also important components of this fishing mode. Total landings for the Mid-Atlantic shrimp trawl mode average 2.7 million lb per year.

The number one port for this fishing mode is Cape May, NJ, (593,000 lb per year, on average) with almost 22 percent of total landings in this fishing mode. The rest of the top five ports for this fishing mode are all located in North Carolina, with Engelhard ( $542,000 \mathrm{lb}$ per year, on average), Wanchese ( $524,000 \mathrm{lb}$ per year, on average), Oriental ( $432,000 \mathrm{lb}$ per year, on average), and Beaufort ( $288,000 \mathrm{lb}$ per year, on average), North Carolina, together accounting for over 65 percent of annual landings, on average. Figure 37 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 37. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic shrimp trawl fishing mode.

### 3.16 Floating Trap

### 3.16.1 New England

The New England floating trap fishing mode has four vessels participating, each taking over 33 trips on average, landing $260,000 \mathrm{lb}$ of fish each year. Trips are almost exclusively less than a day, with the average trip being only three hours.

The principle target species is scup accounting for over 70 percent of landings (184,000 lb per year on average), while Atlantic mackerel comprises 11 percent of total landings. Striped bass, Atlantic herring, and frigate mackerel comprise the remainder of
the top five species landed and represent 8 percent of total landings, combined. The largest port in this fishing mode is Little Compton, RI, with over 82 percent of total landings ( $215,000 \mathrm{lb}$ per year on average). Gloucester, MA, Islesford, ME, and West Point, ME, are also important ports with 14 percent of total mode landings, combined. Figure 38 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 38. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England floating fish trap fishing mode.

### 3.16.2 Mid-Atlantic

The Mid-Atlantic floating trap fishery is slightly larger than its New England counterpart. On average, 7 vessels take 37 trips each, and land a total of 299,000 lb of fish each year. Trips average about $1 / 2$ day.

A wider range of fish species are caught in the Mid-Atlantic than in New England. The primary target species are menhaden with 50 percent of total landings (150,000 lb per year) and bluefish with 34 percent of total landings (100,000 lb per year). Scup constitutes another 7 percent of landings ( $21,000 \mathrm{lb}$ per year) and summer flounder 3 percent ( $8,000 \mathrm{lb}$ per year). Over 69 percent of total landings came into Belford, NJ (207,000 lb per year). The rest of the top five ports are all in New York, the largest being Greenport, with 15 percent of total landings ( $44,000 \mathrm{lb}$ per year). East Hampton, Wainscott, and Amagansett, NY, combined, represent 11 percent of total landings. Figure 39 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 39. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic floating fish trap fishing mode.

### 3.17 Beam Trawl

### 3.17.1 New England

The New England beam trawl fishery consists of eight participating vessels making 20 trips per year, on average. Fishing trips average less than a day. This fishing mode lands an average of $100,000 \mathrm{lb}$ of fish each year. The primary species caught is Northern (pandalid) shrimp (over 45,000 lb per year), which represents 45 percent of total mode landings. Landings of summer flounder ( $16,000 \mathrm{lb}$ per year) represent another 16 percent of landings, while cod ( $7,000 \mathrm{lb}$ per year), skate ( $5,000 \mathrm{lb}$ per year), and yellowtail flounder (4,000 lb per year) round out the top five species landed.

The primary port of landing for the New England beam trawl fishery is Port Clyde, ME with 40 percent of landings. Other important ports include Plymouth, MA (14 percent); Nantucket, MA (13 percent); Harpswell, ME (11 percent); and Woods Hole, MA ( 6 percent). Figure 40 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 40. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England beam trawl fishing mode.

### 3.17.2 Mid-Atlantic

The Mid-Atlantic beam trawl fishery has an average of 11 participating vessels that made an average of 14 trips each in 2007-2011. Trip lengths averaged just over one day with most trips lasting less than a day. However, trips as long as 8 or 9 days are
reported each year. An average of $450,000 \mathrm{lb}$ of fish is landed annually by this fishing mode.

The primary species landed is Illex squid (21 percent), Atlantic croaker (18 percent), summer flounder (12 percent), longfin squid (12 percent), and blue crab (10 percent). The top ports in this fishing mode are Cape May, NJ (37 percent); Wanchese, NC (16 percent); Engelhard, NC (15 percent); Hampton, VA (9 percent); and Point Pleasant, NJ (4 percent). Figure 41 displays the top ports and primary fishing areas utilized by participants in this fishing mode.


Figure 41. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic beam trawl fishing mode.

## SBRM Omnibus Amendment

| Fishing Mode | Primary Regulating FMP(s) <br> (includes only those Federal FMPs <br> subject to the SBRM Omnibus <br> Amendment) | Average <br> Number of <br> Participating <br> Vessels | Average <br> Total Annual <br> Landings <br> (in million Ib) | Top 3 Species Landed |
| :--- | :--- | :--- | :--- | :--- |
| NE Clam Dredge | Surfclam and Ocean Quahog | 15.0 |  | ocean quahog; surfclam; sea scallop |
| MA Clam Dredge | Surfclam and Ocean Quahog | 34.2 | $5.96^{* *}$ | ocean quahog; surfclam; sea scallop |

## SBRM Omnibus Amendment

| MA - Floating Trap | Summer Flounder, Scup, Black Sea Bass; <br> Bluefish <br> (none) | 6.8 | 0.30 | menhaden; bluefish; scup |
| :--- | :--- | :---: | :---: | :---: | :---: |
| NE - Beam Trawl | Mackerel, Squid, Butterfish; Summer <br> Flounder, Scup, Black Sea Bass | 7.6 | 0.10 | Pandalid shrimp; summer flounder; cod |

Table 28. Summary information on the fishing modes addressed in chapter 3 . Averages reflect data from 2007-2011, except as noted in the text. Top species are based on the cumulative landings from 2007-2011 VTR reports. (** Clam dredge landings are New England and Mid-Atlantic combined and given in millions of bushels)

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# Bycatch Reporting Mechanisms 

### 4.1 Introduction

Around the country and around the world, various methods are used to collect information on catch and catch disposition in commercial and recreational fisheries. The variety of methods and tools in use and under development reflect the variety of fisheries on which catch and catch disposition information is collected. Developing a complete understanding of the catch in a fishery, and the implications that the catch and any associated discards may have on fishery resources, involves information collected from a variety of sources utilized in a comprehensive manner. This may include information reported by the fishing industry (e.g., dealer purchase reports and/or FVTRs), fishingrelated information collected by independent sources (e.g., fishery observers and/or electronic monitoring), or information about fishery resources collected independent of fishing activities (e.g., resources surveys). This chapter identifies and describes several mechanisms that may be used to collect information on fishery resources and fishing activities to develop a complete understanding of fishing activities and their implications for fishery resources in the Greater Atlantic Region.

This chapter first provides a general overview of the variety of fishery information collection methods evaluated as part of the development of this amendment in order to establish a general understanding of the types of information collected and how these methods function. Following the general overview discussion of each method, this chapter evaluates the feasibility for utilizing each mechanism for collecting information on bycatch occurring in the variety of fishery modes employed in the Greater Atlantic Region (described in chapter 3). The various fishing modes represent different fishing gears and fishery operating characteristics, and are associated with different bycatch levels and rates. These factors must be taken into account when determining the most appropriate methods with which to collect catch and catch disposition information. This chapter provides a general overview of how the variety of information collection methods described here may be applied to the various Greater Atlantic Region fisheries in order to assess bycatch in the most appropriate manner.

### 4.2 Fishery Independent Surveys

### 4.2.1 Description

A fishery independent resource survey is a catch-all description for a variety of scientific fishery resource assessments conducted by NMFS and state fisheries agencies in the Greater Atlantic Region conducted onboard NOAA or state agency research and chartered vessels. The surveys are specifically designed to gather data on the abundance, distribution, size, and age composition of economically and ecologically important marine species of concern (NMFS 2004). A wide array of at-sea sampling techniques and several different types of fishing gear are used to collect data on finfish and shellfish species. The majority of fishery independent surveys are conducted using a stratified
random sampling design and are conducted over the entire range of a particular species distribution at various times through the year (NMFS 2001). The time series of data for some surveys, such as the bottom trawl survey, date back to 1963 (Azarovitz 1981).

The fishery independent surveys conducted in the Greater Atlantic Region by NMFS are designed and conducted by the Ecosystems Survey Branch of the Northeast Fisheries Science Center (NEFSC). Table 29 lists the surveys conducted by the NEFSC, their frequency and season of occurrence, and the participating NOAA research vessels.

| NOAA Research Surveys | Frequency-Season | NOAA Research Vessels |
| :--- | :--- | ---: |
| Bottom trawl | Annual - Spring/Fall | R/V Albatross IV, R/V <br> Delaware II, R/V Henry B. <br> Bigelow |
| Sea scallop dredge | Annual - Summer | R/V Albatross IV, R/V Hugh R. |
| Sharp |  |  |

Table 29. NOAA Fishery Independent Surveys in the Greater Atlantic Region.
Fishery independent surveys conducted by state fisheries agencies from North Carolina to Maine are typically coordinated through the ASMFC. A committee composed of scientists and staff from state marine fisheries agencies, the ASFMC, the NEFSC, and academia provides oversight and coordination of surveys in the Greater Atlantic Region. Some details of the resulting program, called the Northeast Area Monitoring and Assessment Program (NEAMAP), are listed in Table 30 below (P. Kilduff, pers. comm., ASMFC).

For many of the fishery independent surveys, the primary purpose is to provide estimates of relative abundance for a specific finfish or shellfish species or species assemblage (NMFS 2001, 2004). The fishing methodology and gear utilized may differ substantially from those employed in a commercial fishing operation. Many of the sampling protocols employed include speciation and detailed biological data collection on all captured species.

| Agency or Institution | Survey Name / Gear Type | Time Series |
| :---: | :---: | :---: |
| NC Division of Marine Fisheries | Alosa spp. seine Juvenile fish trawl Pamlico Sound trawl Pamlico Sound gillnet | 1972 - present <br> 1979 - present <br> 1987 - present <br> 2001 - present |
| VA Institute of Marine Science | Small mesh trawl Large mesh trawl | 50+ years 2002 - present |
| DE Natural Resources and Environmental Control | Juvenile species trawl Adult fish species trawl | 1980 - present 1966-1971, 19791984, 1990 - present |
| NJ Dept. of Fish and Wildlife | Ocean stock assessment trawl Delaware Bay trawl | 1989 - present <br> 1991 - present |
| NY State Dept. of Environmental Conservation | Small mesh trawl | 1987 - present |
| CT Dept. of Environmental Protection | Long Island Sound trawl | 1984 - present |
| RI Dept. of Fish and Wildlife | Marine fisheries trawl | 1979 - present |
| MA Division of Marine Fisheries | Inshore bottom trawl | 1978 - present |
| NH Dept. of Fish and Game | Estuarine juvenile finfish seine | 1997 - present |
| Maine Dept. of Marine Resources | ME/NH inshore trawl | 2000 - present |

Table 30. State agency fishery independent surveys in the Greater Atlantic Region.

### 4.2.2 Evaluation and Applicability

Fishery independent surveys are not a means to directly collect bycatch and discard data. Though some detailed information is often collected on a subsample of the catch or for many species of interest, the fishing practices, gears, and the spatial and temporal areas of operation utilized in surveys are often different than those of commercial fisheries. Because of these independent characteristics, fishery survey data are not typically used as a substitute for missing information on commercial fishery bycatch frequency or occurrence within the same spatial or temporal areas. Further, these differences make it difficult to take the data gathered in the fishery survey and expand it to the commercial fishing effort level. In some instances where sufficient observer data are unavailable, research survey abundance data have been used to develop an indirect estimate of discards using regression and ratio analytic techniques (Mayo et al. 1992; NEFSC 2001; NEFSC 2003).

Fishery independent survey data may have some limited utility in providing insight on species occurrence or interaction that could be further investigated through fishery dependent monitoring programs. The systematic design of a fishery independent survey may function to provide catch data for rare or infrequently encountered species as
well as detailed capture information on key species of concern. Information about rare or species of concern provided by a fishery survey could be used to prioritize fishery dependent monitoring within the same spatial or temporal areas to better understand potential interactions of these particular species as bycatch in commercial fishery operations.

### 4.3 Fishing Vessel Trip Reports/Logbooks

### 4.3.1 Description

The vessel owner or operator of any vessel issued a valid Federal permit for any commercial or charter/party fishery except American lobster must maintain on board the vessel, and submit to NMFS, an accurate FVTR for each fishing trip. FVTRs must be submitted regardless of species caught or area fished. This requirement is fully described at 50 CFR 648.7(b) and has been in place since 1994. A listing of the data collected by the FVTR is provided in Table 31.

| Vessel, crew, operator | Gear | Commercial Catch |
| :---: | :---: | :---: |
| Vessel name | Gear type | Pounds kept (by species) |
| USCG documentation number | Quantity and size | Pounds discarded (by species) |
| or State registration number | Mesh/ring size | Sea turtle incidental take |
| Federal permit number |  | Skates by size category |
| Number of crew | Location |  |
| Number of anglers (charter/party) | Chart area (statistical area) | Charter/Party Catch |
| Vessel operator's name | Average depth | Number kept (by species) |
| Signature of vessel operator | Latitude/longitude or Loran station and bearings | Number discarded (by species) |
| Trip Information |  | Sale/Landing |
| Date/time sailed | Effort | Dealer permit number |
| Date/time landed | Number of hauls | Dealer name |
| Commercial or charter/party trip | Tow/soak time duration | Date sold |
|  |  | Port and state landed |

Table 31. Information collected on Greater Atlantic Region FVTRs, by data type.
Because the FVTR is a standardized form designed to capture data from numerous fisheries, the number of logbooks that must be maintained and submitted by a vessel owner or operator that participate in more than one fishery and utilizes more than one fishing permit is minimized. A new FVTR must be completed if the vessel changes gear type, mesh size, or statistical area during a fishing trip. The presence of an onboard observer during a trip does not relieve the vessel of the requirement to submit an FVTR.

FVTRs must be received or postmarked by the $15^{\text {th }}$ of the month following the month in which the trip ended. Amendment 16 to the Northeast Multispecies FMP increased the reporting frequency to weekly for groundfish vessels. The Regional Administrator may authorize individuals to submit reports electronically, by using a VMS or other media. Submitted FVTRs are checked for completeness and then entered into a database. Incomplete, illegible, or inaccurate FVTRs are returned to the submitter for correction. Vessel owner/operators with missing, incomplete, illegible, or inaccurate

FVTRs may not be allowed to renew their Federal fishing permits until the problem(s) are corrected. Copies of FVTRs are required to be maintained onboard the vessel by the vessel owner/operator for one year and retained by the owner/operator for a total of three years.

All discards are required to be reported on Greater Atlantic Region FVTRs (NMFS 2004). Thus, given the mandatory reporting requirement applied to all federally permitted vessels (with the exception of vessels holding only a Greater Atlantic Region lobster permit), FVTR data represent a comprehensive source of information on total fishing effort, location, catch, and bycatch. In addition to the requirement to submit FVTRs, some FMPs require catch information to be reported also through an interactive voice response system or through a VMS.

Owners or operators of commercial groundfish vessels with federal permits now have the option to submit their FVTRs electronically (eVTR). Electronic reporting will make the collection of important data on fishing vessel activity more efficient, convenient, and timely for the fishing industry, fishery managers, and other data users. Vessels choosing to use eVTR must complete the report prior to landing and can either submit it immediately or upon landing. The option to use eVTR may be expanded to other fisheries in the Greater Atlantic Region.

### 4.3.2 Evaluation and Applicability

FVTRs provide an extensive set of data regarding fishing location, effort, catch, and bycatch. However, FVTR data are self-reported by the individual vessel operator and there are several challenges and limitations associated with the use of self-reported catch and discard data that have been well documented (NEFSC 1996; Walsh et al. 2002; NMFS 2004). The challenges and limitations include low compliance with mandatory reporting requirements, misidentification of species, errors in estimating the amount of catch in large volume fisheries (e.g., Atlantic mackerel and Atlantic herring), underreporting (particularly of discards), and data entry errors on FVTR forms. It should be noted that FVTRs are not systematically inaccurate-a comparison of total groundfish landings from FVTR to dealer records for calendar years 2003 and 2004 shows close agreement between the two data sources (Rago et al. 2005). However, many fishermen have expressed concern about disclosing detailed information about primary fishing grounds for target species or providing information on discards in FVTRs for fear that the information may be used in a future management action that would negatively impact their operations.

With caution, the data provided in FVTRs can be utilized to provide the basis for stratum-specific expansion factors to raise the observed portion of the commercial fishing fleet's trips to the entire fleet. While FVTR data can be compared to other fishery dependent data sources such as dealer reports, vessel monitoring systems (VMS), and DAS to ensure the information provided is both complete and accurate, only observer data can be used to confirm the completeness and accuracy of FVTR bycatch and discard data. Additional information on the effective use of FVTRs as a bycatch and discard monitoring tool can be found in chapter 5.

New technologies such as electronic monitoring systems (described in section 4.10) could be used to verify FVTR logbook catch and discard data in hook and line fishery modes as is done with the comprehensive catch accounting system in British Columbia. It should be noted that a rigorous regulatory environment, requiring total retention of key species and documentation of all discards is in place to support British Columbia program. If a similar program were developed for the Greater Atlantic Region, a comprehensive regulatory structure, with considerable technological support and personnel, would need to be established.

### 4.4 Dealer Purchase Reports

### 4.4.1 Description

Since May 1, 2004, all federally permitted seafood dealers (excluding lobster only) have been required to submit electronic reports of all fish purchased on a weekly basis. ${ }^{18}$ This requirement is fully described at 50 CFR 648.7. Dealer purchase reports are compiled and submitted to NMFS through one of two approved software packages specifically developed for this purpose or through a file upload process.

Dealer reports must include the following information for each purchase made from a fishing vessel: Dealer identification information; vessel identification information from which fish were purchased; a trip identifier; dates purchased; amount of species landed; price paid for each species; and disposition of the fish. Dealer reports are assumed to be the best source for comprehensive estimates of total landings and the resulting revenue generated. They can be used by the dealers for tax preparation purposes and as legal documentation of the purchase and sale of the landed catch.

### 4.4.2 Evaluation and Applicability

Federally permitted dealers are required to report all purchases of species governed by a Federal FMP. Dealers are not required to collect or report information on bycatch or discards. Dealer reports of landings may or may not specify the market category ${ }^{19}$ which could, in turn, be used to categorize the general size of animals comprising the landed catch. Landings-related size information would not yield any specific application for quantifying bycatch or discards, even if discards of the same species landed were listed as discards on a FVTR. Dealer reports would not supply any

[^12]information about species not brought to market. Therefore, dealer reports have limited applicability towards documenting discards.

Dealer reports are primarily used as a census of landings in a fishery. In turn, dealer data are important for expanding the catch and discard rates reported by at-sea observers to the entire fishing fleet. This information is used to optimize observer coverage and to developing estimates of total fishing effort and total discards (see Chapter 5 and Appendix A for more information).

### 4.5 At-Sea Observers

### 4.5.1 Description

At-sea fisheries observers are generally biologists trained to collect information onboard fishing vessels. Observers may be deployed for various reasons including monitoring interactions with protected species, measuring catch composition and disposition (including discards), validating or adjusting self-reported data, tracking inseason quotas (including bycatch quotas), or a variety of other reasons (NMFS 2004). In addition to the observer program that operates out of the NEFSC, several states employ observers either through a formal observer program or on an ad-hoc basis. In most cases, state observer programs are intended to provide information on fisheries not covered by the Federal observer program (such as the American lobster fishery).

### 4.5.1.1 Federal Observer Program

Bycatch in Greater Atlantic Region fisheries is monitored primarily through the NEFOP, which is coordinated through the NEFSC and has been in operation since 1989. The quality of observer information is ensured through several aspects of the program: Observers participate in a comprehensive training program that includes proficiency and testing standards; a standardized set of on-board data collection protocols are utilized in training and are available at-sea in written reference documents; and finally, significant auditing and quality assurance of the data collected occurs before it is used in stock assessment and management decisions (NMFS 2006a).

To allow extrapolation of the sample data to the fleet as a whole for the purposes of total bycatch estimation, the NEFOP employs a rigorous statistical sampling design. The procedure includes: Definition of a sampling frame across all relevant fisheries; and identification of sampling strata based on observable properties. A detailed discussion of the precision and accuracy of observer bycatch estimates is provided in chapter 5 . Information on the data flow related to quality assurance and control for the NEFOP can be found in Appendix D.

Observers are trained to collect a variety of information, including the amount of all catch and bycatch, the disposition of the catch (i.e., kept or discarded), biological samples (i.e., for age and size distribution studies), effort data (e.g., number of tows, haul duration, vessel horsepower), gear characteristics, and economic information (NMFS 2006a). Observers record everything caught in the net (both living and non-living) and
identify all organisms caught (including finfish, crustaceans, shellfish, corals, sponges, etc.) to the lowest taxonomic level possible (NMFS 2006a).

Current regulations require any vessel issued a Federal permit to carry an observer aboard a particular fishing trip, if requested to do so. Vessel owners or operators who refuse to carry an observer or that leave dock prior to the observer embarking are referred to the NMFS Office of Law Enforcement and may be prosecuted. Upon embarking, an observer will ensure the vessel has a current U.S. Coast Guard safety decal. Should the vessel not have an inspection decal or other unreasonable safety issues arise, the unsafe vessels will be observed at a later time. The NEFOP continues to work with noncompliant vessels to ensure compliance with safety and requirements (Amy Martins, pers. comm., NMFS).

The NEFOP allocates observer coverage ("sea days") to monitor bycatch (fish, invertebrates, and protected species) in the commercial fisheries in the Northeast. Available funding and the average cost of an observer sea day determine the number of potential sea days in the program for a given period of time. With the exception of some observer coverage funded through industry set-asides in the sea scallop fleet, the costs of observers in the Northeast fisheries are entirely borne by the Federal Government, using funds appropriated to NMFS by Congress. While NMFS requests funding for the NEFOP that it has determined necessary to meet the needs of the fishery and to comply with statutory mandates, the actual levels of future funding cannot be entirely predicted, and are uncertain until Congress approves the budget. Some of these annual funds are 'earmarked' to ensure that the required levels of sea days are available to satisfy mandated levels of coverage required for some fishery management plans or for fisheries that occur specific areas (e.g., funding directed to support observers and at-sea monitors in the Northeast multispecies catch share program). The remaining funds and subsequent sea days are divided amongst the remaining fisheries in the northeast. Within this remaining pool of sea days, it is necessary to maximize the utility of the available days to ensure that resulting bycatch estimates are accurate and precise for each fishery mode. Chapter 5 and Appendix A describe the detailed methods used to optimize available observer coverage throughout certain Greater Atlantic Region commercial fisheries prior to the 2007 SBRM Omnibus Amendment. A description of the methods currently used can be found in Wigley et al. 2012a.

### 4.5.1.2 State Observer Programs

State fisheries agencies often administer at-sea observer programs for fisheries that occur within their jurisdiction. State observer programs generally occur in fisheries that target species that are not federally managed or target federally managed species in state waters. All of the states within the Greater Atlantic Region have conducted some level of at-sea observations. Excluding lobster observation programs, North Carolina, Maryland, Rhode Island, and Massachusetts have formal programs for one or more areas and/or target species.

Standards for state observer programs are established by the Atlantic Coastal Cooperative Statistics Program (ACCSP) and NMFS. Therefore, much of the
information previously described in section 4.5.1.1 also applies to the state administered observer programs.

### 4.5.1.3 At-Sea Monitors

The At-Sea Monitor Program was implemented starting in fishing year 2010 to support the Northeast multispecies sector management program, and collects data to verify fishing vessel catch (landings and discards), by species, gear type and area, for the purpose of monitoring sector catch of each stock for which a sector receives Annual Catch Entitlement. Although the programs function similarly, the NEFOP and At-Sea Monitor Program are each tailored to meet specific monitoring objectives. NEFOP observers collect the same fishing vessel catch information, but with an additional focus on biological sampling of catch, including any incidental take of a marine mammal, seabird, or sea turtle. The target coverage rates for at-sea monitors are determined through a separate process apart from NEFOP observer coverage rates. Although at-sea monitors are not specifically deployed as part of the SBRM, the catch and discard data they collect may be used to supplement SBRM data, for example when computing the precision of discard estimates. NEFOP observer coverage assigned under the SBRM for some fishing modes may fulfill a portion of the target coverage rate for at-sea monitors under the At-Sea Monitor Program. The potential effect of SBRM coverage on at-sea monitoring for a particular groundfish sector in a given year would depend on the mix of fishing modes within the sector, the SBRM target coverage, and the available SBRM funding among other factors.

### 4.5.2 Evaluation and Applicability

Observer-gathered discard information is generally considered the most accurate and objective in recording bycatch and discard information. Observer programs often collect detailed biological information on both catch and discards for all aspects of commercial catch; fish, invertebrates, marine mammals, birds, and protected species. Observers produce quantitative assessments of bycatch and discards. As such, it is often the primary source of bycatch and discard reporting and is the foundation for bycatch and discard estimation. Observer data are utilized extensively in both stock assessment and management actions.

Observer data are preferred over other data sources including FVTR data for a few reasons. Unlike fishermen, who may be performing or managing many fishingrelated tasks at once so that reporting bycatch and discards becomes a lower priority than culling retainable catches or navigating their vessel, observers are solely focused on data collection while deployed at sea. In addition, observers are highly trained in their independent functions of data collection and are unlikely to be distracted by other priorities or influenced to misreport information. However, there are different sampling protocols for fishery resources and for marine mammals, and an observer assigned to a vessel primarily as a marine mammal observer may not conduct complete sampling of vessel catch and discards.

Managing an observer program requires dealing with numerous practical and fiscal constraints. Observers must be carefully trained, work under sometimes hazardous conditions, and deal with a variety of circumstances that can arise while at sea on a fishing vessel. Logistical issues, such as having an adequate number of observers available to cover a wide geographic area, numerous ports, and a variety of fisheries; and getting the observers aboard vessels within relatively short windows of time before they intend to sail further add to the complexity and costs of observer programs. Finally, safety issues must be considered in deploying observers. Observers are not deployed aboard vessels that present unsafe or unhealthy conditions. Vessels that may otherwise be safe may not have space or appropriate accommodations to carry observers. Even on a vessel that is determined to be safe and appropriate to accommodate an observer, weather, sea conditions, and the very nature of the commercial fishing business present some risk. As a result, recruitment and retention of observers is challenging.

While observer programs are one of the best ways to collect bycatch and discard information, they are also one of the most expensive means of doing so, due to the costs of rigorous training, recruitment of observers, salaries and benefits (including premium pay while at sea and on-call pay while waiting for a vessel to depart), contractor profit, travel costs, gear and equipment, and insurance (NMFS 2004). Indirect costs include salaries and benefits of NMFS employees that oversee the observer program, sampling design and analytical support, data entry, and database design and maintenance.

State observer programs may be used to provide the same types of discard and bycatch information provided by the Federal observer program. In many instances, the fisheries observed may not involve vessels with Federal fishing permits or may occur on vessels operating exclusively within the jurisdictional waters of a particular state. The data available from state programs may have value in providing information on non-FMP species or about locations not often sampled by the Federal program. Data collected by state programs are coordinated by the ACCSP and available to Federal stock assessment scientists through data sharing agreements.

### 4.6 Port Sampling (Commercial)

### 4.6.1 Description

Port agents are NMFS staff and contractors located in the major fishing ports in the Greater Atlantic Region. Port agents are responsible for collecting biological samples of landed catch to characterize commercial landings following standardized sampling protocols. Biological sampling data are linked with FVTR data to identify the statistical area the landed fish were harvested. Length and age samples are used to translate landed weight into numbers of fish landed at age. Landings-at-age data are then grouped with discard-at-age data to develop a total catch-at-age matrix used in analytical stock assessment models.

### 4.6.2 Evaluation and Applicability

Biological sampling conducted by port agents contributes to the assessment of total catch of species in the Northeast and provides important biological information on FMP species for use in stock assessment and management actions. Port agents do not collect specific information on bycatch or discards. They may receive anecdotal information occasionally during sampling or conversations with fishermen. The length and age data collected by port agents, along with other fishery dependent data sources, are a key component in estimating size and age of catch and, to some extent, are applicable to discard estimates by providing a size distribution for comparison against observer data.

Port agents also facilitate outreach with the fishing industry and dealers regarding reporting issues, new regulations, data quality concerns, and compliance with regulations. Port agents also work with industry to properly identify species through the use of outreach materials such as the skate and protected resources identification guides. Port agents assist in answering industry questions pertaining to data entry on FVTRs and dealer weigh-out reports. As outreach representatives of the agency, port agents help to increase the accuracy and reliability of the fishery-dependent data sources.

### 4.7 Recreational Fishery Sampling

### 4.7.1 Background

For many fish stocks, catch and discards associated with recreational angling are an increasingly important component of overall fishing mortality. NMFS estimates that in 2011 over 10 million anglers made more than 69 million fishing trips nationwide and caught more than 345 million fish, 60 percent of which were released alive (NMFS 2012). The total weight of recreational catch equates to about 2 percent of the total U.S. commercial harvest (in the states participating in MRIP), but because anglers tend to target relatively few species, the proportion of total catch attributed to recreational fishing on a stock-by-stock basis may be substantially higher. In Atlantic bluefish, for example, the total annual allocation and catch for recreational fishing exceeds the commercial allocation and catch. Accordingly, fishery managers need data on recreational fishing to ensure management actions are informed by estimates of the total impact of the recreational component.

Recreational angling presents NMFS with especially difficult data collection challenges. Angling may occur throughout the EEZ and coastal zone, including estuaries. Effort is broadly dispersed; anglers may work from bridges, piers, public and private beaches, other coastal properties, private docks and boats, and charter and head/party boats. ${ }^{20}$ Also, recreational catch may not be sold, so aggregation points, such as dealers for commercial fisheries, are not available as data collection nodes.

[^13]To begin collecting data on recreational fishing activities, in 1979 NMFS initiated the Marine Recreational Fisheries Statistical Survey (MRFSS). Over the years, the MRFSS was expanded, refined, and supplemented by other surveys and methods. The overall effectiveness of the MRFSS has been evaluated many times (Witzig et al. 2006). Detailed information on the reviews that have been conducted since the inception of the MRFSS is available on the NMFS Office of Science and Technology web site. ${ }^{21}$

In September 2004, NMFS contracted with the National Research Council (NRC) of the National Academy of Sciences to conduct a critical review of the agency's recreational fishing surveys. The report of the review was delivered to NMFS in April 2006. ${ }^{22}$ The report acknowledged the profound difficulty of collecting accurate and precise data on recreational fishing, listed a number of programmatic criticisms including possible sources of imprecision and bias, and included significant recommendations for redesigning the MRFSS.

General findings of the NRC include that:

- Much in recreational fisheries, from participation levels to management goals, changed since the design and implementation of the MRFSS and the survey did not keep pace with the changes;
- Funding and staff support was inadequate, and additional resources were needed to overhaul and maintain MRFSS;
- The Coastal Household Telephone Survey (CHTS) and access-intercept programs had serious design and implementation flaws and used inadequate analytical methods;
- For the purposes of data collection, the for-hire sector has more in common with commercial fishing than with private angling; and
- Concerns about the use of MRFSS to support fishery management decisions were well-justified.

To address issues cited in the report, the NRC recommended changes to the MRFSS and For-Hire Survey (FHS) that would improve the effectiveness of sampling procedures, enhance their applicability as relates to fishery management measures, and heighten the usefulness of the MRFSS social and economic analysis provided by the survey data. The NRC's many recommendations for improvement of the MRFSS and FHS also applied to the state-level recreational surveys designed to supplement the MRFSS data collection and analysis.

Specific to bycatch and discards, the NRC recommended several measures to enhance data quality, including mandatory logbooks in the for-hire sector (charter boats), greater use of onboard observers, and delineation of catch by target effort, catch effort, or

[^14]directed effort, among other things. More background information regarding the NRC assessment and NMFS's efforts to improve recreational fishing data collection is provided in chapter 5.

Following the NRC report, NMFS conducted a major overhaul of the way recreational fishing information is collected and reported. The process involved the participation of state and Federal government, outside experts, recreational fishermen, charter boat captains, conservationists, and other stakeholders. The result of these efforts was the creation of a new program known as the Marine Recreational Information Program (MRIP), which is described in the sections that follow.

### 4.7.2 Description

The MRIP is the only federally coordinated source of fishery independent data available on bycatch for recreational fisheries in the marine waters of the United States, including estuarine areas. Data collected through the MRIP are used to produce estimates of recreational participation, fishing effort, catch, and discards/bycatch of finfish. Data on recreational shellfishing are not collected.

MRIP data are collected by three independent, but complementary, surveys:

- Access-Point Angler Intercept Survey (APAIS) - designed to collect data on catch per unit effort through interviews with individual anglers;
- Coastal Household Telephone Survey (CHTS) - designed to collect data used to estimate the total number of marine recreational trips taken by coastal residents; and
- For-Hire Survey - designed to assess charter and head boat fishing effort.

Intercept surveys are primarily pre-formatted interviews of anglers, conducted at fishing access sites such as docks, marinas, and along the shore. The APAIS has been completely re-designed by the MRIP program following the NRC report mentioned in section 5.7.1. Catch data are obtained from anglers intercepted by trained interviewers stationed at fishing access sites or patrolling the shoreline. Interviewers identify, count, weigh, and measure fish that are available for inspection. Fish not brought ashore (i.e., discarded bycatch) are categorized through the interview as released alive, eaten-plan to eat, used for bait, or discarded dead. In addition to the access-point intercept, surveyors will often ride aboard head/party boats to conduct the interviews with anglers and to collect data on angler practices and fish that are caught and discarded. All the intercept interviews-ashore and aboard party boats-are used to develop estimates of catch per unit effort, which in this case is the recreational fishing trip. Intercept data are not used as the basis for estimating total recreational fishing effort.

The CHTS obtains information on recreational fishing effort (Table 32). The effort information obtained via the telephone surveys can be used to scale estimates of overall recreational fishing effort with the catch-level information collected through the interview program. In combination, these two sources of information can be used to derive estimates of overall recreational fishing impacts, including discard estimates.

## Intercept Survey

- Number, weights, and lengths of fish caught (by species)
- State and county of residence
- Avidity level (trips per year)
- Mode of fishing
- Primary fishing area


## Telephone Household Survey

- Presence of marine recreational anglers in household
- Number of anglers per household
- Fishing trips in 2-month period
- Mode of each trip
- Location (county) of each trip

Table 32. Data collected by the complementary MRIP methods.
Under the CHTS and Access-Point Angler Intercept Survey, marine recreational fishing data on effort, participation, catch, and discards are collected for 2-month periods ("waves") by subregion, state, fishing mode, and primary fishing area. Not all Greater Atlantic Region states and survey modes are sampled in each wave. Total survey effort during a 1-year period usually involves more than 76,000 intercept interviews and over 265,000 telephone interviews (Witzig et al. 2006).

In 2003, the ACCSP launched a coastwide For-Hire Survey ${ }^{23}$ (FHS), which was designed to collect catch and effort data from directory-based interviews with operators of charter and head/party boats. It also includes a "validation data" component that, through dockside observations of vessel activity, is used to validate the interviews and to correct any reporting errors. Catch per unit effort for the FHS relies on the access point intercept interviews noted above.

Unlike CHTS, which relies on random digit dialing to contact households in coastal counties, the FHS uses a telephone directory of known charter and party boat fishery participants. Sampling occurs weekly as vessel operators are contacted and asked about fishing effort in the prior week. The validation surveys are conducted through the same intercept survey method described above, but are targeted to correspond with vessels slated to be interviewed under the FHS at the week's end.

Another source of recreational fishing data is the FVTR. Charter and party boats in the Greater Atlantic Region are required to submit FVTRs per 50 CFR 648.7(b). Though not part of the MRIP, the FVTRs are important sources of recreational fishing data in the region and may be used to supplement MRIP data in the determination of impacts from recreational fisheries in the region.

Finally, over the years, several states have instituted activity- or fishery-specific recreational fishing surveys. Examples include state-level MRIP collections, angler reporting by catch-card, and vessel counts at certain marinas and harbor entrance channels. Such programs are well established on the Pacific, Gulf, and southeast coasts. In the Greater Atlantic Region, however, state-level programs are few and not focused on

[^15]species under management of the Fishery Management Councils. The FHS began as a state program in Maine in 1995, before its methods were adopted coastwide. A catchcard program in North Carolina and Maryland requires reporting on bluefin tuna and marlin catches, and an FHS-type telephone survey, including access-point validation intercepts, is used to collect data on effort and catch of large pelagic species aboard charter boats and private boats with permits for highly-migratory species. None of the state-level programs are relevant to the fisheries considered in this document.

### 4.7.2.1 MRIP Access-Point Angler Intercept Survey Methods ${ }^{24}$

The intercept survey consists of interviews to gather catch and demographic data from marine recreational anglers who have just completed fishing in one of 3 fishing modes: Head/charter boat; private/rental boat; or shore based (e.g., man-made structures, beaches, and banks). As noted above, the intercept survey samples angler catches during the six 2-month sampling periods depending on the state. APAIS sampling is conducted in North Carolina in January/February; Massachusetts-Georgia in March/April; Maine to North Carolina in May/June, July/August, and September/October waves; and in Massachusetts to North Carolina in November/December. In January/February only shore, private or rental boat or charter boat angling is surveyed in North Carolina. During March/April (wave 2) head boats may be surveyed in New Hampshire. All modes are sampled in wave 2 in Massachusetts to North Carolina. All APAIS modes (shore, charter boat, head boat, and private/rental boat anglers) and all included states in the region are sampled in waves 3 through 5 . In wave 6, all modes are surveyed in New York to North Carolina, and shore, private/rental boat, and charter boat modes are sampled from Massachusetts, Rhode Island, and Connecticut. The APAIS is not conducted in wave 6 in Maine and New Hampshire. Approximately 25,000 intercepts per year are allocated in the Greater Atlantic Region under MRIP (NMFS 2012SOW).

At the core of the APAIS plan is the Master Site Register (MSR), a complete coastwide list of access sites for marine recreational fishing. It was originally developed in 1979 and has been continuously updated. Sites are chosen for interviewing assignments by randomly selecting from among the MSR sites, as they are weighted by estimates of expected fishing activity. The intent of the weighting procedure is to sample in a manner such that each angler trip has an equal probability of inclusion in the sample.

The method used for assigning samplers to conduct interviews and collect data aboard a head/party boat is analogous to the MSR intercept assignment process. A directory of head/party boats is maintained and each entry is assigned a "pressure" reflective of the number of trips the vessel is expected to make in a week. Pressure is determined through field observations by MRIP staff and contractors, and the directory is updated regularly. Vessels annotated with a greater pressure value are likely to have samplers aboard more frequently than those vessels with a relatively low pressure. As with shore-based intercept sampling, the method for assigning samplers to ride aboard head/party boats helps to ensure each vessel trip has an equal probability of being

[^16]sampled and minimize sampling bias and increase precision (Robert Andrews, pers. comm., NMFS).

A sampling "assignment" consists of a target mode, a time interval, a cluster of fishing sites with activity in that target mode, the order in which those sites are to be visited, and the date on which the cluster is to be visited. Designated time intervals in all states are 2am-8am, 8am-2pm, 2pm-8pm, and 8pm-2am. Site clusters are determined each wave based on the site pressures for the wave, among other criteria (e.g., proximity, staff constraints). In addition to angler interviews, samplers collect a count of all anglers and fishing boats that complete fishing during the assigned sampling period.

Anglers are intercepted, screened, and interviewed at assigned access sites upon completion of their fishing trips. In addition to conducting interviews with eligible anglers the APAIS includes counting all anglers, and fishing boats, that exit the site (i.e., complete fishing in the assigned mode) during the sampling period at each site. At sites with high activity interviewers may need to alternate between counting and conducting interviews. Anglers fishing along natural shorelines may have several points of entry or exit and may be difficult to intercept at the completion of their fishing trip. Therefore, after conducting normal sampling for most of the assigned time period, some interviews are conducted with beach/bank shore mode anglers who have not completed their trip.

Each interview consists of:

- An introduction to the survey and information on the Privacy Act of 1974;
- An oral interview concerning the fishing trip just completed;
- A thorough examination of the respondent's catch; and
- Measurement of lengths and weights from all of (or if necessary, a random sample) the fish of each species in the respondent's catch.

Interview procedures vary slightly among fishing modes:

- When assigned to head/charter boats, the interviewer occasionally rides on head boats to interview anglers and to examine their catches.
- Private/rental boat anglers are interviewed at boat ramps and hoists while they are recovering their boats or at dockside while they are cleaning their boats.
- Anglers fishing from natural shorelines often are widely distributed along beaches and banks with multiple access points, hence samplers often have to rove from angler to angler within the defined boundaries of the site to obtain interviews.
- Man-made structures often have a single egress point at which samplers can easily intercept departing anglers.

Interviewing procedures have been developed to allow separate recording of information on the following:

- Catch which is unavailable for identification;
- Available catch which cannot be easily subdivided among anglers; and
- Catch obtained during multiple-day boat trips.

For fish not available for the interviewers' examination, information is only recorded for individual anglers. For the fish available for inspection, grouped catch is allowed.

The procedure for interviewing anglers while aboard a head/party boat is roughly the same, except that parts of the interview may occur even before any fish are caught while the boat is heading out to sea (NMFS 2012SOW). Samplers do not attempt to interview all of the passengers, but randomly select passenger to be interviewed. As fish are brought aboard, the sampler will attempt to collect data on all catch (retained and discarded). Retained catch is weighed and measured (fork length). Discarded catch is measured, but is not weighed due to the concern of causing the fish further injury. The location fished may be obtained from the boat's captain after the trip. Otherwise, the vessel's crew are not interviewed.

### 4.7.2.2 MRIP Telephone Survey Methods

The CHTS is carried out in 2-week periods of interviewing starting the last week of each 2-month wave of fishing activity and continuing in the first week of the following month. For example, for the March/April wave, households are called during the last week of April and the first week of May. Respondents are asked to recall on a trip-bytrip basis all marine recreational fishing trips made within their state during the 60 days prior to the interview.

A summary of the methods used in the telephone survey are as follows:

- The telephone survey is only used to gather information on fishing effort, not on catch rate or species composition.
- The telephone interview sample quota for each wave varies with the amount of fishing activity expected. The allocation is based on historic MRIP data on fishing effort.
- Interview allocations for each county are proportional to the square root of the number of households within the county. This ensures a minimal level of sampling in coastal counties with small populations.
- The sampling units in the telephone survey are households with telephones in coastal counties. Households are contacted using a procedure called "random digit dialing." In this procedure, each telephone number (including unlisted numbers) within the county has an equal probability of selection.
- The household effort data obtained in each county is weighted by the number of households in the county for calculation of a state level estimate of the mean household fishing effort. In statistical terms, a stratified sampling estimator is used.
- This weighting procedure was started in 1993 and applied to all historical estimates. In earlier years, an improper weighting scheme (based on the number of households in the state) was used. States with large coastal
population centers (e.g., Boston, Baltimore) were the most affected by the change.
- Sampling is without replacement within strata (state/county/wave), as well as among strata within a year. Generally, no household telephone number is included in the sample more than once during a calendar year.
- Telephone interviews are conducted between 8:00 a.m. and 9:00 p.m. (respondent's local time) on weekdays and weekends, with at least one weekday attempt and three night or weekend attempts.
- At least five attempts are made to reach each household. Repeated attempts are made to complete the questionnaire with all eligible anglers residing in each contacted household.
- As necessary, interviews are conducted in Spanish.
- Information on marine recreational fishing activity is obtained from each angler in the household or from a responsible adult when appropriate.
- A procedure called "hot deck" imputation ${ }^{25}$ is used to adjust for nonrespondent anglers and households prior to estimation.


### 4.7.2.3 For-Hire Survey

The FHS is designed to collect data on fishing effort and catch per unit effort aboard charter and party boats. Effort data are collected through pre-formatted telephone interviews with vessel operators. A directory of active for-hire vessels is the source from which the sample frame is drawn. The directory is updated opportunistically and through information collected in the telephone surveys.

Sampling is stratified by state, mode (charter or party), week, and sampling wave. The sampling waves are the same as with MRIP. In each week of the survey, called a "sampling week," approximately 10 percent of the for-hire fleet is selected to be queried. In areas where a 10 percent sample would result in fewer than three samples per stratum, additional samples are drawn. The vessels selected for the FHS are contacted by mail the week prior to the sampling week. A letter explains the program and the data that are needed, and the vessel operator is given a copy of the basic reporting form.

Vessel operators are contacted the week following their sampling week and interviewed in accordance with the FHS questionnaire and established protocols. The questions focus on the number of trips taken, the length of the trips, distance from shore, the number of anglers, and fishing method (trolling, jigging, etc.). The interviewer asks what species were targeted on the trip but does not ask the respondent to quantify or otherwise describe the catch and discards. Ditton et al. (2001) reports that, on average, 83 percent of the for-hire vessels in the survey are successfully contacted and about 80 percent respond to the survey. The FHS provides vessel operators with the alternative of

[^17]self-reporting by submitting the completed reporting form to a toll-free fax number or through a PIN-protected secure website. About 5 percent of respondents use these alternative reporting modes.

The FHS includes dockside validation of self-reported trip data. During the designated sampling week, interviewers visit the marina/dock where the target for-hire vessel is moored. The interviewer notes the time and date and records the vessel status (moored, underway, hauled out, etc.) Ideally, interviewers will visit the dock several times during the sampling week. The presence/absence/activity data are compared to and used to correct errors in the self-reported FHS data. CPUE data are collected through access intercept surveys, conducted ashore at access points or afloat aboard party boats as described above.

### 4.7.2.4 FVTRs from Party and Charter Boats

Throughout the Greater Atlantic Region, party and charter boats are subject to the requirements at 50 CFR 648.7(b) for preparing and submitting FVTRs, just as are commercial vessels. An FVTR must be completed for each fishing trip. A new page must be started for each statistical area in which the vessel fishes. The FVTR logbook must be submitted by the $15^{\text {th }}$ of the month following the month in which the trip ended. If a vessel holds a Federal permit for Northeast multispecies, Atlantic herring, Atlantic mackerel, longfin squid, Illex squid, or butterfish the FVTR logbooks must be submitted weekly, by the first Tuesday following the end of the reporting week. Charter and party boats are required to report the number of anglers fishing and the number (rather than the weight) and species of all fish kept and discarded.

A description and an evaluation of FVTRs are included in this document under section 4.3. The section is applicable to charter/party FVTRs with one exception. In commercial fisheries, the dealer report, documenting the species and pounds landed, provides an independent form of verification of the commercial FVTR. Catch from recreational fishing, however, may not be sold. Consequently, no dealer report is generated, and the party/charter FVTR cannot be verified in the same manner. Otherwise, the uses and limitations of the charter/party FVTR are the same as those addressed in section 4.3.

### 4.7.3 Evaluation and Applicability

In the Greater Atlantic Region, the species for which recreational angling is a significant source of fishing mortality include summer flounder, winter flounder, scup, bluefish, Atlantic cod, and striped bass. For each of these stocks, FVTRs, MRIP, and FHS data are primary sources of bycatch and discard information, used to document bycatch of these species, along with all others, in recreational fisheries. Data include landing and discard distributions by catch and size class by stock area and mode. Catch and discard per trip estimates are used in conjunction with effort data obtained by both surveys to estimate total recreational catch and bycatch for use in stock assessments.

Data on fish caught by recreational anglers are categorized as follows:

- Type A - Fish brought back to the dock and identified by MRIP interviewers.
- Type B1 - Fish that are released dead, used for bait, or filleted and identified only by the angler.
- Type B2 - Fish that are released alive and identified by the angler.

Types A and B1 are considered directly in the determination of total mortality from recreational fishing. Though type B2 data are reports of fish released alive, certainly some of the fish do not survive. Live-release mortality rates for the stocks listed above range from 8 to 50 percent. The estimations are based on empirical evidence, observations in commercial hand-gear fisheries, comparisons to similar species, and, in some cases, directed studies. Summer flounder, for example, were thought to die 25 percent of the time after release by a recreational angler, but studies in the 1990s determined the mortality rate to be approximately 10 percent. Taken together, types A, B1, and a percentage of B2 catch, form the basis for estimations of total mortality resulting from recreational fishing (Mark Terceiro, pers. comm., NMFS).

Fish age data are not collected under MRIP or the FHS. Age is derived from length-frequency data collected on landed fish (Type A) through intercepts. Lengthfrequency data on discards (Types B1 and B2) are collected by intercept samplers when they ride aboard party/head boats. Other sources of data for estimation of lengthfrequency of discards include intercept-observed sub-legal fish, at-sea sampling by state agencies, and self-reporting programs in Virginia, Maryland, New York, Connecticut, and Massachusetts. Catch-at-age, derived in this manner, is a component in the determination of stock size and total fishing mortality (Mark Terceiro, pers. comm., NMFS).

### 4.8 Industry-Based Surveys

### 4.8.1 Description

Industry-based surveys (IBS) are fishery-independent assessment studies that are conducted using commercial fishing vessels. IBS surveys often use gear designed to optimize the catch of the specific species being targeted by the survey. These IBS surveys are statistically designed and conducted under the oversight of scientists from academic institutions, State or Federal fishery agencies, or other marine research organizations (NMFS 2013c). Often, collaborations among these groups and NMFS occur with specific hypotheses to test as well as conducting stock monitoring programs. IBS surveys often use stratified random sampling designs as well as fishermen-selected stations. Fishermen-selected sample sites integrate the empirical ecological knowledge of fishermen to conduct surveys in areas where specific species are known to occur in either unusually high abundance or in areas outside the scope of the traditional NMFS surveys (Earl Meredith, pers. comm., NMFS). Survey designs that use fishermenselected sample sites must be analyzed differently to control for inherent bias. Studies have shown that fishermen-selected sites do not necessarily improve the precision or accuracy of the survey abundance estimates.

The primary purpose of most IBS is to supplement existing estimates of relative abundance for a specific finfish or shellfish species or species assemblage obtained in NMFS surveys and to provide abundance data for areas and/or species poorly sampled by NOAA surveys (Table 33). These data may be utilized in conjunction with other data sources in performing stock assessments. The fishing methodology and gear utilized in industry-based surveys may be more similar to standard commercial fishing operations than fishery independent surveys, but may still differ substantially from typical fishing operations. Not all of the sampling protocols employed include detailed data collection on all captured species (Earl Meredith, pers. comm., NMFS).

| Industry-Based Survey | Principal Investigator |
| :---: | :---: |
| ME/NH inshore trawl | ME Dept. of Marine Resources |
| Gulf of Maine Atlantic cod trawl | MA Division of Marine Fisheries |
| Yellowtail flounder trawl | RI Dept. of Environmental Management and University of Massachusetts-SMAST |
| Surf clam inventory | NJ Dept. of Environmental Protection |
| Sea scallop abundance | Virginia Institute of Marine Science, University of Delaware, ME Dept. of Marine Resources, Coonamesset Farm |
| Sea scallop photographic and video | University of Massachusetts, Arnie's Fisheries, and Woods Hole Oceanographic Institution (HABCAM) |
| Scup \& black sea bass trap survey in non-trawlable areas | University of Rhode Island/Charles Borden |
| Northeast Area Monitoring and Assessment Program (NEAMAP) | Atlantic States Marine Fisheries Commission |
| Monkfish Trawl | NEFSC |
| Downeast Maine long line and jig surveys | Penobscot East Resource Center |
| Flat-fish trawl survey | NEFSC |
| Georges Bank longline survey | NEFSC |

Table 33. Industry-based surveys in the Greater Atlantic Region.

### 4.8.2 Evaluation and Applicability

Industry based surveys may provide an alternate source of information on species distribution and the frequency of occurrence in fishing gear. However, because of their focused design, spatially and temporally limited orientation, and specialized fishing gears, IBS surveys are not suited to replace or supplement current data sources for bycatch information. The data generated through IBS surveys cannot be directly expanded to the commercial fishery. IBS surveys do not present a complete picture of all species encountered by commercial vessels, as the gears used, areas and seasons fished, and sampling schemes differ substantially from commercial fishing operations. The time series of industry-based survey data may be susceptible to lapses or compression pending
research priorities and funding availability and therefore cannot be relied upon for future bycatch estimation.

### 4.9 Study Fleets

### 4.9.1 Description

In collaboration with the New England and Mid-Atlantic fishing fleets, NMFS established a study fleet to develop and implement state-of-the-art electronic data reporting devices for use aboard commercial fishing vessels (NMFS 2013d). The study fleet was designed to collect higher resolution and more timely fishing effort, harvest, discard, and oceanographic data. Electronic data systems were developed and field tested by commercial fishermen to enhance data accuracy and ease of submitting fishery dependent data to NEFSC. The study fleet data reflect activities that are truly commercial fishing and not scientifically designed fishing like the IBS described above.

There will soon be over one hundred commercial vessels reporting to the study fleet program. Vessels range in size from small day-boat otter trawlers to large off-shore trip boats. Study fleet vessels operate from ports in Southern Maine to Virginia. Otter trawl and scallop dredge fishing make up the majority of study fleet vessels.

Specialized equipment is necessary for data transmittal; currently the equipment is paid for by NMFS cooperative research program and a grant from the Pacific States Marine Fisheries Commission. Vessels participate on a voluntary basis and are currently compensated for their participation in the project (Earl Meredith, pers. comm., NMFS).

Data collected include an automated global positioning satellite (GPS) link for detailed catch location information. The reporting system can automatically capture water temperature throughout the water column, and depth information for use in profiling species abundance by depth or temperature. Oceanographic data are being correlated with bycatch information to model and predict areas where bycatch is high. This allows the opportunity to guide commercial fishing operations away from those areas with higher bycatch.

Once study fleet data are transmitted, the sender may perform a one-time correction to the submission via a web site interface. The data are then usable with little additional modification for analysis/management or submission to quota monitoring systems. The study fleet data provide a middle-level resolution between detailed tow/haul level observer and broad trip/area FVTR data and can be made available at or near real-time (Earl Meredith, pers. comm., NMFS).

### 4.9.2 Evaluation and Applicability

The NEFSC Study Fleet provides all of the self-reported data elements supplied in a FVTR, but the data are transmitted electronically and are provided on a tow-by-tow basis rather than at the sub-trip level (statistical area or change of fishing gear type). The study fleet can provide more detailed location data than is available on a FVTR including
location information for each tow/set of the fishing gear. Additionally, the study fleet system has dynamic data fields that allow for the collection of additional information such as specific gear characteristics, length frequency of target species, or specialized information for other research needs.

Similar caveats and limitations apply to study fleet data and FVTRs (section 4.3.2). The electronic recording and transmittal of the study fleet data may minimize the transcription entry errors or recall bias associated with current filings of FVTRs, but may introduce new errors. The most functional current study fleet is a small subset of the groundfish trawl fishery mode. Because it is not necessarily a statistically valid allocation of the groundfish fleet, expanding the self-reported tow-by-tow bycatch and discard data to the entire fleet may not be representative of overall fishing practices. Soon, the number of study fleet vessels in the groundfish and squid fisheries may be sufficient to expand up to fishery-level estimates, but further review will be required.

The study fleet project has the capability to provide more detailed location and more precise effort data, such as tow distance, than is available from FVTRs. The improved location data may be beneficial in performing more precise expansions of observer-based bycatch estimates, particularly if the program is retooled to be a representative sample of the fleet or is expanded to encompass entire small fleet fisheries such as red crab or tilefish. The near real-time reporting capabilities of the study fleet could be useful in directing additional fishery dependent data collection efforts to specific areas to further investigate unusual bycatch events reported by the study fleet.

The study fleet project received a detailed evaluation and review in 2006. At present, the project has demonstrated that the hardware and software developed can be used to effectively collect and transmit tow by tow catch and discard information and provide detailed high resolution oceanographic data from commercial vessels conducting normal fishing operations. The study fleet will soon be investigating other technology to ensure verifiability and perhaps visual monitoring of commercial fishing operations.

### 4.10 Digital Video Cameras

### 4.10.1 Description

### 4.10.1.1 Electronic Monitoring Systems

The use of fixed placement, high resolution, and tamper resistant video cameras on-board fishing vessels that record digital video data to large capacity computer hard drives has been a relatively recent development in fisheries around the world (Ames 2005; McElderry 2003; McElderry et al. 2003; Tamee Mawani, pers. comm., DFO Pacific Region; Bob Stanley, pers. comm., AFMA). These systems are often referred to as electronic monitoring systems.

Electronic monitoring can be utilized to augment or replace onboard human observers in some data collection tasks. The majority of applications using electronic monitoring have been developed to monitor gear interactions with protected species and
birds, to detect presence or absence of specific fish species occurring as bycatch, or to validate vessel landing and logbook information (e.g., as monitoring in full retention programs). Forays into bycatch quantification have yielded mixed results with success largely dependent on the type of gear being monitored and the electronic monitoring video quality (Mark Buckley, pers. comm., Digital Observers, Inc.). The technology supporting electronic monitoring has advanced significantly in a short time and issues of image quality that were once prevalent are virtually nonexistent when the cameras are properly placed. Electronic monitoring applications have been deployed successfully in fixed gear fisheries (i.e., longline, pot/trap, mechanical jig) and in trawl fisheries with relatively homogeneous catch composition.

Within the Greater Atlantic Region, a proof of concept project has been completed using electronic monitoring onboard small longline vessels operating off Cape Cod (McElderry et al. 2005). This project produced very similar data results as would be collected by an onboard observer in identifying and quantifying bycatch species, namely Atlantic cod occurring in sets targeting haddock (McElderry et al. 2005). A pilot program to test the applicability of electronic monitoring technology to collect catch and fishing effort data abroad commercial vessels was begun in 2010. Phase III of this project has recently been completed and a report of the results is pending. In addition, NMFS has recently approved a new policy document on electronic technologies and fishery-dependent data collection (NMFS 2013b).

### 4.10.1.2 Image Processing Systems

Also known as "digital observers," this is an enhanced version of electronic monitoring systems described above. Digital video data are captured by fixed placement video equipment. The resulting video data are run through custom image recognition software that process the picture through a series of algorithms to identify fish species, provide length data and in some cases where a length/weight relationship has been established, weight data (Davis 2002). Video data are typically reviewed by technicians to visually confirm software identification findings and system performance.

### 4.10.2 Evaluation and Applicability

### 4.10.2.1 Electronic Monitoring Systems

Some initial successes using electronic monitoring have been demonstrated in several specific, limited programs worldwide (McElderry et al. 2005). In these programs, electronic monitoring technologies have been capable of providing visual catch data to answer specific questions about what is being caught, discarded, or interacting with fishing gear. Because of these successes, electronic monitoring is considered to have considerable potential for fishery applications and has been hailed by some as a replacement for onboard human observers. This may be true to a certain extent in fisheries where little previous at-sea data collection of any type has occurred. Considering the current limits of the technology and recent experience utilizing the technology, electronic monitoring is currently capable of acquiring only simple presence
and absence data rather than the highly detailed data collected by at-sea observers such as those utilized in the Greater Atlantic Region.

Current successful electronic monitoring programs use video as a means to monitor retention or validate logbook data for retention and discards. In these programs, electronic monitoring uses visual data in an attempt to confirm logbook reports, and is only a part of the total monitoring program and does not do anything beyond confirming presence or absence of catch and discards. Such retention or logbook monitoring programs are supported by extensive regulatory environments that include some type of limited access privilege program and significant administrative support. These programs require extensive post-trip comparisons of video data to logbook and landings records. No such analogous program or regulatory environment currently exists in any Greater Atlantic Region fishery mode.

In the Greater Atlantic Region fishery modes, the at-sea observer programs are very complex in their sampling schemes and in regards to the data collected. Electronic monitoring technology is currently not capable of performing most of the detailed data collection tasks performed by human observers. Simple presence/absence characterization of catch would not lend itself to data expansion in any meaningful way in the models used in the Greater Atlantic Region unless additional parameters such as weight or length can be associated with the visual data. To obtain such data, vessel crews would have to handle catch and discards in a tightly prescribed manner at designated locations to ensure image capture. In contrast, electronic monitoring may be useful in documenting marine mammal or protected species interactions with commercial fishing operations in the absence of an at-sea observer, because in these cases, simple presence/absence data are usually sufficient. Deployment of electronic monitoring into fisheries with little to no at-sea observer coverage as a supplement to overall coverage levels would not yield data with much utility unless the deployments were tailored around answering very simple presence/absence questions.

The technology supporting the onboard video units has under gone significant development in recent years. So too has the number of programs testing the technology in applications worldwide. The potential for future uses of electronic monitoring remains high as continued refinement occurs. Many features of electronic monitoring are desirable. Electronic monitoring units can be deployed on small vessels that could not reasonably accommodate an onboard observer and may have a lower daily operational cost to industry when compared to onboard observers. There are some important electronic monitoring issues relating to the Freedom of Information Act (FOIA), privacy, data use, and chain of custody have not been widely discussed or resolved. In addition, significant program administrative support and costs are associated with large-scale electronic monitoring programs. Significant costs are involved with retrieving, reviewing, analyzing, and storing the electronic image data (Kinsolving 2006). Decisions would also need to be made regarding minimum performance standards and who would bear the costs of implementing an electronic monitoring program.

### 4.10.2.2 Image Processing Systems

This technology is still in pilot study development and has yet to demonstrate that it can replace human observers in field applications. Significant challenges have occurred during field testing in capturing quality images under sufficient lighting on an adequate background for the imaging software to perform at an acceptable standard for species identification (Mark Buckley, pers. comm., Digital Observer, Inc.). Additional challenges have occurred in configuring systems to provide length and weight data. Often, fish handling practices may require modification to ensure that optimal image captures occur. Discards must occur at a designated area and may also require special handling and lighting for image capture for the systems to function properly. Further testing of this technology needs to be performed to determine its potential utility for specific fishery applications.

### 4.11 Alternate Platforms

### 4.11.1 Description

Alternate platform programs are observer programs utilizing skiffs (i.e., other small marine vessels) to deploy human observers in proximity to operations of near-shore fixed gear operations to collect information on gear interactions with marine mammals or other protected species. Observations may not always occur in close enough proximity to the fishing operation to identify animals to the species level. Collection of biological data is often restricted to animals that have been killed as a result of gear interactions.

A program in Alaska utilized skiffs to monitor sea bird and marine mammal interactions with shore-based salmon gill nets (NMFS 2006b). In the Greater Atlantic Region, an alternate platform observation program is in use to monitor bycatch, primarily sea turtles, in the Chesapeake Bay pound net fishery (Ryan Silva, pers. comm., NMFS) and to monitor dolphin and turtle interactions with coastal gillnet fisheries in North Carolina and Virginia.

### 4.11.2 Evaluation and Applicability

Use of alternate platforms may allow observation of vessels that are too small to accommodate an onboard observer. Observers may be able to cover several vessels or gear locations in a short period of time. Observers may be able to set their own sampling agenda as they would not be dependent on a particular vessel hauling gear at a particular time, provided the vessels to be observed are in close proximity (NMFS 2006b). Use of alternate platforms requires the operation of the alternate vessel, either by the observer or by a vessel operator. Safety issues may arise with the operation of small vessels.

The type of data collected is not detailed; typically only presence/absence information and species identification are performed. Identification may be limited by factors affecting visibility of the catch, such as the distance between the observer and the fishing vessel, time of day, sea state, etc. Current alternative platform programs are
focused on marine mammal and protected species interactions and do not currently collect any information on other species (e.g., fish).

### 4.12 Stranding Networks

### 4.12.1 Description

Stranding is a term used to describe an event when marine mammals or sea turtles become stuck, or 'beached', in shallow waters or on land. Stranded animals may be alive or dead. Formal networks of experts have been formed in coastal states to monitor and respond to the occurrence of and collect data on stranding events.

The Marine Mammal Health and Stranding Response Program was formalized by the 1992 amendment to the MMPA. The program has the following components: Stranding networks; responses/investigations of mortality events; biomonitoring; tissue/serum banking; and analytical quality assurance (NMFS 2006e). A similar program, the Sea Turtle Stranding and Salvage Network, coordinates responses to sea turtle stranding and mortality events (NMFS 2006e). NMFS has been designated as the lead agency to coordinate stranding network related activities for both programs.

Within both networks, initial information on strandings are provided by the public, mariners, educational institutions, and other interested parties by contacting a local stranding network member, which may be a university, non-profit organization, state fish and wildlife agency, or NMFS. Both stranding programs utilize an extensive group of qualified individuals from Florida to Maine to fully investigate any stranding that occurs. Investigators are well trained in species identification, animal handling, data and sample collection, necropsy, common injuries, and often rehabilitation. Data on both marine mammal and turtle strandings are maintained by NMFS databases.

### 4.12.2 Evaluation and Applicability

Stranding networks have only limited value in providing bycatch-related data. The data collected by stranding networks is useful to ascertain if human interaction was involved with the stranding or mortality event. In most instances, stranded animals are found on shore and any interaction with fishing gear may have occurred well before or some distance from the stranding location.

Strandings may be caused by a number of factors including, but not limited to, illness, predation, fisheries bycatch, vessel strikes, and ingestion of marine debris. During a stranding investigation, every effort is made to determine if human interaction contributed to the stranding or mortality event. Stranded animals may or may not have external evidence of human interaction. In either case, they are thoroughly examined and/or necropsied to determine whether human interaction contributed to the stranding or is an incidental finding. In some cases, a determination can be made that an interaction with commercial or recreational fishing gear contributed to or caused the stranding. When fishing gear is involved, it is often difficult to identify the specific fishery in which the gear was used. For example, vertical lines are used in many different pot/trap and
gillnet fisheries. Understanding the characteristics of the gears and how they may impact an animal provides valuable information that can be used in addressing fisheries bycatch.

### 4.13 Vessel Monitoring Systems

### 4.13.1 Description

Vessel monitoring systems are electronic transceivers placed onboard commercial fishing vessels that transmit electronically location information captured from either the vessel's GPS receivers or by triangulating position from VHF radio transponders or mobile phone short message service (Trumble et al. 2004). Vessel location can be monitored remotely in either real time or retrospectively and the speed of the vessel can be derived by plotting the locations identified and the time at which the vessel occupied those locations. The activity of the vessel can be discerned by the speed at which the vessel is traveling-generally, slower speeds indicate fishing and higher speeds indicate transiting ("steaming").

GPS satellite-based VMS provides NMFS in the Greater Atlantic Region with accurate locations of fishing vessels that are either required to or voluntarily use VMS. Real-time location information can be used to monitor compliance with closed areas, special access programs, and validate FVTR data. Obtaining location information, known as polling, typically occurs on a specified schedule (frequency) according to the regulations of the fishery in which the vessel is participating. NMFS may poll VMS vessels at any time.

Most VMS units are capable of sending and receiving text messages or e-mail. Vessel operators may use the text message functionality of VMS to supply self-reported, real-time catch information, including the amount of fish kept and discarded. Several special access programs in the Greater Atlantic Region require reporting of this type (see below). DAS use can also be monitored by VMS. When a vessel crosses the demarcation line, DAS will begin to be utilized at whatever rate is specified for the fishery and/or area in which the vessel is participating.

VMS may also be used to provide notification of a vessel's return to port to facilitate dockside inspection of vessel landings by NMFS law enforcement or other officials. VMS is currently required in several Greater Atlantic Region fisheries or fishery programs (Table 34). As of September 24, 2013, there were 1,010 vessels using VMS in the Greater Atlantic Region. Several Council actions under development may increase the number of participants.

| Permit Category | Number |
| :--- | :---: |
| Full-time and part-time sea scallop | 331 |
| General category sea scallop | 573 |
| Northeast multispecies (under DAS or in sector) | 502 |
| Limited access Atlantic herring | 84 |
| Atlantic Surfclam | 618 |
| Ocean Quahog | 629 |

Table 34. Number of VMS users, by permit category (as of September 24, 2013).
Many of the fisheries listed in Table 34 have requirements to report bycatch via VMS. Atlantic sea scallop vessels are required to use VMS and are required to report catch of groundfish when operating in Sea Scallop Access Areas. Framework 42 to the Northeast Multispecies FMP requires all limited access DAS vessels participating in the Northeast multispecies fishery to use VMS. Monkfish fishing vessels are required to use VMS only when participating in special management programs.

### 4.13.2 Evaluation and Applicability

The applicability of VMS as a bycatch monitoring and reporting system is twofold. First, the systems provide the real-time position of each vessel tracked. The position data are used, for example, to ensure compliance with closed areas and monitor participation in special fishery access programs, many of which have specific bycatch quotas. Closed and special access areas may be designed to protect habitat, limit fishing mortality on spawning aggregations of fish, or to limit potential interactions with marine mammals, protected species, or other species of concern.

Second, vessels in some fisheries are required to supply self-reported discard data via VMS. In addition, vessels may use VMS to declare into specific fishery programs (e.g., the U.S./Canada management area, SAPs established under Amendment 13 to the Northeast Multispecies FMP, sea scallop access areas, and the monkfish offshore fishing area). By declaring into a specific fishery, program, or intent to fish in a particular mode, the amount of bycatch or the ability to discard legal-sized catch may be restricted. The submitted data are used in conjunction with observer data to monitor target and bycatch quotas, primarily in special access programs throughout the region.

VMS supplied data are validated using positional information, FVTRs, dealer reports, and observer data, and vice-versa. VMS may also help identify potential bias in regards to fishing location, effort, or trip length that may arise between observed and unobserved vessels.

It has been suggested that self-reported bycatch data and positional information supplied by VMS could be used for real-time bycatch avoidance (e.g., 'hot-spot' management) by providing the spatial and temporal characteristics of fishing activity as predictors for bycatch occurrence. At present, the Federal system is not structured to be responsive enough to enact dynamic management measures based on "hot spots," such as
avoiding bycatch in a small area. Significant regulatory changes and additional personnel, as well as changes in the administrative rulemaking process would be necessary to bring that type of management to fruition. Any bycatch "hot spot" management program would probably succeed far better if developed on a voluntary basis by the fishing industry.

### 4.14 Trawl Monitoring Devices

### 4.14.1 Description

Several marine electronic systems are available to monitor the performance of mobile fishing trawl gear (Trumble et al. 2004). These systems use wire or acoustic links to send information from sensors mounted on the trawl net to a receiver onboard the vessel. These devices can be used to measure the actual time and distance that the net is in contact with the bottom, when codends are filling or are full, and net opening height (i.e., net performance). Both commercial fishers and fishery researchers have made use of these technologies to better monitor their respective trawl nets as they operate.

### 4.14.2 Evaluation and Applicability

If tamper-resistant monitoring units were developed and made available for widespread use, they could be used as enforcement tools to ensure pelagic nets were not fished in contact with the bottom. At present, this type of monitoring is achieved through performance standards based on catch composition (e.g., if a percentage of benthic or demersal species are found in midwater trawl catch). Sensors could provide bottom contact information when used in conjunction with vessel location information, such as VMS, which could be useful in monitoring habitat impacts. In addition, these types of devices if employed in all trawl fisheries, could help reduce discards that result from "topping off" the catch when vessel holds are almost full.

### 4.15 Future Developments and New Technologies

The speed of development for electronics and technologies capable of operating in a marine environment to collect various data inputs is ever expanding. New technologies should be viewed with some degree of caution. Often regarded as the panacea for solving the monitoring or data needs of the day, new technologies should be developed and applied in fisheries with clearly developed goals for the end product of data generated. Rigorous development of new programs, testing, and performance standards must be developed as new technologies and data collecting methods are researched. Only through well planned proof-of-concept testing followed by beta-level field testing can new technologies be adequately assessed for suitability in any given fishery mode. In addition, thorough analysis of the costs and benefits must be considered relative to all parties involved; industry, government, and tax payers. Programs should focus on producing usable data that answer a specific question or set of questions, not just proving that the technology will work. Ideally, these types of tests and considerations
will occur prior to full regulatory implementation of new technologies or replacement of current data collection sources are phased out.

# Sampling Design and Estimation of Precision and Accuracy 

### 5.1 Introduction

This chapter presents the results of analyses conducted in support of the SBRM developed for Greater Atlantic Region fisheries. These analyses include: (1) A comprehensive summarization of 2004 data collected by the NEFOP; (2) an estimation of discard precision for fish and protected species using three different estimation methods and two different discard ratio estimators; (3) an evaluation of these different methods; and (4) an estimation of the observer sea days that would be required to achieve a desired level of precision. Other analyses related to the SBRM can account for the overlapping nature of multiple species caught by a fishery, develop species-specific imputation methods, and expand the optimization tool used prior to the 2007 SBRM Amendment to allocate sea day coverage to account for all monitoring objectives. These secondary analyses are briefly described in this document and can be undertaken in the future, but are not the primary focus for this analysis. Based on the initial analyses, further work was undertaken to refine the importance filter and to integrate the sea days required to monitor sea turtles derived from model-based methods with the sea days required to monitor fish derived from design-based methods.

The methods used generally follow those recommended by the National Working Group on Bycatch (NWGB) (NMFS 2004) and further developed by Rago et al. (2005, Appendix A) and Fogarty and Gabriel (2005) for the Northeast multispecies fishery. These methods reflect a design-based rather than a model-based approach, and directly link the data collection monitoring program with the evaluation analyses. In Rago et al. (2005), 3 fishing modes and 12 species were examined; in this document, it was necessary to examine 45 fishing modes and 60 species/species groups to encompass all relevant federally managed species in the Greater Atlantic Region.

The NEFOP data are a key element of the SBRM. The SBRM should be viewed as the combination of sampling design, data collection procedures, and analyses used to estimate bycatch in multiple fisheries. The SBRM provides a structured approach for evaluating the efficacy of the allocation of observer sea days to monitor discards associated with multiple fisheries targeting a large number of resource species while operating under 13 different FMPs. The SBRM Omnibus Amendment is not intended to be the definitive document on all possible bycatch estimation methods, nor is it a compendium of discard rates and totals. Instead, the SBRM is intended to support the application of multiple bycatch estimation methods used in specific stock assessments. The SBRM provides a general structure for defining fisheries into homogeneous groups and allocating appropriate levels of observer coverage based on prior information and the expected improvement in overall performance of the program. The general analytical structure helps identify gaps in existing observer coverage, similarities among fishing modes that allow for realistic imputation, and the tradeoffs associated with potential coverage levels for different target and discard species. The observer sea day allocation
process, while guided by a concept of optimization, explicitly recognizes that many different factors affect the realized allocation of observer days to specific fisheries. Moreover, the optimization model allows for continuous improvement in observer allocation as new information on the results of the previous year's data is obtained.

None of the analyses associated with the SBRM are based on the potential mortality associated with unobserved encounters with fishing gear. The omission of these mortality sources does not confirm or deny their potential importance. Rather, it explicitly recognizes that such events cannot be observed even when an observer is present on a given trip and, therefore, there is no basis for extrapolation to unobserved sampling trips.

The analyses conducted in support of this amendment have occurred over a protracted time period (Wigley et al. 2007, Wigley et al. 2011, Wigley et al. 2012a, Murray 2012, and Wigley et al. 2012b). The initial analyses using 2004 data illustrated design-based methods; the methods are not specific to any given year. Therefore, it was not necessary to redo the analysis for this amendment. The analyses presented in this chapter are primarily presented in chronological order to help illustrate that more recent analysis builds upon the prior work done for the 2007 SBRM Omnibus Amendment.

### 5.2 Precision and Accuracy

It is important to understand that precision and accuracy are not the same thing and that they represent related, but different, aspects of a data collection program. Accuracy is defined as the closeness of a measured or estimated value to its actual value (for example, an estimate that there were 300 million people living in the United States during October 2006 can be considered reasonably accurate, but the actual number would have varied slightly with daily births, deaths, and immigration). Precision is defined as the degree of agreement of repeated measurements of the same quantity or object.

Precision is a measure of how closely repeated samples will agree to one another (i.e., the variability of the samples), and accuracy is an indication of how closely the estimate derived from the samples will agree with the true value. The precision of a sampling program can be measured because the data collected can be compared with one another using several basic statistical methods (to calculate the variance, standard error, standard deviation, etc.). However, the accuracy of the data rarely can be measured because the true value of the population feature being estimated is not known (which is why it is being estimated). As an example, consider a fish survey designed to generate an estimate of the total biomass of a fish species. The survey takes repeated samples (via tows of an otter trawl) of the population and those samples are used to estimate the total population. Because we can compare the samples (reported as kg/tow) to one another, we can calculate the variability and, hence, get a measure of the precision of the observations. However, because the actual biomass of the population cannot be known, we cannot compare the estimate to the true value. Therefore, there is no quantifiable measure of accuracy.

Data collected through a sampling program generally may be: Accurate but imprecise (substantial variability in the observations, but the observations coalesce to provide an estimate close to the true value); accurate and precise (low variability in the observations, which provide an estimate close to the true value); precise but inaccurate (low variability in the observations, but the estimate is not close to the true value); or neither precise nor accurate (high variability in the observations and an estimate that is not close to the true value). In a sampling program such as the at-sea observer program, the precision of the observations can be measured and controlled by calculating measures of variability and, if necessary, increasing the number of observations. While accuracy cannot be directly measured, it can be accounted for by reducing potential sources of bias in the data collection program. Bias is defined as a systematic difference between the expected value of a statistical estimate and the quantity it estimates. Thus, the case where the data were precise but inaccurate would most likely result from some source of bias in the data collection program. Absent bias, precision will lead to accuracy; thus, bias and accuracy are used interchangeably, but bias is generally associated with the design of sampling program. Eliminating potential sources of bias improves the accuracy of the results.

There are generally two primary potential sources of bias in a sampling program such as the at-sea observer program: Non-representative sampling; and the statistical properties of the consistency of the estimators (Rago et al. 2005). Non-representative sampling means that the targets of the sampling program (i.e., the vessels and trips on which an observer is present) are distinct and different from the overall population for which an estimate is desired. For example, if observers were placed only on small vessels fishing just offshore using a single gear type, these trips would not be representative of the variety of vessels, fishing gears, trip lengths, and fishing locations that comprise the wider fleet. The following section addresses the many ways in which the NEFOP strives to ensure that the observer program samples (observes) the Greater Atlantic Region fishing fleets in a representative manner. Later sections of this chapter address the statistical properties of the estimators, and provide evidence that there is very little bias associated with the data collected by the at-sea observers.

### 5.3 SBRM Design Considerations

### 5.3.1 Initial Design

### 5.3.1.1 Sampling Unit, Response Variables, and Precision Goals

Among the most important decisions in the preparation of the SBRM are associated with defining the sampling unit, determining the quantity to be measured for each sampling unit (in statistical terms this is known at the response variable), and establishing the desired level of precision for this value. The sampling unit is an object on which a measurement is taken (Cochran 1963; Mendenhall et al. 1971). The sampling unit for the SBRM is the vessel trip. For the purpose of the SBRM, the response variable for each trip is the total bycatch for a single species or a group of species. A bycatch ratio can be derived by dividing the total bycatch by some measure of fishing effort. If all trips have similar attributes (e.g., vessel power, fishing gear used, trip duration, etc.),
then the average amount of bycatch per trip may be an acceptable ratio. Otherwise, the bycatch rate can be expressed as the ratio of total discards to vessel days absent from port, vessel days fished (i.e., the portion of the trip spent actually fishing), or the total kept weight of all species. Total kept weight of all species is, in this sense, a proxy for effective fishing power. For finfish and shellfish, the numerator of the bycatch ratio is defined as the total weight of the discards of the species or species group. The denominator of the bycatch ratio is either the total weight of all species kept (landed) or a measure of fishing effort. Owing to difficulties in interpreting quantitative measures of fishing effort found in the FVTRs, fishing effort is approximated by days absent. ${ }^{26}$ For sea turtles, marine mammals, and sea birds, the numerator in the bycatch ratio is the total number of individuals discarded. Bycatch rates for these species are expressed as numbers per unit of fishing effort or numbers per species kept pounds.

The NWGB advocated evaluating bycatch programs on the basis of aggregated species, but this will not guarantee that programs will be adequate for individual species (NMFS 2004). To address this issue, the analyses conducted in support of the SBRM estimate not only bycatch ratios and the associated precision (relative standard error) for species complexes relevant to the FMPs (e.g., large-mesh multispecies, skates, etc.), but also bycatch ratios and precision for each individual species. Stock areas will not be considered in the analyses, although retrospective data on observed discards would be available at this scale. Conceptually, the problem of stock area is similar to that of estimating age-specific discard rates. The full variability of the estimates is the product of the uncertainty of the species-specific discard estimates and the sampling distribution of the age-length key, an issue of fine-scale detail that is beyond the scope of the broad SBRM. Parenthetically, the sampling design underlying the SBRM supports robust poststratification, sufficient estimation of stock-area, and age-specific estimates of discards.

Although the Magnuson-Steven Act does not include marine mammals and sea birds in the definition of bycatch to be addressed by an SBRM, marine mammals and sea birds are included in these analyses to illustrate the comprehensive nature of the NEFOP and the SBRM. The aggregate species approach will illustrate the overall effectiveness of the SBRM. The individual species approach will show the tradeoffs for varying levels of precision. With respect to the precision targets, the NWGB determined that a 20-30 percent coefficient of variation (CV) ${ }^{27}$ for the bycatch estimate is a useful goal:

Protected species: For marine mammals and other protected species, including sea birds and sea turtles, the recommended precision goal is a $20-30$ percent CV for estimates of bycatch for each species/stock taken by the a fishery.

[^18]Fishery Resources: For fishery resources, excluding protected species, caught as bycatch in a fishery, the recommended precision goal is a $20-30$ percent CV for estimates of total discards (aggregated over all species) for the fishery; or if total catch cannot be divided into discards and retained catch then the goal is a 20-30 percent CV for estimates of total catch (NMFS 2004).

As the NWGB pointed out, "Ideally, standards of precision would be based on the benefits and costs of increasing precision" (NMFS 2004) and noted that under some circumstances, attaining the precision goal alone would not be an efficient use of public resources. In the evaluation of precision of discard estimates, a CV of 30 percent was selected to derive the number of sea days that would be necessary to sufficiently monitor the bycatch of species groups within a fleet. Selection of the higher value is predicated upon stratification of species and fisheries at a finer level than the NWGB recommended. In this document, the term CV is defined as the ratio of the standard error of the estimate divided by the estimate. The estimate can be total discard or mean discard rate. Use of the term CV is equivalent to the term proportional standard error; for the sake of consistency with the NWGB (NMFS 2004), we use CV throughout this document. The NWGB recommended overall precision goals for a "fishery," but in the Northeast Region, a fishery may comprise several gear types; e.g., the groundfish fishery is composed of otter trawls, gillnets, and longlines. Thus, in order to define a fishery, gear type and mesh size are used as two key components in defining fishing modes within an overall fishery.

### 5.3.1.2 Definition of Strata-Fishery Identification

To monitor the diverse fisheries off the Northeast coast of the U.S. with at-sea observers, it is necessary to stratify the trips into fleet with similar characteristics. For the SBRM, fleets (fishing modes) are defined as strata within the overall survey design.

Commercial fishing trips are partitioned into fleets using six classification variables: Calendar quarter; geographical region; fishing gear type; mesh size; access area; and trip category. Some fleets were further stratified due to FMP requirements. These classification variables are selected because they are generally known before a trip occurs. Using these criteria, it is possible to generate a list of candidate vessels for each stratum, which simultaneously enables a random selection process and reduces the number of repeat trips on vessels. This is a critical aspect for both strata definition and sample selection. One cannot base a sampling design on the outcome of a sample observation. For example, in this exercise, it is not possible to select a sampling design that specifically improves the precision of cod discards, because that objective is dependent on the realization of the actual sample. However, it is possible to select samples that will improve the probability of obtaining improved discard estimates by estimating the expected proportion of trips that catch species groups of interest. These are important considerations to ensure that the observer allocations reflect a representative sample of active fishing vessels.

Calendar quarter was considered the most appropriate temporal unit to capture seasonal variations in fishing activity and bycatch rates over the full range of fisheries. Although some management regulations operate at a finer scale, once collected, quarterly
data can be further subdivided if finer resolution is needed. Additionally, fishing trips are classified into two broad geographical regions, New England and Mid-Atlantic, based upon the port of departure: Ports located from Maine to Connecticut were grouped together to form the New England region and ports located in states from New York to North Carolina comprise the Mid-Atlantic region. While data from both FVTRs and NEFOP are summarized by port landed, allocation of sea day coverage is necessarily based upon port of departure because an observer must physically board the vessel before it departs. A review of the observer and FVTR databases for 2004 revealed few instances (less than 2 percent of trips) where a change of port of landing from port of departure resulted in a change in region (i.e., New England to Mid-Atlantic or vice versa). The basis for classifying trips is the region/port of departure because areas fished are not always predetermined. The majority (over 93 percent) of 2004 observer trips both originated and fished in the same region and exhibited the same general pattern observed in the FVTR data (see Table 35 and Table 36); however, the proportion of trips that do not do so can be accounted for in the sea day allocation.

|  | Area Fished |  |
| :--- | :---: | :---: |
| Region/port of departure | New England | Mid-Atlantic |
| New England | 72.4 percent | 6.3 percent |
| Mid-Atlantic | 0.2 percent | 21.1 percent |

Table 35. Percentage of 2004 observer trips that departed and fished in the New England and MidAtlantic regions.

|  | Area Fished |  |
| :--- | :---: | :---: |
| Region/port of departure | New England | Mid-Atlantic |
| New England | 60.1 percent | 3.8 percent |
| Mid-Atlantic | 0.8 percent | 35.3 percent |

Table 36. Percentage of $\mathbf{2 0 0 4}$ FVTR records that departed and fished in the New England and MidAtlantic regions.

In these analyses, 14 general gear types were considered: Longline, otter trawl; scallop trawl; shrimp trawl; gillnets; scallop dredge; mid-water trawl (paired and single); fish pots/traps; purse seine; hand line; Scottish seine; clam dredge; crab pots; and lobster pots. Although the northern shrimp and the lobster fisheries are managed under the Atlantic Coastal Fisheries Cooperative Management Act (rather than the MagnusonStevens Act), these fisheries have bycatch of species managed by the New England and Mid-Atlantic Councils and, therefore, these gear types are included in the analysis to the extent possible.

Mesh size groups were used to further classify the otter trawl and gillnet gear types. For otter trawls, two mesh groups were used: Small mesh (less than 5.5 inches) and large mesh ( 5.5 inches and greater). For gillnets, three mesh groups were used: Small mesh (less than 5.5 inches); large mesh (from 5.5 to 7.99 inches); and extra-large
mesh (8 inches and greater). Fishing trips that used either scallop trawls or scallop dredges were further classified into two access areas (open or closed) and well as two trip categories (general category or limited access). Trips using other gear types were not further classified beyond gear type and mesh size. Due to the mixture of species caught during a trip, it is not sufficient to classify trips with regard to target species because discard of target and non-target species may occur.

A total of 60 individual species or species groups are examined in these analyses. These species/species groups comprise the 13 FMPs of the New England and MidAtlantic Councils, an all species combined group, and five protected species groups. The fisheries encompassing these 60 species/species groups required 45 different fleets to account for all regional, gear type, mesh size, and quota-monitoring status combinations (Table 40).

### 5.3.2 Data Sources

The sampling unit used in these analyses is the fishing trip. Trip characteristics are recorded in both the NEFOP and FVTR datasets. Together, these databases are used to define the size of the sample and the size of the strata. Data from each source are retrieved and prepared separately before they are combined.

### 5.3.2.1 FVTR Data

Beginning in June 1994, the Northeast Region's data collection system was changed from a voluntary to a mandatory reporting system for fishermen and seafood dealers holding federal permits (with the exception of those vessels that hold only Federal lobster permits) issued under regulations implementing FMPs developed by the New England and/or the Mid-Atlantic Council. The mandatory reporting system consists of two primary components: (1) Dealer reporting and (2) vessel trip reporting. Each component contains information needed for fishery management and stock assessment analyses. The dealer reports contain total landings by market category, while the FVTRs contain information on area fished, kept and discarded portions of the catch, fishing effort, and the gear type and mesh size used. Ideally, these data collection systems would record equivalent total landings. In practice, a variety of problems, especially incomplete or delayed reporting of FVTR, generally results in a slight underestimation of landings. The FVTR data have been routinely used in management analyses and peer reviewed stock assessments. Details on example applications of the FVTR to stock assessments may be found in a large number of reports of the Stock Assessment Review Committee (SARC). ${ }^{28}$

In these analyses, the 2004 FVTR (commercial) data are used to: (1) Define the sampling frame of the commercial fishing trips; (2) expand bycatch rates to total discards; and (3) evaluate the accuracy of the observer data with respect to area fished, kept pounds, and trip length. The FVTR data are the only synoptic data source for vessel activity, area fished, and fishing effort for commercial fisheries. The VMS data and the

[^19]DAS data systems cover only portions of the fisheries and, therefore, their use is limited for this type of analysis.

The FVTR data can be used as a basis for defining the sampling frame, because all federally permitted vessels are required to file a FVTR for each fishing trip. These self-reported data constitute the basis of the fishing activity of the commercial fleets. FVTR trip data are collapsed into fleets as defined above. For each fleet, the number of trips, the average number of days absent per trip, and the kept weight of species are calculated.

The limitations of self-reported catch data, such as the data obtained through the FVTR, are well established (e.g., Walsh et al. 2002; NMFS 2004). Limitations of the initial FVTR datasets were described by the SARC in 1996 (NEFSC 1996). Since then, many of these limitations have been addressed. In particular, subsequent peer-reviews through numerous SARCs and a review by the National Research Council (1998) have identified the strengths, weaknesses, and appropriate uses of the FVTR data from the Northeast. Measures currently used to ensure the validity of the FVTR database include routine auditing procedures, standardized data entry protocols, and compliance reviews (Greg Power, pers. comm., NMFS).

In the analysis described below, the FVTR data are converted to round (live) weight using Commercial Fisheries Database System (CFDBS) conversion factors for each species. Days absent and total species kept on a trip are also calculated. The FVTR trips are collapsed into strata as defined above. For each fleet, the number of trips is calculated. Note that trips by vessels participating in the US-Canada access area, B DAS program, and other quota-monitored programs could not be identified in the FVTR data. These trips have been grouped by the other stratification variables and have not been partitioned separately.

The validity of using the FVTR data as a basis for developing a sampling frame is supported by comparisons with total landings data from dealer records. All federally permitted seafood dealers are required to report 100 percent of their purchases. These data are generally considered to represent a near complete census of total landings. A comparison of species landings from FVTR and dealer records for calendar year 2004 reveals some discrepancies, by species group, between these two sources (see Table 37). Overall, there is a 2.3 percent difference between landings reported in the dealer and FVTR databases; however, this low percentage difference is driven in part by a -10 percent difference for herring. If herring landings are removed from the total, the difference between the total kept weights in the two databases is 4.7 percent.

|  | FVTR <br> Landings <br> (mt, live) | Dealer <br> Landings <br> (mt, live) | Difference <br> (mt, live) | Percent <br> Difference |
| :--- | :---: | :---: | :---: | :---: |
| Atlantic Bluefish | 2,357 | 3,423 | 1,067 | $31.2 \%$ |
| Atlantic Herring | 94,223 | 85,456 | $-8,766$ | $-10.3 \%$ |
| Atlantic Salmon | - | - | N/A | N/A |
| Deep-Sea Red crab | 1,733 | 2,041 | 307 | $15.1 \%$ |
| Mackerel/Squid/Butterfish | 97,400 | 97,083 | -317 | $-0.3 \%$ |
| Monkfish | 14,643 | 21,185 | 6,543 | $30.9 \%$ |
| Large-mesh multispecies | 35,101 | 41,414 | 6,313 | $15.2 \%$ |
| Small-mesh multispecies | 8,883 | 9,277 | 394 | $4.2 \%$ |
| Sea Scallop | 242,550 | 243,736 | 1,187 | $0.5 \%$ |
| Skate complex (7 species) | 13,054 | 16,073 | 3,020 | $18.8 \%$ |
| Spiny Dogfish | 600 | 983 | 382 | $38.9 \%$ |
| Summer Flounder/Scup/Black Sea Bass | 11,732 | 13,887 | 2,155 | $15.5 \%$ |
| Tilefish | 1,229 | 1,216 | -13 | $-1.0 \%$ |
| Total | 523,505 | 535,774 | 12,269 | $2.29 \%$ |
| Total minus Atlantic Herring | 429,282 | 450,318 | 21,036 | $4.67 \%$ |

Table 37. The differences, in $\mathbf{l b}$, in reported landings for 2004 between the FVTR and dealer databases (surfclam and ocean quahogs are not included in this table due to a different dealer reporting system for these species).

The apparent large percentage difference in the two databases for monkfish landings may be a result of misreporting monkfish product in the FVTR. If the incorrect product grade is reported (i.e., whole monkfish ("monk) are reported instead of monkfish tails ("monkt")), then an underestimation of monkfish landings in the FVTR may result because the reported weight of monkfish tails would not be appropriately scaled up to the live weight equivalent. Large percentage differences for bluefish and spiny dogfish may be due to an inability to partition out the mandatory reporting landings (reflective of the FVTR data) from the state landings data, but this issue is unique to 2004 when mandatory electronic reporting for dealers was first implemented. Additionally, total landings of bluefish and spiny dogfish represent a small fraction of the total landings of all species and, overall, these differences are considered negligible. Ideally, it would be preferable to use total kept species weight and days absent from dealer data to expand bycatch rates and in the variance calculations of total discards; however, the FVTR data are currently the only source for information on gear type and mesh size-two key aspects of fishing operations used in stratifying trips and discard data. Thus, although they are considered to represent the complete landings, the dealer data do not present a complete picture of fishing activities.

Measures of fishing effort may be in terms of numbers of fishing trips, numbers of days absent, or numbers of days fished. Days fished is the finest level of effort, representing the time the gear is actually deployed in the water (e.g., trawl duration, soak time for fixed gears, etc.), while days absent represents a coarser level of effort, generally measuring the time a vessel is away from port. The lowest resolution of effort is the trip, which may encompass varying levels of days fished, days absent, and fishing power. The above comparisons of dealer and FVTR-based landings estimates suggest that some of the expansion factors for estimating total discards, and the weighting factors for $\mathrm{d} / \mathrm{k}$ ratios will be underestimated slightly.

### 5.3.2.2 NEFOP Data

The NEFOP is a multi-purpose program that collects a broad range of data on all species that are encountered during a fishing trip, as well as data on gear characteristics, economic information, and biological samples. The NEFOP employs trained, sea-going observers to collect these data that also includes the weight, by species, and the disposition (retained and discarded), of the entire catch. Standard sampling protocols have been established and are utilized throughout the various fisheries. ${ }^{29}$ For most gear types, observers use a complete sampling protocol that includes obtaining species weights for both kept and discarded portions of all species in the catch on every haul. In addition to the complete sampling protocol, there is a limited sampling protocol that is used on a portion of gillnet trips where specific information for marine mammals is collected. In a ‘limited’ sampling scenario, only kept species weights are obtained (no discard weights) because the observer must watch the gillnet gear during haul-back to observe if marine mammals roll out of the gear before the gear returns to the deck. Because there are two sampling protocols used for data collection, two datasets were formed using the 2004 NEFOP data: One dataset for fish observed on trips for which the complete sampling protocol was used; and another for turtles, marine mammals, and birds observed on trips for which either the complete or limited sampling protocols were utilized.

For the fish dataset, only observed hauls in which all discarded species were recorded are used. In the majority of trips, all hauls are observed. However, for some gear types, particularly the scallop dredge-where fishing activity occurs continuously and a single observer cannot observe all hauls-it was necessary to expand discard species weights by the ratio of the number of total hauls to the number of observed hauls to account for all hauls in the trip. The expanded discard weight was used in the subsequent discard-to-days-absent analysis (but not in the discard-to-kept analysis) because days absent is a trip level variable representing the entire trip, not just the observed portion of the trip. Fishing trips utilized for training observers were excluded from the fish dataset but were utilized for the protected species set because it was assumed that training trips were capturing protected species information even though all discarded fish information might not be collected. For the protected species dataset, all

[^20]on-watch hauls are included in the dataset, regardless if discarded fish species were recorded. Because all hauls are used in this dataset, it was not necessary to adjust the discard weight to account for non-observed hauls.

Fishing trips observed under one of the regulatory quota-monitoring programs were included, by gear type, in the protected species dataset but were partitioned into separate strata for the fish dataset because the total allowable catch limits associated with these access area programs may result in different fishing patterns than non-quota-based trips. There were limitations associated with developing estimates of total discards for these strata because these trips are not identified in the FVTR data. Species hail weight can be reported in round or dressed weights; ${ }^{30}$ if kept hail weights are reported as dressed, then the hail weight is converted to round weight using CFDBS conversion factors for the species. All discard hail weights are assumed to be round weight. Turtles, marine mammals, and sea birds are recorded as numbers of individuals, rather than by weight. The NEFOP trip data are collapsed into strata as defined above. For each fleet, the number of observed trips, number of observed hauls, average trip length (days), kept weight of all species in the trip, the discard weight of each species, and the discard weight of all species (combined) are calculated.

A summary of the number of 2004 observed trips and sea days and 2004 commercial FVTR trips and sea days by fleet and calendar quarter is presented in Table 40 and Table 41. There was a broad range of at-sea observer coverage by fishing gear type in 2004; 11 of the 14 gear types had observer coverage. The lobster pot, crab pot, and clam dredge gear types were not covered in 2004. Regionally sparse coverage occurred for longline, shrimp trawl, fish pots, and handline. Some gear types, such as Scottish seines and purse seines, have very low industry activity and/or strong seasonal activity patterns. For the fleets examined in the analyses, there were a total of 126,498 fishing trips in the FVTR database and, of these, a total of 3,587 trips were observed, resulting in approximately a 3 percent overall coverage rate. Finer scale coverage rates vary among fleet and quarter. The highest observer coverage rate ( 45 percent) occurred in the Mid-Atlantic closed-area scallop dredge fleet. It should be noted that percent coverage is only one measure for monitoring adequacy, and that precision of discard rates, along with overall discard magnitude relative to population size, are the preferred measures for monitoring the adequacy of observer coverage levels.

### 5.3.2.3 Recreational Fishing Data

### 5.3.2.3.1 The NRC Report

As noted in section 4.7.1, a committee of the NRC began a review of NMFS's recreational fishing data collection programs in 2004 and submitted a report of findings and recommendations in April 2006. Two parts of the NRC report are particularly relevant to the issues of bias in data collection and estimations of bycatch and discards in recreational fishing. This section introduces the findings and issues identified by the

[^21]NRC as related to sampling and statistical estimation. For more detail on these issues, please refer directly to the report. ${ }^{31}$

The NRC report notes that a goal of the MRFSS was to minimize the bias and to maximize the precision of the estimators used to analyze recreational fishing activity. The difficulty is that data are not (cannot be) collected from all recreational anglers, and representative samples must be selected that allow for unbiased estimation of the catch. Unfortunately, due to the dispersed nature of recreational fishing (spatially, temporally, and in terms of angler practices)—and in light of limited resources-it is exceptionally difficult to design a survey that will adequately sample or represent all possible fishery modes at all times. Some of the modes and the challenges of sampling them are described below:

- Shore-based fishing: The full extent of publicly accessible shoreline from which fishing occurs is impossible to monitor completely. Some anglers fish from private-property and are inaccessible to interviewers.
- Boat ramps and docks: In many areas, public boat ramps are too numerous to be monitored adequately. Again, access to docks and ramps on private property is restricted and unobserved.
- Night fishing: Generally, samplers/interviewers do not work at night. Night fishing is common in some areas and is likely not to be sampled.

For each of these modes, if the catch per unit effort of the inaccessible fishing activity is not the same as it is at accessible sites, then bias is introduced to the data.

Another source of bias may be the MRFSS' use of the MSR for intercept assignments. The MSR cataloged the fishing access sites along the coast, weighted relative to expected angler activity at the sites. NRC found that the updating of the MSR and the methods for weighting the sites were not performed consistently across regions. Also, the practice of weighting the MSR sites, while likely to improve the chances of successful angler intercepts, did not account for potential site-to-site variation of CPUE, and, thus, may have introduced bias to the estimators. To address these problems, the NRC recommended that the access intercept program be redesigned. It should not depend on the assumption of an unvarying CPUE. It should provide for sampling at small and private access sites, for night fishing, and other poorly sampled modes. The NRC found that the methods of the CHTS may have introduced sampling errors. In 1979, no accommodation was necessary to account for the use of cellular phones. Today, residents in coastal counties may use cell phones with non-coastal area codes and vice versa. Removing cellular phone numbers from the sampling frame is not an acceptable solution, because many people are using cellular phones exclusively and they would be excluded from the survey.

In surveys such as the MRFSS, a basic rule of thumb is that precision can be improved by increasing the sample size. The CHTS had very low success rate at identifying households the residents of which participated in marine recreational fishing
${ }^{31}$ Unless otherwise noted, all of the information in this subsection is drawn from NRC 2006.
in the previous 2 months. Increased call efficiency would improve the sample size and could be realized if random digit dialing were replaced by directory-based dialing. The latter would require a universal registry of all marine anglers, but, at the time of the report, there was no requirement for anglers to register to fish in the EEZ. In the Greater Atlantic Region, only Virginia had a comprehensive registration requirement for anglers.

The main NRC recommendation that would address the shortcomings of the CHTS is that all saltwater anglers should be required to register, either through a Federal or state program. There should be no exceptions for age, gear, or locality. A requirement to have all anglers registered would reduce the telephone survey sampling frame from all coastal county residents to only marine recreational fishing registrants. Sampling from the set of more likely participants would greatly improve survey efficiency, and, with the same resources, many additional samples could be drawn and the precision of the survey would be improved. Registration would also address the CHTS problems associated with the widespread use of cell phones.

The fate of fish caught and released by recreational anglers was recorded by MRFSS; however, the survival rate of the discarded fish was not known. The NRC found that "the survey fails to provide a valid and reliable method of adequately accounting for fish caught and not brought to the dock." These unaccounted fish would include fish released alive or dead, used as bait, or given away before reaching the dock. The NRC noted that the lack of such a method may have introduced error to estimates of catch and discards. Also, incorrect fish species identification of catch and discards was another source of potential error cited by the NRC.

The statistical estimation methods used for analyzing recreational catch were also evaluated by the NRC. The NRC found that many program assumptions related to sampling design, only a few of which are noted above, were untested and the direction and amount of bias were undetermined. Therefore, the cumulative effect of bias on the final estimates could not be assessed. The NRC also found that the survey did not take advantage of the latest methods and current knowledge of finite population sampling theory. The NRC report states, "The current estimates are particularly deficient when applied to small areas because they do not use information in adjoining areas or time periods, nor do they consider relationships between species that occur together." The NRC determined that the resulting data were likely of lower precision than would have been possible if this information were used. To address these matters, the NRC recommended that NMFS convene a group of statisticians to examine program assumptions and evaluate inherent biases. Also, the NRC recommended that the group design new analyses based on recent developments in sampling theory.

The full NRC committee report on the MRFSS is available for download from the National Academies Press web site. ${ }^{32}$ NMFS's efforts to overhaul the recreational data
${ }^{32} \mathrm{http}: / /$ books.nap.edu/catalog.php?record_id=11616
collection programs are described in documents posted in Office of Science and Technology's website. ${ }^{33}$

### 5.3.2.3.2 Recreational Fishing Data Improvement and the Magnuson-Stevens Reauthorization Act

Upon receipt of the NRC's findings, NMFS initiated a national effort to respond quickly to the report's many recommendations and improve the agency's recreational fishing data collection programs. A senior-level steering committee guided the execution of a plan that included 60 programmatic changes needed to overhaul the MRFSS, FHS, and other recreational fishing data collection programs. Chief among the many improvements is an effort to collect angler registration information from all of the states.

In December 2006, Congress passed the Magnuson-Stevens Reauthorization Act, which, among many other things, included provisions requiring the Secretary of Commerce to "establish and implement a regionally based registry program for recreational fishermen in each of the eight fishery management regions" (§ 201). As noted above, the establishment of an angler directory will greatly enhance the effectiveness of the CHTS by improving call efficiency and markedly increasing the number of successful interviews. Thus, effort estimations are likely to be supported by substantially more interviews/samples than in the past.

In addition to calling on NMFS to require angler registration, the MagnusonStevens Reauthorization Act mandates an overall improvement to the MRFSS, taking into consideration the recommendations of the NRC. By January 12, 2009, NMFS, after consultation with representatives of the recreational fishing industry, expert statisticians, and others, was required to "establish a program to improve the quality and accuracy of information generated" by the MRFSS. The Magnuson-Stevens Reauthorization Act provision specifies the methodologies the program shall employ, including an "adequate number" of angler intercepts, use of angler directories as a basis for surveys, collection of FVTRs from for-hire vessels, development and application of a weather corrective factor for catch and effort estimates, and establishment of an expert review/advisory committee to scrutinize the data and methods by which it was collected.

Development of the MRIP as a replacement to the MRFSS began in 2006. MRIP is designed to evolve as a system of regional data collection programs adhering to national standards and protocols. Improvements such as new survey sampling designs are developed, piloted tested, and approved before undergoing a phased implementation to continually improve the program. In recent years significant improvements have been made to the collection, reporting, and management of recreational fishing catch and effort data. Additional improvements are being developed and will likely be implemented over the next few years.

The MRIP is an important source of data on discards by recreational anglers. Consistent with the ongoing agency-wide effort to improve recreational fishing data
${ }^{33} \mathrm{http}: / / \mathrm{www}$. st.nmfs.noaa.gov/recreational-fisheries/index
collection programs, the alternatives considered under this SBRM Omnibus Amendment would effect no direct changes to existing recreational fishing survey programs. Instead, the proposed alternatives would fully incorporate the improved recreational survey programs that continue to result from the nationwide upgrade effort.

### 5.3.3 Additional Considerations

### 5.3.3.1 Unlikely Cells

In the matrix of fishing modes by species/species group, there are some combinations of species and gear modes that are considered infeasible or highly unlikely to occur (e.g., scallops in longline gear, surfclam in gillnet gear, etc.). With the assistance of the Councils' Plan Development Teams, Monitoring Committees, and Fishery Management Action Teams, some of these combinations have been identified as "unlikely" based on review of the previous 16 years of observer data, general knowledge of gear, fish distribution, and abundance patterns. Unlikely combinations of species and fishing modes are indicated in the matrix as gray-shaded cells (see Table 42). For some protected species, there was insufficient information with which to determine whether or not a combination was unlikely, so most combinations were assumed to be possible (see Table 43). When evaluating needed coverage levels, the unlikely cells would be removed from consideration to provide a more meaningful estimate. It is important to note that as fishing patterns, species abundance, and/or distributions change, these gray-shaded cells may be adjusted to reflect these changes.

The occurrence of trips with zero discards is summarized in Table 42 and Table 43 for fish and protected species, respectively. Generally, the unlikely gray-shaded cells correspond to trips where 100 percent of the trips had zero discards for the species. In August 2006, members of the two Councils’ Science and Statistical Committees (SSCs) met to review the analytical work being done in support of this amendment. One aspect in particular that the SSC members addressed was the use of the unlikely cell process to help refine the cumulative observer coverage levels needed. The SSC members suggested that the process used to identify unlikely cells should serve as a first step in a more comprehensive "importance filter" process. The importance filter developed at the suggestion of the SSC members, and further refinements based upon operational use during 2009 through 2012 are described in chapter 6.

### 5.3.3.2 Missing Cells: Imputation and Pilot Coverage

The absence of at-sea observer coverage for some gear types/fishing modes during one or more quarters causes problems in two ways. First, if those quarters are ignored, the basis for comparing the average bycatch ratio will vary by fishery, species, and species group. In this situation, the inferences about the overall efficacy of an observer program are restricted to the set of quarters with observer data. Second, if the quarters are included, it is necessary to make some assumption about the mean and variance of the discard rate for these cells. This process is known as imputation, and it relies on information from the known part of the survey to attribute information to the unknown cells (quarters). Imputation of missing cells is routinely used in survey
estimation, but it can be controversial because of the expert judgment required. Use of imputed values to compute an overall estimate of the CV of a bycatch rate will lead to a conditional estimate. "Conditional" in this context implies that the estimate depends on the set of rules/decisions used for imputation.

As part of the feedback process for improving the sampling design, it is necessary to use imputed values as a basis for allocating future at-sea observer coverage. Prior to the 2007 SBRM Amendment, imputation procedures were developed for Northeast multispecies (Rago et al. 2005) using a multi-tier imputation procedure for three gear types. Due to the diverse species and large geographic range of the comprehensive SBRM, a detailed imputation procedure is needed to account for the seasonal variability of all managed species over the full geographic range of the FMPs. Implementation of this amendment would continue to expand the imputation described in Rago et al. (2005) to provide appropriate means and variances by stratum for various species and species complexes and gear types.

Until the work to fully expand the formal imputation process is complete, a simple imputation approach was used in which data from adjoining strata were used. In this simple imputation, only the temporal stratification-calendar quarter-was relaxed (to half year or year) recognizing that seasonal variation can occur for some species (Table 40 and Table 41). In the case of shrimp trawl, given that the northern shrimp fishery is a seasonal fishery comprising only half the year, the quarterly data were applied annually. Data from adjoining cells were pooled to impute estimates for cells with zero or one trip. However, simple imputation could not be applied to fleets where observer coverage was low or missing throughout the year (i.e., there were too few data to support the simple imputation approach). In these cases, imputed values were not used, and the fleet was designated as a fleet in need of pilot observer coverage. If some data were available, then some estimates were derived; however, the sea days needed to achieve a 30 percent CV were estimated based on pilot coverage levels.

Pilot observer coverage is defined as a minimum level of at-sea observer coverage to acquire initial bycatch information with which to calculate variance estimates that in turn can be used to further define the level of sampling needed. Based on NMFS (2004), pilot coverage can range between 0.5 and 2 percent. In this analysis, pilot observer coverage was set based on the number of fishing trips needed to cover at least 2 percent of the annual FVTR trips for a fishing mode, with a minimum of 12 trips per year (3 trips per quarter) and a maximum of 400 trips per year ( 100 trips per quarter). The fishing modes that needed pilot coverage in 2004 are indicated in Table 40 and Table 41.

Based on 2004 observer coverage, four scenarios were developed to determine when to use imputation or pilot coverage: (1) If observer coverage exists in all 4 quarters with sufficient sample sizes to generate quarterly CVs, then no imputation or pilot coverage was used; (2) if observer coverage exists in 3 quarters with sufficient sample sizes to generate a CV, then the missing quarter was imputed using half-year estimates; (3) if observer coverage exists in 1 or 2 quarters with sufficient sample sizes to generate a CV and the other 2 or 3 quarters had zero or 1 trips, then there were insufficient data to
apply simple imputation and pilot coverage was used instead for those quarters; or (4) if no observer coverage exists in all 4 quarters; then pilot coverage was used.

The need for pilot coverage originates from two different scenarios: (1) when there is insufficient observer data upon which to derive the sea days needed to achieve the precision standard; (2) when there is sufficient observer data but the sea days for all species groups are filtered out via the importance filter within a given fleet (Table 38). As described above, when there is insufficient observer data, pilot observer coverage was set based on the number of fishing trips needed to cover at least 2 percent of the annual FVTR trips for a fishing mode, with a minimum of 12 trips per year ( 3 trips per quarter) and a maximum of 400 trips per year ( 100 trips per quarter). However, when there is sufficient observer data yet all sea days are filtered out for a given fleet, a minimum pilot coverage of three trips per quarter would be used to maintain a minimal level of monitoring that would support a variance-based estimate of the sea days needed. The minimum pilot coverage of three trips per quarter is multiplied by the mean trip length within a quarter and summed over quarter to obtain the number of sea days for the given fleet.

If the minimum pilot coverage was applied to the 2012 sea days needed to monitor fish (see Table 5 in Wigley et al. 2012a), than a total of 18,641 sea days would be required rather than 18,822 sea days (Table 60) - a 181 day difference. Some fleets had no change in the number of sea days because the pilot coverage was already at the minimum; however, other fleets were reduced from the 2 percent pilot coverage to the minimum pilot coverage. Applying the minimum pilot coverage for fleets with sufficient observer coverage utilized the data (i.e., bycatch is known to be low for the fleet and hence the sea days are filtered out) yet maintaining some coverage to monitor the fleet in the upcoming year.

This represents an extension of the importance filter process and a refinement to the use of pilot coverage. The sea days derived from the minimum pilot coverage serve as a 'floor' in the prioritization alternatives to prevent the allocation of too few sea days to derive a variance-based estimate of the sea days needed for a given fleet. Use of minimum pilot coverage may result in the expansion of observer coverage to fleets that have not had coverage in recent years. It is expected that some transition period may be necessary for NEFOP to update sampling and deployment protocols and conduct any necessary training to effectively cover these fleets.

| Row | Gear Type | Access Area | Trip Category | Region | Mesh | BLUE | HERR | SAL | RCRAB | SCAL | SBM | MONK | GFL | GFS | SKATE | DOG | FSB | SCOQ | TILE | $\begin{aligned} & \text { pilot } \\ & \text { deys } \end{aligned}$ | 2012 Sea Days Needed FISH | Pilot | 2012 Sea Days Needed FISH |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | P | 67 |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 24 | MPC | 16 |
| 3 | Hand Line | OPEN | all | MA | all | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | P | 81 |
| 4 | Hand Line | OPEN | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 | 62 | MPC | 16 |
| 5 | Otter Trawl | OPEN | all | MA | sm | 0 | 0 | 0 | 3,231 | 0 | 364 | 0 | 497 | 545 | 397 | 325 | 513 | 0 | 0 | 160 | 3,231 |  | 3,231 |
| 6 | Otter Trawl | OPEN | all | MA | 1 l | 0 | 0 | , | 5,551 | 0 | 0 | 164 | 141 | 0 | 107 | 333 | 173 | 0 | 0 | 266 | 5,551 |  | 5,551 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 0 | 0 | 0 | 0 | 0 | 411 | 0 | 461 | 451 | 531 | 1,151 | 489 | 0 | 0 | 168 | 1,151 |  | 1,151 |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 0 | 0 | 0 | 3,879 | 0 | 0 | 568 | 76 | 280 | 261 | 229 | 788 | 0 | 0 | 415 | 3,879 |  | 3,879 |
| 9 | Scallop Trawl | AA | GEN | MA | all | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | P | 21 |
| 10 | Scallop Trawl | AA | LIM | MA | all | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | P | 98 |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | , | , | 25 | 32 |  | 32 |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | P | 163 |
| $13+$ | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 9 | , | 9 | 9 | 9 | , | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | P | 9 |
| $14+$ | Otter Trawl, Ruhle | OPEN | all | NE | sm | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | P | 27 |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 l | 0 | 0 | 0 | 0 | 0 | , | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 59 | 59 | MPC | 59 |
| $16+$ | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 l | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 8 | MPC | 8 |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 l | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 257 | 567 | 0 | 0 | 0 | 100 | 567 |  | 567 |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | P | 131 |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 0 | 0 | , | 0 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 65 | 34 |  | 34 |
| 20 | Floating Trap | OPEN | all | MA | all | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | P | 6 |
| 21 | Floating Trap | OPEN | all | NE | all | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | , | 6 | 6 | 6 | 6 | 6 | 6 | P | 6 |
| 22 | Sink, Anchor, Dritt Gillnet | OPEN | all | MA | sm | 0 | 0 | , | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 40 | MPC | 13 |
| 23 | Sink, Anchor, Dritt Gillnet | OPEN | all | MA | 1 g | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 43 | MPC | 13 |
| 24 | Sink, Anchor, Dritt Gillnet | OPEN | all | MA | xlg | 0 | 0 | 0 | 0 | 0 | , | 70 | 0 | 0 | 83 | 0 | 0 | 0 | 0 | 61 | 83 |  | 83 |
| 25 | Sink, Anchor, Dritt Gillnet | OPEN | all | NE | sm | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | P | 41 |
| 26 | Sink, Anchor, Dritt Gillnet | OPEN | all | NE | 1 g | 0 | 0 | 0 | 0 | 0 | 0 | 0 | , | 0 | 0 | 97 | 0 | 0 | 0 | 134 | 97 |  | 97 |
| 27 | Sink, Anchor, Dritt Gillnet | OPEN | all | NE | x 19 | 0 | 0 | 0 | 0 | 0 | 0 | 132 | , | 0 | 118 | 171 | 0 | 0 | 0 | 94 | 171 |  | 171 |
| 28 | Purse Seine | OPEN | all | MA | all | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | P | 15 |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 23 | MPC | 23 |
| 30 | Scallop Dredge | AA | GEN | MA | all | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | P | 31 |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | , | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 14 | MPC | 14 |
| 32 | Scallop Dredge | AA | LIM | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 282 | , | , | 0 | 0 | 0 | 0 | 0 | 102 | 282 |  | 282 |
| 33 | Scallop Dredge | AA | LIM | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 189 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 121 | 189 |  | 189 |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 95 | 50 |  | 50 |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | , | 0 | 0 | 0 | 87 | 87 | MPC | 17 |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 312 | , | 0 | 164 | 0 | 0 | 0 | 0 | 238 | 312 |  | 312 |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | - | 0 | , | 0 | 500 | 0 | 234 | 107 | 0 | 163 | 505 | 607 | 0 | 0 | 277 | 607 |  | 607 |
| 38 | Mid-water Paired \& Single Trawl | OPEN | all | MA | all | 0 | 0 | 0 | , | , | 0 | 0 | 0 | - | 0 | 0 |  | 0 | 0 | 17 | 17 | MPC | 17 |
| 39 | Mid-water Paired \& Single Trawl | OPEN | all | NE | all | , | 0 | 0 | 0 | 0 | 0 | , | 0 | 0 | 0 | 571 | 0 | 0 | 0 | 43 | 571 |  | 571 |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | P | 25 |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | P | 15 |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | P | 27 |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | P | 26 |
| 44 | Pots and Traps, Hagish | OPEN | all | MA | all | 3 | 3 | 3 | 3 | 3 | 3 | , | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | P | 3 |
| 45 | Pots and Traps, Hagifi | OPEN | all | NE | all | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | P | 74 |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | P | 6 |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | P | 65 |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | P | 429 |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | P | 12 |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | P | 67 |
| 51 | Beam Trawl | OPEN | all | MA | all | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | P | 31 |
| 52 | Beam Trawl | OPEN | all | NE | all | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | P | 16 |
| 53 | Dredge, Other | OPEN | all | MA | all | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | P | 41 |
| 54 | Ocean Quahog/Surf Clam | OPEN | all | MA | all | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | P | 67 |
| 55 | Ocean Quahog/Surf Clam | OPEN | all | NE | all | 38 | 38 | 38 | 38 | 38 |  | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | P | 38 |
|  |  |  |  |  | Totals | 1,638 | 1,638 | 1,638 | 14,299 | 2,138 | 2,413 | 3,589 | 2,920 | 2,948 | 3,801 | 5,587 | 4,208 | 1,638 | 1,638 | 4,379 | 18,822 |  | 18,641 |

Table 38. The number of sea days needed to achieve a $30 \% \mathrm{CV}$ of the discard estimate for each the $\mathbf{1 4}$ fish and invertebrate species groups, the number of pilot sea days, and the maximum number of sea days needed for each fleet ( 2012 Sea Days Needed) for fish and invertebrate species groups based on July 2010 through June 2011 data (red font indicates basis for fleet sea days; species group abbreviation are given in Wigley et al. 2012a). Fleets in need of pilot coverage are indicated with a ' $P$ '; fleets in need of minimum pilot coverage are indicated with 'MPC' and blue font

### 5.4 Bycatch Rates and Total Discards

### 5.4.1 Estimation of Bycatch Rates

There are many different established methods for estimating bycatch rates in fisheries based on at-sea observer data. Design-based estimators are often used for finfish bycatch (e.g., Pikitch et al. 1998; Stratoudakis et al. 1999; Rochet et al. 2002), while model-based estimators are more commonly used for predicting less frequent bycatch events (e.g., Walsh et al. 2002; Perkins and Edwards 1996). Ratio estimators represent a simple form of model-based estimation within a sampling design. Studies that have compared the use of ratio estimators with other simple and proportional probability estimators have reported mixed results. Diamond (2003) found that ratio estimators overestimated discards compared to simple means-based estimators. However, Allen et al. (2001) found that ratio estimators performed better but that the appropriate covariate varied among species. Discard estimation is a very active area of fisheries and statistical research and the techniques and approaches used are undergoing continual development and refinement (e.g., Miller and Skalski 2006; Kaiser 2006). The sampling design proposed in this document is considered sufficiently robust to meet the needs of the Councils and NMFS.

For the purpose of the SBRM, a number of design-based approaches were examined that have been advocated in the literature and the assumptions of each were tested. Bycatch rates are expressed as: (1) The ratio of total weight of one or more species discarded to total weight of one or more species kept (d/k); (2) the ratio of total weight of one or more species discarded to days absent (d/da); and (3) discards per trip The basic difference between methods (2) and (3) is that "days absent" is assumed to contain more information about fishing effort than the sampling unit "trip." For the ratio estimators (1) and (2), we examined the effects of pooling ratios over strata, using the "separate" and "combined" approaches given in Cochran (1963). Details of the separate and combined estimators follow a brief introduction to ratio estimators. Overall, we examined two different ratio estimators (discard/kept ( $\mathrm{d} / \mathrm{k}$ ) vs. discard/days absent ( $\mathrm{d} / \mathrm{da}$ )) for two different pooling strategies (separate vs. combined). In addition, the discard per trip estimator (3) was applied individually to the datasets for $\mathrm{d} / \mathrm{k}$ and $\mathrm{d} / \mathrm{da}$. The only differences between the two datasets were slight variations in the number of cases available in each stratum. Thus a total of six different estimators were applied to the set of 45 fleets and 60 species/species groups.

### 5.4.1.1 Ratio Estimators

Bycatch rates for each fleet, quarter, and species/species groups (stratum) were estimated using two ratios: Discard to all species kept ( $\mathrm{d} / \mathrm{k}$ ) and discard to days absent (d/da) (equations 1a and 1b, respectively).
(1a) $\hat{R}_{j h}=\frac{\sum_{i=1}^{n_{h}} d_{i j h}}{\sum_{i=1}^{n_{h}} k_{i h}}$
and
(1b) $\hat{R}_{j h}=\frac{\sum_{i=1}^{n_{h}} d_{i j h}}{\sum_{i=1}^{n_{h}} d a_{i h}}$
where $R_{j h}$ is the bycatch rate of species group $j$ in stratum $h ; d_{i j h}$ is the discards (for fish, weight in pounds; for protected species, in numbers of animals) for species group j within trip i in stratum h ; $\mathrm{k}_{\mathrm{ih}}$ is the kept weight, in pounds, of all species within trip i in stratum h ; and $\mathrm{da}_{\mathrm{ih}}$ is the days absent of trip i in stratum h .

The approximate variance of the estimate of $\mathrm{R}_{\mathrm{jh}}$ is obtained from a first order Taylor series expansion about the mean. The computational formula for these quantities can be expressed as:
(2a) $V\left(\hat{R}_{j h}\right)=\frac{1}{n_{h} \bar{k}_{h}^{2}}\left[\frac{\left(\sum_{i=1}^{n_{h}} d_{i j h}^{2}\right)+\hat{R}_{j h}^{2}\left(\sum_{i=1}^{n_{h}} k_{i h}^{2}\right)-2 \hat{R}_{j h}\left(\sum_{i=1}^{n_{h}} d_{i j h} k_{i h}\right)}{\left(n_{h}-1\right)}\right]\left[\frac{N_{h}-n_{h}}{N_{h}}\right]$
and
(2b)

$$
V\left(\hat{R}_{j h}\right)=\frac{1}{n_{h} \overline{d a}_{h}^{2}}\left[\frac{\left(\sum_{i=1}^{n_{h}} d_{i j h}^{2}\right)+\hat{R}_{j h}^{2}\left(\sum_{i=1}^{n_{h}} d a_{i h}^{2}\right)-2 \hat{R}_{j h}\left(\sum_{i=1}^{n_{h}} d_{i j h} d a_{i h}\right)}{\left(n_{h}-1\right)}\right]\left[\frac{N_{h}-n_{h}}{N_{h}}\right]
$$

where $d_{i j h}$ is the total discard weight of species group $j$ in trip $i$ within stratum $h$; $\mathrm{k}_{\mathrm{ih}}$ is the total kept weight of all species in trip i within stratum h ; da $\mathrm{i}_{\mathrm{ih}}$ is the days absent of trip I in stratum $h ; n_{h}$ is the number of observed trips in stratum $h ; N_{h}$ is the number of FVTR trips in stratum h ; $\mathrm{k}_{\mathrm{h}}{ }^{\text {ber }}$ is the mean kept landings of all species within the stratum, and dah ${ }^{\text {bar }}$ is the mean days absent within stratum $h$.

The coefficient of variation for the bycatch ratio for species group $j$ in stratum $h$ is defined as:
(3) $C V\left(\hat{R}_{j h}\right)=\frac{\sqrt{V\left(\hat{R}_{j h}\right)}}{\hat{R}_{j h}}$

It should be noted that when only one stratum is considered, the CV of the total discards for species group j in stratum h is the same as the CV of the bycatch ration.

The number of trips necessary to achieve a 30 percent CV for species group j in stratum $h$ is defined as:

$$
\begin{equation*}
\hat{T}_{j h}=\frac{N_{h}\left(\frac{n_{h} N_{h}}{N_{h}-n_{h}}\right) V\left(\hat{R}_{j h}\right)}{(0.09) \hat{R}^{2} N_{h}+\left(\frac{n_{h} N_{h}}{N_{h}-n_{h}}\right) V\left(\hat{R}_{j h}\right)} \tag{4}
\end{equation*}
$$

where $n_{h}$ is the number of observed trips in stratum $h ; N_{h}$ is the number of FVTR trips in stratum h; $R_{j h}{ }^{\text {hat }}$ is the discard ratio of species group $j$ in stratum h; and $V\left(R_{j h}{ }^{\text {hat }}\right)$ is the variance of the discard ratio of species group $j$ in stratum $h$.

The number of sea days necessary to achieve a 30 percent CV for species group j in stratum $h$ is defined as:
(5) $\hat{S}_{30 j h}=\hat{T}_{j h} * \overline{D A_{h}}$
where $\mathrm{DA}_{\mathrm{h}}{ }^{\text {bar }}$ is the average trip length of FVTR trips in stratum h .
The calculation of sea days uses the average FVTR trip length and not average observer trip length. Use of the FVTR data, which represent the entire industry, guards against sampling variability induced by small sample sizes. Sampling variability may be bi-directional with observers sampling trips that may be longer or shorter trips, on average, than industry is making overall.

Due to minor difficulties with fleet identification, including limitations in identifying FVTR trips with regard to access area, some sample size irregularities occur where $N_{h}<n_{h}$. This occurred in three fishing modes: (1) The New England limited access closed area scallop dredge mode in the first three quarters; (2) the Mid-Atlantic limited access closed area scallop dredge mode in the first three quarters; and (3) the Mid-Atlantic mid-water paired and single trawl mode in the first and fourth quarters (Table 40). To prevent negative sampling fractions in equations 2, 4, and 16, when $\mathrm{N}_{\mathrm{h}}<$ $\mathrm{n}_{\mathrm{h}}, \mathrm{N}_{\mathrm{h}}$ was assigned the value of $\mathrm{n}_{\mathrm{h}}+1$.

### 5.4.1.2 Ratio Assumptions

Equations 2a and 2 b are the computational formulas for a more general expression of the variance of a ratio $(R=y / x)$ estimate that incorporates the covariance of the relationship between the numerator y and denominator $x$. The correlation ( $\rho$ ) between the numerator and denominator is simply the covariance divided by the product of the standard errors of the numerator and denominator. The ratio estimator of a total Y can be written as the $\mathrm{Y}=(\mathrm{y} / \mathrm{x}) \mathrm{X}$ where X is the total value of the covariate. The approximate variance of $Y$ based on a ratio estimator can be written as:

$$
\begin{equation*}
V\left(\hat{Y}_{R}\right)=\frac{N^{2}(1-f)}{n}\left(S_{y}^{2}+R^{2} S_{x}^{2}-2 R \rho S_{y} S_{x}\right) \tag{5.1}
\end{equation*}
$$

where $S_{y}$ and $S_{x}$ are the standard errors of $y$ and $x$. Note that increases in the correlation coefficient ( $\rho$ ) will decrease the variance of the total. Increases in $\rho$ imply a higher degree of association between the numerator and denominator and imply that the variance will decrease when the ratio model is appropriate. When $\rho$ approaches zero the benefits of ratio estimation decrease and the variance may actually increase because the squared ratio estimate (the second term within the parentheses on the right hand side of equation 5.1) could increase the variance of the total.

In general, the ratio estimate has a bias of order $1 / n$ (Cochran 1963). For moderate and large sample sizes, the bias is negligible. In this study, approximately three quarters of the strata have sample sizes of 30 or smaller. To evaluate the impact of bias in this study, the significance of correlation between sample size and $\rho$ (the correlation of the ratio estimate, rho) was examined.

The correlation of the ratio estimate is defined as:
(6) $L_{x y, j}=n_{h} \sum_{i=1}^{n_{h}} x_{i, j} y_{i, j}-\left(\sum_{i=1}^{n_{h}} x_{i, j}\right)\left(\sum_{i=1}^{n_{h}} y_{i, j}\right)$

$$
\begin{align*}
& L_{x x, j}=n_{h} \sum_{i=1}^{n_{h}} x_{i, j}^{2}-\left(\sum_{i=1}^{n_{h}} x_{i, j}\right)^{2}  \tag{7}\\
& L_{y y, j}=n_{h} \sum_{i=1}^{n_{h}} y_{i, j}^{2}-\left(\sum_{i=1}^{n_{h}} y_{i, j}\right)^{2} \\
& \rho_{j}{ }^{2}=\frac{L_{x y, j}^{2}}{L_{x x, j} L_{y y, j}}
\end{align*}
$$

where $\mathrm{x}_{\mathrm{ij}}$ is days absent or kept pounds for species j in trip i ; $\mathrm{y}_{\mathrm{ij}}$ is discarded pounds of species jon trip $i$; $n_{h}$ is number of observed trips in stratum $h$; and $\rho^{2}$ is squared correlation coefficient for species $j$.

The results of the correlation analyses are summarized in Table 44 and Table 45 for the ratio of discards by species group to total kept. Overall, the correlation coefficients were low but the exceptions are important and notable. Correlations exceeded 0.47 in the New England large-mesh trawl fishery for monkfish, and the largeand small-mesh multispecies fisheries. Associations for small-mesh otter trawls in New England were also strong for squid, mackerel, and butterfish and small-mesh multispecies. Correlations for skate discard rates were above 0.32 in the New England and Mid-Atlantic large-mesh trawl fisheries, above 0.48 in the New England and MidAtlantic extra-large-mesh gillnet fisheries, and above 0.2 in four of the six scallop dredge fisheries. A high correlation indicates a strong relationship between the two variables measured (in this case, the numerator and denominator of the discard ratio). The evidence indicates strong relationships for the three primary fisheries (large-mesh otter trawls, extra-large-mesh gillnets, and scallop dredges).

### 5.4.1.3 Linearity Assumptions

The ratio estimator assumes that a zero intercept regression is an appropriate model of the relationship between discard and kept (or days absent). The putative linear relationship between discarded and kept components of observed trips was examined by gear type and species group. For illustration purposes, two example plots of discard and kept are given using two different scales: Nominal scale and fourth root transformation. ${ }^{34}$ These two illustrative plots (Figure 42 and Figure 43) reveal that the fourth root transformation facilitates the depiction of information and does not obscure the underlying pattern of increasing variance and a zero intercept. Thus, using a fourth root transformation, examples of the comparison between discard and kept (or days absent) are illustrated by thirteen fish species groups in otter trawl and gillnet gears by mesh sizes (presented in Appendix B, Figures B-1a to B-1xx) and by five protected species groups for longline, otter trawl, gillnet and scallop dredge (Appendix B, Figures $\mathrm{B}-2 \mathrm{a}$ to $\mathrm{B}-2 \mathrm{j}$ ). Departures from linearity are often controlled by large numbers of trips with zero discards. When trips with zero discards are removed, improvement in linearity occurs. Examples of these are given for large-mesh groundfish discarded in the otter trawl and gillnet fleets (Appendix B, Figures B-3a to B-3d). Rho and sample size analyses (using power $=0.80$, alpha $=0.10$; alternative hypothesis $=$ 'not equal' and null value $=0$ ) indicated that a low percentage of fleets and species groups had linear relationships using a ratio estimator ( $\mathrm{d} / \mathrm{k}$ or $\mathrm{d} / \mathrm{da}$ ).

### 5.4.2 Estimation of Total Discards

Three methods were examined to estimate annual total discards, precision, and coverage necessary to achieve a 30 percent CV for fleets and species/species groups: (1) A separate ratio method; (2) a combined ratio method; and (3) a simple expansion method (mean discard per trip). Cochran (1963) discusses these three methods in greater detail. Each method utilized quarterly estimates of bycatch rates ( $\mathrm{d} / \mathrm{k}$ and $\mathrm{d} / \mathrm{da}$ ) and associated CV, and the number of sea days necessary to achieve a CV of 30 percent. In these analyses, stratum is defined as fleet and species group. Significant improvements in discard estimation may be possible through a variety of species-specific refinements. These might be accomplished via use of additional covariates, post stratification, or other model-based approaches.

In the notation that follows, we consider the definition of strata in general terms such that ' $h$ ' refers to a set of unique attributes. Recall that the observations are stratified by gear, access area, trip category, geographic region, mesh, and calendar quarter. These strata are nested, but not factorial. Totals can be computed over specific temporal, spatial, and 'type' strata by holding other strata values constant. In equations 10-15, we illustrate the mean and variances of the total discards, where the summation is over calendar quarter. Implicitly, the other strata values are held constant.

[^22]
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Figure 42. Comparison of nominal scale (top) and fourth root transformation (bottom) of Northeast multispecies (large-mesh) discards and kept weight of all species from 2004 observed large-mesh otter trawl trips in New England; each dot represents one fishing trip.

Figure 43. Comparison of nominal scale (top) and fourth root transformation (bottom) of squid, butterfish, and mackerel discards and kept weight of all species from 2004 observed small-mesh otter trawl trips in New England; each dot represents one fishing trip.

### 5.4.2.1 Separate Ratio Method (Method 1)

The total discarded pounds of species j using method 1 are defined as:

$$
\begin{equation*}
\hat{D}_{1, j}=\sum_{h=1}^{L} K_{h} r_{s, j h} \quad \text { and (10b) } \hat{D}_{1, j}=\sum_{h=1}^{L} D A_{h} r_{s, j h}^{\prime} \tag{10a}
\end{equation*}
$$

where
(11a) $r_{\mathrm{s}, j h}=\frac{\sum_{i=1}^{n_{h}} d_{j i h}}{\sum_{i=1}^{n_{n}} k_{i h}} \quad$ and (11b) $r_{\mathrm{s}, j h}^{\prime}=\frac{\sum_{i=1}^{n_{h}} d_{j i h}}{\sum_{i=1}^{n_{h}} d a_{i h}}$
where $D_{1, j}{ }^{\text {hat }}$ is the total discarded pounds for species $j ; K_{h}$ is the FVTR total kept pounds in stratum $\mathrm{h} ; \mathrm{DA}_{\mathrm{h}}$ is the FVTR total days absent in stratum $\mathrm{h} ; \mathrm{r}_{\mathrm{s}, \mathrm{h}}$ is the separate ratio for species $j$ in stratum $h ; d_{j i h}$ is discards of species $j$ from trip $i$ in stratum $h ; k_{i h}$ is kept pounds of all species on trip $i$ in stratum $h$; and $d_{i h}=$ days absent from trip $i$ in stratum h.

The variance of $D_{1, j}^{\text {hat }}$ is defined as:

$$
\begin{equation*}
V\left(\hat{D}_{1, j}\right)=\sum_{h=1}^{L} K_{h}^{2}\left(\frac{N_{h}-n_{h}}{n_{h} N_{h}}\right) \frac{1}{\left(\frac{\sum_{i=1}^{n_{h}} k_{i h}}{n_{h}}\right)^{2}}\left[\frac{\sum_{i=1}^{n_{h}}\left(d_{j i h}^{2}+\left(r_{s, j h}\right)^{2} k_{i h}^{2}-2 r_{s, j h} d_{j i h} k_{i h}\right)}{n_{h}-1}\right] \tag{12a}
\end{equation*}
$$

and

$$
\begin{equation*}
V\left(\hat{D}_{1, j}\right)=\sum_{h=1}^{L} D A_{h}^{2}\left(\frac{N_{h}-n_{h}}{n_{h} N_{h}}\right) \frac{1}{\left(\frac{\sum_{i=1}^{n_{h}} d a_{i h}}{n_{h}}\right)^{2}}\left[\frac{\sum_{i=1}^{n_{h}}\left(d_{j i h}^{2}+\left(r_{s, j h}^{\prime}\right)^{2} d a_{i h}^{2}-2 r_{s, j h}^{\prime} d_{j i h} d a_{i h}\right)}{n_{h}-1}\right] \tag{12b}
\end{equation*}
$$

where $D_{1, j}{ }^{\text {hat }}$ is the total discarded pounds for species $j ; K_{h}$ is the FVTR total kept pounds in stratum h; $\mathrm{DA}_{\mathrm{h}}$ is the FVTR total days absent in stratum $\mathrm{h} ; \mathrm{r}_{\mathrm{s}, \mathrm{h}}$ is the separate ratio for species $j$ in stratum $h ; d_{j i h}$ is discards of species $j$ from trip $i$ in stratum $h ; k_{i h}$ is kept pounds of all species on trip i in stratum h ; $\mathrm{da}_{\mathrm{ih}}=$ days absent from trip i in stratum $h ; N_{h}$ is the number of FVTR trips in stratum $h$; and $n_{h}$ is the number of observed trips in stratum h .

The coefficient of variation of $D_{1, j}{ }^{\text {hat }}$ is defined as:

$$
\begin{equation*}
C V\left(\hat{D}_{1, j}\right)=\frac{\sqrt{V\left(\hat{D}_{1, j}\right)}}{\hat{D}_{1, j}} \tag{13}
\end{equation*}
$$

### 5.4.2.2 Combined Ratio Method (Method 2)

The combined ratio method is based on a ratio estimate pooled over all strata and trips within strata. The total discarded pounds for species j are given by:

$$
\begin{equation*}
\hat{D}_{2, j}=\sum_{h=1}^{L} K_{h} r_{c, j} \quad \text { and } \quad(14 \mathrm{~b}) \quad \hat{D}_{2, j}=\sum_{h=1}^{L} D A_{h} r_{c, j}^{\prime} \tag{14a}
\end{equation*}
$$

where
(15a) $r_{c, j}=\frac{\sum_{h=1}^{L} N_{h} \sum_{i=1}^{n_{h}} \frac{d_{j i h}}{n_{h}}}{\sum_{h=1}^{L} N_{h} \sum_{i=1}^{n_{n}} \frac{k_{i h}}{n_{h}}} \quad$ and (15b) $\quad r_{c, j}^{\prime}=\frac{\sum_{h=1}^{L} N_{h} \sum_{i=1}^{n_{h}} \frac{d_{j i h}}{n_{h}}}{\sum_{h=1}^{L} N_{h} \sum_{i=1}^{n_{h}} \frac{d a_{i h}}{n_{h}}}$
where $D_{2, j}{ }^{\text {hat }}$ is total discarded pounds for species $j$; $K_{h}$ is FVTR total kept pounds in stratum h ; $\mathrm{DA}_{\mathrm{h}}$ is FVTR total days absent in stratum $\mathrm{h} ; \mathrm{r}_{\mathrm{c}, \mathrm{j}}$ is the combined ratio of species j ; $\mathrm{d}_{\mathrm{jih}}$ is discards of species j from trip i in stratum $\mathrm{h} ; \mathrm{k}_{\mathrm{ih}}$ is kept pounds of all species on trip $i$ in stratum $h ; \mathrm{da}_{\mathrm{ih}}$ is days absent from trip i in stratum $\mathrm{h} ; \mathrm{N}_{\mathrm{h}}$ is the number of FVTR trips in stratum $h$; and $n_{h}$ is the number of observed trips in stratum $h$. In equations 15 a and $15 b$, the summation over strata $h=1$ to $L$ is over calendar quarters and the other strata values are held constant. Equations 16a and 16b require a more explicit definition of the stratum designation because the summation over quarter relies on an annual average ratio defined in equation 15.

The variance of $D_{2, j}$,hat for species $j$ is defined as:
(16a) $V\left(\hat{D}_{2, j}\right)=\sum_{q=1}^{4} K_{q h}^{2}\left(\frac{N_{q h}-n_{q h}}{n_{q h} N_{q h}}\right) \frac{1}{\left(\frac{\sum_{i=1}^{n_{h}} k_{i q h}}{n_{q h}}\right)^{2}}\left[\frac{\sum_{i=1}^{n_{q h}}\left(d_{j i q h}^{2}+\left(r_{c, j}\right)^{2} k_{i q h}^{2}-2 r_{c, j} d_{j i q h} k_{i q h}\right)}{n_{q h}-1}\right]$
and
(16b) $V\left(D_{2, j}\right)=\sum_{q=1}^{4} D A_{q h}^{2}\left(\frac{N_{q h}-n_{q h}}{n_{q h} N_{q h}}\right) \frac{1}{\left(\frac{\sum_{i=1}^{n_{h}} d a_{i q h}}{n_{q h}}\right)^{2}}\left[\frac{\sum_{i=1}^{n_{q h}}\left(d_{j i q h}^{2}+\left(r_{c, j}^{\prime}\right)^{2} d a_{i q h}^{2}-2 r_{c, j}^{\prime} d_{j i q h} d a_{i q h}\right)}{n_{q h}-1}\right]$
where $D_{2, j}{ }^{\text {hat }}$ is total discarded pounds for species $j$; $K_{q h}$ is FVTR total kept pounds in quarter $q$ and stratum $h ; \mathrm{DA}_{\mathrm{qh}}$ is FVTR total days absent in quarter q and stratum $\mathrm{h} ; \mathrm{r}_{\mathrm{c}, \mathrm{j}}$ is the combined ratio of species j ; $\mathrm{d}_{\mathrm{jiqh}}$ is discards of species j from trip i in quarter q and stratum h ; $\mathrm{k}_{\text {iqh }}$ is kept pounds of all species on trip i in quarter q and stratum h ; $\mathrm{da}_{\mathrm{iqh}}$ is days absent from trip i in quarter q and stratum $\mathrm{h} ; \mathrm{N}_{\mathrm{qh}}$ is the number of FVTR trips in
quarter q and stratum h ; and $\mathrm{n}_{\mathrm{qh}}$ is the number of observed trips in quarter q and stratum h.

The coefficient of variation of $D_{2, j}^{\text {hat }}$ is defined as:

$$
\begin{equation*}
C V\left(\hat{D}_{2, j}\right)=\frac{\sqrt{V\left(\hat{D}_{2, j}\right)}}{\hat{D}_{2, j}} \tag{17}
\end{equation*}
$$

### 5.4.2.3 Simple Expansion Method: mean discard per trip (Method 3)

The total discarded pounds for species j using method 3 is given by:

$$
\begin{equation*}
\hat{D}_{3, j}=\sum_{h=1}^{L} N_{h}\left(\frac{\sum_{i=1}^{n_{h}} d_{j i h}}{n_{h}}\right) \tag{18}
\end{equation*}
$$

where $\mathrm{d}_{\mathrm{jih}}$ is discards of species j from trip i in stratum h ; $\mathrm{N}_{\mathrm{h}}$ is the number of FVTR trips in stratum $h$; and $n_{h}$ is the number of observed trips in stratum h. Note that $\mathrm{D}_{3}{ }^{\text {hat }}$ will differ between $\mathrm{d} / \mathrm{da}$ and $\mathrm{d} / \mathrm{kl}$ sets due to expansion of discards to account for non-observed hauls in the $\mathrm{d} /$ da set.

The variance of $D_{3, j}{ }^{\text {hat }}$ for total discarded pounds using method 3 for species $j$ is defined as:

$$
\begin{equation*}
V\left(\hat{D}_{3, j}\right)=\sum_{h=1}^{L} N_{h}^{2}\left(\frac{N_{h}-n_{h}}{N_{h}}\right)\left[\frac{\sum_{i=1}^{n_{h}} d_{j i h}^{2}-\frac{\left(\sum_{i=1}^{n_{h}} d_{j i h}\right)^{2}}{n_{h}}}{n\left(n_{h}-1\right)}\right] \tag{19}
\end{equation*}
$$

where $D_{3, j}{ }^{\text {hat }}$ is total discarded pounds for species $j$; $d_{j i h}$ is discards of species $j$ from trip i in stratum $h ; N_{h}$ is the number of FVTR trips in stratum $h$; and $n_{h}$ is the number of observed trips in stratum h .

The coefficient of variation of $D_{3, j}$ hat is defined as:

$$
\begin{equation*}
C V\left(\hat{D}_{3, j}\right)=\frac{\sqrt{V\left(\hat{D}_{3, j}\right)}}{\hat{D}_{3, j}} \tag{20}
\end{equation*}
$$

### 5.5 Sample Size Analysis

A sample size analysis was conducted to estimate the number of trips and sea days needed to achieve a 30 percent CV for each species group and fishing mode. Two alternative methods are used: (1) The sample size based upon the variance of the quarterly bycatch ratio; and (2) the sample size based upon the variance of the composite annual total discard.

### 5.5.1 Sample Size Based Upon the Variance of the Quarterly Bycatch Ratio

The number of observer sea days ( $\mathrm{S}_{30}$ ) necessary to achieve a 30 percent CV for a fleet and species/species group is defined as:

$$
\begin{equation*}
\hat{S}_{30, j h}=\sum_{q=1}^{4} \hat{S}_{30, j h q} . \tag{21}
\end{equation*}
$$

If a quarterly sea day estimate was not available (due to no observer coverage or the CV could not be estimated due to a bycatch rate of zero), then the quarterly sea days were estimated by pilot coverage, as follows:
(22) $\hat{S}_{30, j h q}=\hat{T}_{h q} * \overline{D A_{h q}}$
where $\mathrm{T}^{\text {hat }}$ is 2 percent of the FVTR trips in stratum h and quarter q , and $3<=$ $\mathrm{T}_{\mathrm{hq}}{ }^{\text {hat }}<=100$ trips, and $\mathrm{DA}_{\mathrm{hq}}{ }^{\text {bar }}$ is the average trip length of FVTR trips in stratum h and quarter q .

Equations 2-5 were applied to each quarter and the total number of trips and sea days for the year were obtained by summing over the quarterly estimates. In this approach, the number of sea days and trips necessary to achieve a 30 percent CV does not depend on any of the three methods used to estimate total discards. Instead, it depends on the estimated variance of the discard ratio within each quarter.

### 5.5.2 Sample Size Based Upon the Variance of the Composite Annual Total Discard

The number of sea days and trips needed to achieve a 30 percent CV were derived based on the variance of the composite annual total discards using the combined ratio method and the $\mathrm{d} / \mathrm{k}$ bycatch ratio (equation 16a). From equation 16a, let:

$$
\begin{equation*}
\hat{S}_{j q h}^{2}=\left[\frac{\sum_{i=1}^{n_{\text {gh }}}\left(d_{j i q h}^{2}+\left(r_{c, j h}\right)^{2} k_{i q h}^{2}-2 r_{c, j} d_{j i q h} k_{i q h}\right)}{n_{q h}-1}\right] \text { and } \tag{23}
\end{equation*}
$$

$$
\begin{equation*}
\delta_{q h}=\frac{n_{q h}}{\sum_{q=1}^{4} n_{q h}} \tag{24}
\end{equation*}
$$

where $\delta_{\mathrm{qh}}$ is the fraction of the trips in quarter q in stratum $\mathrm{h} ; \mathrm{r}_{\mathrm{c}, \mathrm{jh}}$ is the combined annual ratio of species j in stratum h ; $\mathrm{d}_{\mathrm{jiqh}}$ is discards of species j from trip i in stratum h in quarter q ; $\mathrm{k}_{\text {iqh }}$ is kept pounds of all species on trip i in stratum h in quarter q ; and $\mathrm{n}_{\mathrm{qh}}$ is the number of observed trips in stratum $h$ in quarter $q$. The $\mathrm{r}_{\mathrm{c}, \mathrm{jh}}$ in equation 23 is defined in equation 15a where the summation is over quarters within a given strata defined by gear, region, access area, trip type, and so forth.

The number of trips necessary to achieve a 30 percent CV based on the variance of the composite annual total discards for species group $j$ in stratum $h$ is defined as:

$$
\begin{equation*}
\hat{T D_{30 j h}}=\frac{\sum_{q=1}^{4}\left(\frac{K_{q h}^{2}}{\bar{k}_{q h}^{2}} \hat{S}_{j q h}^{2} \frac{1}{\delta_{q h}}\right)}{(0.09) D_{j h}{ }^{2}+\frac{\sum_{q=1}^{4} \frac{K_{q h}^{2}}{\bar{k}_{q h}^{2}} \hat{S}_{j q h}^{2}}{N_{h}}} \tag{25}
\end{equation*}
$$

The number of sea days necessary to achieve a 30 percent CV based on the variance of the composite annual total discards for species group $j$ in stratum $h$ is defined as:

$$
\begin{equation*}
\hat{S} D_{30 j h}=\hat{T} D_{30 j h} * \overline{D A_{h}} \tag{26}
\end{equation*}
$$

where $\mathrm{DA}_{\mathrm{h}}{ }^{\text {bar }}$ is the weighted average trip length of FVTR trips in stratum h (weighted by the number of FVTR trips in each quarter).

When total discards could not be estimated due to little or no observer coverage (i.e., pilot coverage will be needed) or when total discards are zero (no variance), the sum of the quarterly trips and sum of the quarterly sea days are used (i.e., $\mathrm{TD}_{30}=$ sum of quarterly $\mathrm{T}_{30}$ and $\mathrm{SD}_{30}=$ sum of quarterly $\mathrm{S}_{30}$ ).

Pilot coverage has been used when the bycatch ratio is zero or when variance of the bycatch ratio or the variance of the composite total discards is zero. It is recognized that pilot coverage may result in excessive coverage in cases where no observer coverage is needed for a cell. As new bycatch information is obtained, the unlikely (gray-shaded) cells should be re-evaluated and updated to prevent the overuse of unnecessary pilot coverage. As discussed later in section 6.2.3, when "importance filters" are applied, cells with pilot coverage may be excluded when cells have little or no discards due to other factors (e.g., discard amount is extremely low compared to total landings, etc.). It should be noted that pilot coverage plays an important role in determining coverage for protected species (species where bycatch may be a rare event) and only the unlikely (gray-shaded) filter is applied to protected species groups (other importance filters are not applied to protected species).

### 5.6 Additional Analyses

### 5.6.1 Meta-Analysis

A meta-analysis of the 60 species groups and 39 fishing modes (excluding the 5 quota-monitoring modes and the Scottish seine mode in the Mid-Atlantic) was conducted to compare estimates of total discards and the precision of the three methods and two bycatch ratio estimators (Wigley et al. 2007).

The total discards derived from each method and each ratio estimator were compared to each other by plotting all combinations within a single graph for each major gear type and region. The comparisons of total discard for four major gear types (longline, otter trawl, scallop dredge, and gillnet) and region are presented in Appendix B, Figures B-4a to B-4g. The comparisons of standard error (SE) of total discard and the CV of total discards for the four major gear types by region are presented in Appendix B, Figures B-5a to B-5n. For Figures B-4 and B-5 of Appendix B, the symbol within each subplot represents a species/species group and mesh size, the line represents a regression through the data points and the ellipse is the 68 percent confidence region.

Generally, there is a close relationship between all methods and ratio estimators for longline, otter trawl, and scallop dredge for total discards (Appendix B, Figures B-4a to $\mathrm{B}-4 \mathrm{~g}$ ). For longline and scallop dredge gear, the estimated total discards were strongly correlated among estimators (Appendix B, Figures B-4a,d,e). Differences between the "combined" and "separate" estimators of total discards in the trawl fisheries were negligible, but differences between $\mathrm{d} / \mathrm{k}$ - and d/da-based estimates were more pronounced (Appendix B, Figures B-4b,c), especially for high values of discard.

There is some departure between methods and ratio estimators for gillnets in the Mid-Atlantic (Appendix B, Figure B-4f), but not in New England (Appendix B, Figure B-4g). This may be attributed to the use of days absent with a fixed gear fishery. Some vessels actively tend (stand by) their nets while the gear is in the water; thus, days absent is correlated with soak time-this may not be true for fleets who do not tend their gear (i.e., vessels that set their gillnets and return to port, returning to retrieve their nets at a later time or date).

For measures of uncertainty of the estimate, there was general agreement among the three methods and two ratio estimators (Appendix B, Figures B-5a to B-5g). Confidence ellipses for longline, gillnet, and scallop dredge were stronger than for otter trawl; however, although the otter trawl ellipses (measuring the strength of the associations) were wider than for gillnet and longline, they remain relatively narrow, indicating not much variability and a strong association. In general, results in Figures B5h to B-5n of Appendix B suggested a greater degree of dispersion among methods 1 to 3 when days absent was used as a measure of fishing effort. Because days absent does not account for variations in steam time versus fishing time nor the effects of soak time for fixed gear, it was judged to be less useful than estimators based on a discard-to-kept ratio. In particular, estimators based on the separate ratio method were more variable than those based on the combined ratio method.

Closer examination of the comparison of precision from the combined ratio method and the simple expansion method are presented in Appendix B, Figures B-6a to B-6g, for four major gear types (longline, otter trawl, gillnet, and scallop dredge). In these figures, the identity line and a reference line representing a 30 percent CV are given; the symbol represents a species/species group and mesh size. There is general symmetry above and below the identity line, except for Mid-Atlantic otter trawl where coverage is low and precision estimates are higher, consequentially leading to higher coverage.

The meta-analyses indicate that generally there was little difference between the two bycatch ratios ( $\mathrm{d} / \mathrm{da}$ and $\mathrm{d} / \mathrm{k}$ ) for most species in most fleets, with the exception of gillnets where the d/da provided lower estimates of variation of total discards compared with $\mathrm{d} / \mathrm{k}$ ratios. Generally, there was little difference between the three methods, but the ratio estimators tended to give higher CVs of the total than the simple expansion method. A relatively large fraction of the overall estimates for species, gear, and mesh size had CVs less than 30 percent, irrespective of which method was used.

The tables presenting precision (Table 46 and Table 47), ranking of total discards (Table 48, Table 49, Table 50, and Table 51), and the sea days and trips necessary to achieve a CV of 30 percent (Table 52-Table 57) are based upon the variance of the composite annual total discards using the combined ratio method (method 2 ).

The precision of the total discards by fleet and species is presented in Table 46 and Table 47 (see Appendix B, Table B-1 for individual species). Cells with adequate precision (at or below a CV of 30 percent) are identified with bold font. Note that when a CV is reported for a fishing mode where pilot coverage is needed, the CV is based upon the available, limited observer coverage.

For the 28 fishing modes for which a CV could be estimated, 19 (68 percent) had CVs less than or equal to 30 percent for all species combined (Table 46 and Table 47). For tilefish, three of the four fishing modes where discarded tilefish occurred had a CV above 30 percent. Of the 600 cells in the fleet by species matrix, 29 percent of the cells had a CV less than or equal to 30 percent. Caution should be used in evaluating the matrix in this manner, as this percentage does not include the cells where no discarding occurred ( $\mathrm{CV}=$ null), nor does it incorporate the unlikely cells (gray-shaded cells). Additionally, the relative magnitude of the discard should also be considered when evaluating the precision. There are cases, such as encounters of large-mesh Northeast multispecies in mid-water trawls that are examples of where the magnitude of the total catch, rather than the precision of the estimate, is the most important factor.

Looking at the non-gray cells for which there was observer coverage, the majority ( 58 percent) had either no discards or CVs of 30 percent or less. By definition, those cells that had either no discards or CVs less than 30 percent were of sufficient quality to meet the performance standard proposed to be implemented through this amendment. Less than 25 percent of the non-gray cells for which there was observer coverage in 2004 had CVs in excess of 50 percent, while the remainder of cells (18 percent) had CVs between 30 percent and 50 percent. http://www.st.nmfs.gov/st4/nop/.

To provide insight into which species are discarded in each fleet, the total discard of each species group was ranked (highest in $\mathrm{lb}=1$, lowest in $\mathrm{lb}=\mathrm{n}$ ) within a fishing mode. The rank indicates the relative magnitude of the discarded species group within a fishing mode. Ranking of total discard weight within a fishing mode for fish species groups are presented in Table 48, and the ranking of total number of incidental takes of sea turtles, marine mammals, and sea birds within a fishing mode are presented in Table 49 (see Appendix B, Table B-2 for individual species). In the gillnet modes, spiny dogfish are discarded the most (rank $=1$ for all gillnet modes), while in the scallop dredge modes, scallops and skates are the two species most heavily discarded. Although protected species are not often encountered, dolphins/porpoises are encountered more often in otter trawl modes than other protected species, while sea birds and sea turtles are encountered more frequently than other protected species in the gillnet and scallop dredge modes. Ranking of total discard weight for fish species and ranking of total numbers of incidental takes were also ranked within species group (Table 50 and Table 51, respectively; see Appendix B, Table B-3 for individual species). Compared to other fishing modes, the New England large-mesh otter trawl mode discards the most dogfish and Northeast multispecies. The open area, limited access scallop dredge modes discard the most scallops and monkfish. Sea turtles are taken most often in the Mid-Atlantic scallop trawl modes.

The sea days and trips needed to achieve a 30 percent CV based on the variance of the composite annual total discard for each species group and fishing mode are presented in Table 52 and Table 53 (sea days) and Table 54 and Table 55 (trips), respectively (see Appendix B, Tables B-4 and B-5 for individual species). Similar to the sea days and trips based on the variance of the quarterly bycatch ratio, the sea days and trips are additive across fishing modes within species groups (i.e., column sums); however, the sea days and trips are not additive across species groups within fishing modes (i.e., row sums). Fine-tuning of the unlikely (gray-shaded) cells may be necessary before making a final determination of the number of sea days and trips needed to monitor bycatch in the Greater Atlantic Region due to exceptions to the 30 percent CV standard and the relative magnitude of the discards. For example, the apparent need for 15,593 observer sea days to estimate surfclam discards in the New England large-mesh otter trawl fishery is driven by imprecise estimates of small amounts. Such an allocation of observer days would be wasteful with respect to surfclam discards and would oversample by a factor of 145 the estimated days necessary to obtain a CV of 30 percent for large-mesh groundfish species (107 days).

To determine the number of sea days and trips needed to achieve a 30 percent CV within a fishing mode, the maximum number of sea days for all species groups in the study (i.e., the maximum number of days within a row) is used. This ensures that all other species groups will have a CV of 30 percent or less. Based on this approach, Table 56 and Table 57 present the number of sea days and trips needed for each fishing mode for: (1) All 20 species groups considered in the study; (2) 15 species groups required under the Magnuson-Stevens Act (all of the fish species groups plus sea turtles); (3) the 20 species groups, filtering out the unlikely (gray-shaded) cells; and (4) the 15 Magnuson-Stevens Act species groups filtering out the unlikely cells. In Table 56 and Table 57, the total number of sea days and trips needed to achieve a CV of 30 percent for
each of these four scenarios is attained by summing each column. These totals range from 56,427 to 73,524 days; for comparative purposes, approximately 8,000 observer sea days were utilized by the NEFOP in 2004.

While the seasonal variation is captured more effectively in the variance of the quarterly bycatch ratio, the composite annual total discard captures the aggregated pattern of bycatch and its variability. Finer-scale variation of bycatch patterns at the quarterly level are not specifically addressed but implicitly assume that the estimates of total days at sea would be allocated in the same proportions as the original sample, i.e., $\delta_{\mathrm{qh}}$. Variation in the allocation factors, such as might be obtained via optimal allocation (Cochran 1963) or use of the optimization model (Rago et al. 2005) could further reduce the annual estimate.

Given the four-fold disparity between the projected number of sea days needed to meet the CV performance standard and the number of observer sea days generally available through the NEFOP, further refinements in the number of sea days may be necessary. This could be accomplished by applying a series of "importance filter" to the number of sea days (see section 6.2.3).

### 5.6.2 Accuracy Analyses

As noted above and elsewhere (Rago et al. 2005; Methot 2005), the most effective means to ensure the accuracy of a sampling program is to eliminate potential sources of bias that may be associated with the design of the sampling program.

Several analytical tests were conducted to evaluate the potential sources of bias in the 2004 observer data. We compared several measures of fishing performance for vessels with and without observers present. Bias can arise if the observed vessels and trips within a stratum are not representative of the unobserved vessels and trips within the stratum. Such bias could arise if the vessels with observers on board consistently catch more or less than unobserved vessels, if the average trip durations are different, or if observed vessels fish in different areas than the rest of the fleet. All federally permitted fishing vessels are required to report the total trip landings, the number of days absent from port, and the primary statistical area fished. This information provides a means to directly compare trips between observed and unobserved vessels.

Based on analysis that compared available FVTR data from unobserved vessels with data recorded by observers, average catches (kept pounds) by species groups for observed and total trips compare favorably (Appendix B, Figure B-7) and followed an expected linear relationship. If the observed and unobserved trips within a stratum measure the same underlying fishing processes, one would expect not to detect a significant statistical difference in the average catches (and the standard deviations) between the FVTR and observer datasets. An examination of the distribution of these differences (Appendix B, Figures B-8 and B-9), by species group, indicates no evidence
of systematic bias and general symmetry in the pattern of positive and negative differences. ${ }^{35}$

The average difference in catch, by species, between the observed and unobserved trips was generally small as a proportion of total catch, and the average catch rates between the two datasets were not significantly different from zero in 12 of the 14 comparisons (Table 58). As well, a paired t-test of the stratum-specific standard deviations of pounds kept showed significant differences from six of the 14 comparisons. A strong correlation was detected in trip duration between observed and unobserved trips (Appendix B, Figure B-10), with observed trips averaging about a quarter-day longer (Table 58 and Appendix B, Figure B-11). However, the difference in stratum-specific standard deviations of trip length was significantly different from zero ( $\mathrm{p}=0.002$ ). Some skewing of the differences in mean trip duration is evident, with observed trips being slightly longer.

These results suggest that average catch rates on observed trips were not significantly different from average catch rates reported on FVTRs, indicating no evidence of bias in the observer data based on the measure of average catch rate. Some differences were detected in the standard deviations indicating more variability in the FVTR data than in the observer data. The results also suggest that average trip durations were similar between the observed trips and the FVTR trips, indicating no evidence of bias in the observer data based on the measure of average trip length. There is evidence of small skewing of the data on a small scale, with observer trips being slightly longer by 0.25 day. The standard deviations of the average trip duration between the two datasets were different, indicating that the observer data were more variable than the FVTR data. Overall, these results indicate that observer trips are generally similar to FVTR trips and there are no bias issues evident.

Two measures of spatial coherence were also examined. Within stratum h (fleet and quarter) the expected number of observer trips by statistical area $\mathrm{j}\left(\mathrm{E}_{\mathrm{jh}}\right)$ as the product of the proportion of FVTR trips in statistical area $j$ and stratum $h\left(V_{\mathrm{jh}}\right)$ and the number of observed trips in stratum $\mathrm{n}_{\mathrm{h}}$. Thus, $\mathrm{E}_{\mathrm{jh}}=\mathrm{V}_{\mathrm{jh}} * \mathrm{n}_{\mathrm{h}}$. These expectations can then be compared to the actual frequencies $\left(\mathrm{O}_{\mathrm{jh}}\right)$ of observed trips by statistical area. Results of these analyses indicate that the spatial distribution of fishing effort for trips with observers on board closely matches the spatial distribution of trips for the stratum as a whole (Table 59). It was possible to compute chi-square statistics for 86 strata. The null hypothesis of observer proportions equal to FVTR proportions was rejected ( $\mathrm{P}<0.05$ ) in 38 of the 86 comparisons, which suggests that there are some spatial differences in the observed data compared with the FVTR data. This analysis included data collected on trips used for training observers, as well as quota-monitoring trips which have

[^23]disproportionate higher rate of observer coverage than other observed trips, and this may explain the significant differences observed for otter fleets. Murawski et al. (2005) compared the spatial distribution of 2003 otter trawl fishing effort for vessels with VMS with the distribution of fishing effort from 2003 observed trips. Qualitatively, the spatial distributions match very well with high concentrations of effort near the boundaries of existing closed areas on Georges Bank and within the Gulf of Maine. Moreover, the effort concentration profiles deduced from VMS data coincide almost exactly with the profiles derived from the observed trips. Overall, these comparisons suggested strong coherency between these two independent measures of fishing locations; therefore, there is no evidence of bias in the observer data.

Additional analyses of accuracy and potential bias in discard estimations have been conducted since the development of the 2007 SBRM Omnibus Amendment. The 3year review of the SBRM process (Wigley et al. 2012b) found there was little evidence of systematic bias across all fleets. There are a few fleets where evidence suggests there may be differences between observed and unobserved vessels that could affect discard estimates. However, further investigation would be needed to determine if these differences could lead to inaccurate discard estimates. The New England Council's Northeast Multispecies Plan Development Team has conducted some preliminary analysis of potential observer effect on catch information in the groundfish fishery. However, to date, this work has not yielded any specific conclusions or recommendations.

Recent work to determine at-sea monitoring requirements for Northeast multispecies sectors included a discussion of discard accuracy (NMFS 2013a). This work included analysis by Dr. Paul Rago to approach the issue as a statistical control problem in which the question is--How much would the discard rate have to increase on unobserved trips in order to exceed a biological threshold? This was done by examining scenarios where there is a hypothetical increase in the rate of discards on unobserved trips. The results of this analysis suggest that, for the groundfish stocks examined, the bias in discard rates would have to be at least 5 to 10 times greater than presently observed in order to pose an appreciable risk of exceeding the ABC or OFL. The bias analyses conducted to date do not suggest behavioral differences of this magnitude.

This SBRM Omnibus Amendment does not preclude further analysis into accuracy and potential bias in discard estimations. The SBRM could be modified in the future to incorporate processes that are found to improve the accuracy of discard estimations.

### 5.6.3 Overlap Analyses

Within a given fishing mode, it is rare that fishing vessels would not catch species from more than one species group. Thus, an observer documenting discards of skates on an otter trawl trip may also document discards of spiny dogfish on the same trip. The degree of overlap among species groups has important implications for the efficacy of sampling within strata. Accounting for the magnitude of overlap can circumvent this potential inefficiency. The overlap approach developed and described by Rago et al.
(2005) for New England groundfish could be expanded and applied to all the species groups and fishing modes subject to the SBRM.

The attribution of discards to a fishery or permit type may be challenging given the number of fishing permits held by an individual fishing vessel. A provisional summary of the number of fishing permits held by individual vessels in 2010 indicate that in most fleets the majority of vessels within that fleet held more than one fishing permit (plan and category). For example, in the 2010 NE large mesh otter trawl fleet, approximately 68percent of the vessels in this fleet hold more than 10 fishing permits. Without a fishery declaration for every trip, it may not be possible to attribute discards of various species groups to one (or more) particular FMP. Additionally, the summary of discard reasons revealed that for many species, the discarding is not due to regulatory reasons, but rather economic (i.e. "No Market") reasons (Wigley et al. 2012b).

### 5.6.4 Optimization Tool

The optimization model described by Rago et al. (2005) could be expanded to encompass more species groups and gear types. For the optimization model to be useful, it will take extensive analyses to ensure that the assumptions necessary to set up the model are appropriate across a wider range of species and fishing modes. Even then, the optimization model is simply a tool to help guide the allocation process and would not replace other means by which observer effort is allocated across the fisheries.

The most important aspect of using the optimization model is that it explicitly incorporates a regular feedback mechanism for continuously improving the performance of the bycatch monitoring. The optimization tool should be viewed as a set of quality assurance/quality control measures that provide a formal way of updating and improving the sampling design as new information is obtained. The optimization tool interacts with the formal sampling design by using updated estimates of variances and overall patterns of fishing effort to improve, via reallocation of observer coverage, the overall performance of the sampling program. The overall performance of the observer sampling program is measured as a composite of the precision of discard estimates. Developing a composite measure of performance requires developing weighting factors for each species group and fishery to account for differences in the scope and scale among the fishing modes. As the number of combinations of species and fishing modes is high, defining a complete set of weighting factors is challenging.

The optimization tool also explicitly incorporates external constraints that affect the allocation of observer effort, such as the annual budget available to the observer program. While the budget is ultimately the most important constraint, prescribed coverage levels for regulatory programs (e.g., US/Canada resource sharing areas, B DAS, and scallop vessels in closed areas), have substantial impacts on the overall performance of the program. The optimization tool provides at least one measure of the potential impacts of externally imposed constraints.

The use of observer data for single species stock assessments and the sea day allocation are presented in Figure 44. This overview illustrates the 'feed-back' loop and
the use of observer data in the stock assessment process and in the sea day allocation process. The stock assessment analyses benefit from the sea day allocation process through improved monitoring of bycatch.

Overview of Stock Assessment and Sea Day Allocation Processes


Figure 44. Overview of feedback loop used to improve bycatch monitoring in the Greater Atlantic Region(status quo).

### 5.7 Integration of Model-Based Methods for Sea Turtles

Since 2007, revised approaches have been considered for sea turtles due to the rare nature of turtle discard events. Total bycatch of turtles and the amount of sea days for monitoring are estimated independently from fish, and then monitoring needs for both fish and turtles are integrated together in the process described below.

### 5.7.1 Background on Bycatch Estimation Methods for Turtles

To date, the NEFSC has estimated interactions [where interactions are synonymous with the Endangered Species Act definitions of "takes"36] of loggerhead and

[^24]hard-shelled turtles with fishing gear in the Mid-Atlantic (i.e. see Murray 2011, Warden 2011a, and Murray 2009a). These estimates are subsequently allocated across fisheries, where a "fishery" is defined as a managed fish or invertebrate species landed, to provide information requested by Greater Atlantic Regional Fisheries Office (GARFO) for their Endangered Species Act Section 7 consultations (Warden 2011b, Murray 2009b). The model-based estimates pool several years of data, pool across multiple fishing fleets within the same gear type, and account for gear or environmental correlates with turtle discard rates over broad spatial regions. As such they tend to have lower variance than those generated from annual ratio estimators (Orphanides 2009), because of the larger sample sizes and inclusion of environmental covariates that significantly affect estimated discard rates.

The total number of interactions between loggerheads and commercial fishing gear has typically been estimated via Generalized Additive Models (GAMs), developed from NEFOP data. The response of the model is the expected turtle interaction rate, defined as the number of observed turtles per unit of fishing effort. The definition of fishing effort will vary between gear types, but typically reflects the amount of fishing time in the water (i.e. days fished or dredge hours). The form of the Generalized Additive Model (GAM) can be written as:

$$
\log \left(E\left[y_{j}\right]\right)=\log \left(\text { fishing effort }_{j}\right)+\alpha+\sum_{i=1}^{n} f_{i}\left(x_{i j}\right)+\xi
$$

where $y_{j}$ is the number of hard-shelled turtles observed on the $j$ th haul, $\alpha$ is a constant intercept term, $f_{j}$ are a series of smoothing functions for each predictor variable, $\mathrm{x}_{i}$ describe environmental or fishing characteristics at each haul, and $\xi$ is unexplained error (Hastie \& Tibshirani 1990). The estimated interaction rates from the GAM model are then applied to commercial effort data (typically from FVTRs) to obtain the number of predicted loggerhead interactions on each fishing trip. Coefficients of variation (CVs) are determined from the distribution of predicted interactions that result from applying the GAM model to 1000 bootstrap replicates of the observer data.

### 5.7.2 Estimation of Sea Day Monitoring Needs

Projected amounts of observer sea days for vessels fishing gillnet, trawl (for fish and scallops), and dredge gear are derived from CVs around the total estimated loggerhead interactions in specific fisheries, where a fishery is defined within each gear type by the highest amount (by weight) of landed fish or invertebrate species on a trip (Murray 2012). The number of observed sea days needed to achieve a 30 -percent CV, and other levels of precision, around an estimate of total loggerhead interactions is derived from:

$$
n_{\text {proj }}=\left(C V_{\text {obs }} * \sqrt{n_{\text {obs }}} / C V_{\text {proj }}\right)^{2}
$$

where $n_{p r o j}=$ the amount of projected effort required to achieve a given precision level (converted to sea days); $C V_{\text {obs }}=$ the precision levels around estimated interactions levels
as reported in Warden 2011b (trawl), Murray 2009b (gillnet), or Murray 2011 (dredge); $n_{\text {obs }}=$ the observed effort as reported in the above publications; and $C V_{p r o j}=$ the projected precision level to be achieved. Estimates of sea day needs for turtles are revised when new bycatch estimates are published for a particular gear type (approximately every five years). Sea day monitoring needs for non-loggerhead species are not currently estimated, but it may be possible in the future if there are sufficient data to estimate total interactions of non-loggerhead species.

### 5.7.3 Integrating Sea Day Monitoring Needs for Fish and Turtles

Estimated sea days to monitor loggerhead interactions are subsequently integrated with annual sea days estimated for fish. The following describes the steps used in 2012.

For fish/invertebrate species groups, the numbers of sea days needed to achieve a 30 percent CV of total discards of each species groups were estimated for 55 fleets using data collected during the June 2010 through July 2011(see Wigley et al. 2012a for details). An estimated 18,822 sea days are needed for the 14 fish and invertebrate species groups.

For loggerhead turtles, the numbers of sea days needed to achieve a 30 percent CV of turtle discards was estimated by fishery, defined as a managed fish or invertebrate species landed on vessels using bottom otter trawl, sink gillnet, or scallop dredge gear in the Mid-Atlantic region (see Murray 2012 for details). The maximum amount of projected coverage across all the fisheries was considered the desired level of sampling to monitor turtle discards for that gear type. Roughly 4,800 days are needed across bottom trawl fisheries. Roughly 1,400 days are needed across sink gillnet fisheries. Lastly, $\sim 1,300$ days are needed in the scallop dredge fishery, based on loggerhead bycatch precision levels after chain mats were implemented in the fishery.

The numbers of sea days needed to achieve a 30 percent CV associated with the Mid-Atlantic ${ }^{37}$ turtle gear types and fish/invertebrate fleets are given in Table 60 and summarized below.

| Turtle Gear Types and Fish Fleets | Sea Days |  |
| :--- | :---: | :---: |
|  | Loggerhead Turtles | Fish/Invertebrates <br> Species Groups |
| MA Otter Trawl and Scallop Trawl <br> Rows 5, 6, 9, 10, 11 and 12 | 4,838 | 9,096 |
| MA Gillnet <br> Rows 22, 23, and 24 | 1,440 | 109 |
| MA Scallop Dredge | 1,293 | 675 |

[^25]
## Rows 30, 32, 34 and 36

Table 39. Example number of observer sea days needed in select gear types to achieve a $\mathbf{3 0}$ percent CV for loggerhead turtles and fish/invertebrate species groups.

The number of sea days needed for the combined fish/invertebrates and turtle species groups are derived as followed:

- If the sum of the sea days needed for fish/invertebrates species groups of the corresponding fish fleets exceeds the sea days needed for the turtle gear type, then the sea days needed for fish/invertebrate sea day are used.
- If the number of sea days needed for turtles for the gear type exceeds the sum of the sea days needed for fish/invertebrates of the corresponding fish fleets, then the sea days needed for turtles are distributed according to the proportion of sea days needed for fish/invertebrates of the corresponding fish fleets.

A total of 20,590 sea days are needed for fish/invertebrates and loggerhead turtles (combined) during the April 2012 through March 2013 period (Table 60).

### 5.8 Sources of Uncertainty and General Discussion

The difficulties of discard estimation are well known and have been described extensively in the literature (e.g., Rochet et al. 2002; Diamond 2002; Rago et al. 2005; Kaiser 2006). In this analysis, a design-based approach was used to organize the basic concepts of inferring the behavior of a population from the properties of a sample. The design-based approach should be viewed as a first approximation of the overall efficacy of an observer sampling program. As additional information is obtained, more refined estimators of discards for individual or groups of species can be devised. The design approach does not preclude such development. Instead, it facilitates further development by ensuring that the sampling is sufficiently robust to address uncertainties associated with fishing operations. Allocation of observer effort to independent fishing modes, by quarter, protects against unforeseen changes in seasonal effort patterns, shifts to new fisheries (e.g., trawlers to general category scallopers), or the effects of closed areas. Moreover, the design-based approach can help smooth out the allocation process over time, thereby reducing potential problems associated with the logistics of running a large observer program (e.g., recruiting observers, training, ability to deploy observers, etc.). A design-based approach for biological sampling has proven to be an excellent technique for monitoring the biological attributes of landings. Extension of this approach to observer coverage allocation has similar advantages.

In spite of the many advantages associated with the current observer allocation approach, several areas of concern remain. These include:

1. How to appropriately address/minimize the influence of zero values (no discards) in the observer datasets;
2. How to appropriately address/minimize the influence of extremely high variation on measures of central tendency;
3. Developing alternative predictive variables;
4. Developing adequate measures of performance/efficacy for the observer program;
5. The influence over-stratification may have estimation (potential bias);
6. The lack of persistence in fishing behavior over years;
7. Addressing the influence of fishing regulations on fishing operations and vessel behavior;
8. The imprecise estimation of location reported on the FVTR;
9. The utility of using aggregate species measures of discards;
10. Improving the correspondence between FVTR and dealer data;
11. Incorporating more advanced statistical estimators that explicitly account for zero observations and over-dispersion; and
12. Developing appropriate criteria to filter the importance of fisheries and species combinations for the estimation of adequate sampling coverage.

The statistical theory applicable to the estimation of fisheries bycatch is evolving and significant advances are anticipated during the next few years. Several promising methods, recently published or now under development, are expected to advance the reliability of discard estimation; however, field testing these newer methods for multiple geographical regions and fisheries will take time. Meanwhile, the sampling design described in this chapter and, more importantly, the underlying data collected by NMFS should retain enough flexibility to accommodate/support using many of these newer methods.


Table 40. Number of trips in the 2004 NEFOP and FVTRs, by fishing mode and quarter. The comments indicate where imputation and pilot coverage were used (shading indicates cells used in the imputation) in the fish and protected species datasets.

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| Gear Type | Access Area (Open/ Closed) |  |  |  | NUMBER OF SEA DAYS IN 2004 OBSERVER PROGRAM |  |  |  |  |  |  |  |  |  | NUMBER OF SEA DAYS IN 2004 VTR (commercial) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | FISH SET |  |  |  |  | PROTECTED SPECIES SET |  |  |  |  | INDUSTRY ACTIVITY |  |  |  |  | Comments |
|  |  |  | Region | mesh groups | QTR 1 | QTR 2 | QTR 3 | QTR 4 | TOTAL | QTR 1 | QTR 2 | QTR 3 | QTR 4 | TOTAL | QTR1 | QTR 2 | QTR 3 | QTR 4 | $\begin{array}{r} \text { VTR } \\ \text { TOTAL } \end{array}$ |  |
| Longline | all | all | NE | all | 5 | 1 | 3 | 3 | 12 | 8 | 1 | 8 | 116 | 133 | 654 | 132 | 319 | 474 | 1579 | impute |
| Longline | all | all | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 11 | 290 | 310 | 277 | 272 | 1149 | Pilot |
| Otter Trawl | all | all | NE | small | 84 | 100 | 79 | 186 | 449 | 86 | 128 | 118 | 245 | 577 | 3093 | 2608 | 2422 | 2442 | 10565 |  |
| Otter Trawl | all | all | NE | large | 377 | 207 | 152 | 340 | 1076 | 390 | 389 | 484 | 684 | 1947 | 8231 | 9997 | 11445 | 8660 | 38333 |  |
| Otter Trawl | all | all | MA | small | 162 | 56 | 100 | 153 | 471 | 165 | 57 | 102 | 175 | 499 | 2363 | 2539 | 2855 | 2047 | 9804 |  |
| Otter Trawl | all | all | MA | large | 100 | 15 | 26 | 42 | 183 | 103 | 15 | 26 | 42 | 186 | 4935 | 4563 | 3791 | 3787 | 17076 |  |
| Scallop Trawl | open | limited | MA | all | 0 | 0 | 0 | 11 | 11 | 0 | 0 | 11 | 11 | 22 | 154 | 591 | 593 | 305 | 1643 | Pilot |
| Scallop Trawl | open | general | MA | all | 0 | 0 | 48 | 8 | 56 | 0 | 3 | 58 | 10 | 71 | 27 | 633 | 1215 | 365 | 2240 | Pilot |
| Shrimp Trawil | all | all | NE | all | 12 | 0 | 0 | 0 | 12 | 12 | 0 | 0 | 0 | 12 | 1822 | 46 | 0 | 127 | 1995 | impute |
| Shrimp Trawl | all | all | MA | all | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 2 | 0 | 2 | 6 | 276 | 1100 | 442 | 1824 | Pilot |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 5 | 3 | 18 | 17 | 43 | Pilot |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 84 | 98 | 276 | 199 | 657 | 169 | 138 | 322 | 247 | 876 | 1526 | 1602 | 2514 | 1388 | 7030 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 54 | 92 | 232 | 155 | 533 | 80 | 152 | 258 | 211 | 701 | 1252 | 2327 | 2006 | 1611 | 7196 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 1 | 0 | 1 | 1 | 3 | 57 | 99 | 82 | 137 | 375 | 560 | 744 | 1172 | 605 | 3081 | Pilot for fish |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 0 | 1 | 0 | 3 | 4 | 13 | 28 | 15 | 29 | 85 | 121 | 481 | 266 | 529 | 1397 | Pilot for fish |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | 1 | 0 | 0 | 29 | 30 | 23 | 54 | 3 | 72 | 152 | 787 | 1299 | 170 | 1164 | 3420 | Pilot for fish |
| Scallop Dredge | open | limited | NE | all | 52 | 78 | 53 | 161 | 344 | 61 | 78 | 123 | 195 | 457 | 3106 | 4628 | 3780 | 1915 | 13429 |  |
| Scallop Dredge | open | limited | MA | all | 45 | 91 | 263 | 192 | 591 | 45 | 146 | 280 | 204 | 675 | 3220 | 5624 | 4779 | 2802 | 16425 |  |
| Scallop Dredge | open | general | NE | all | 1 | 0 | 2 | 8 | 11 | 1 | 0 | 5 | 18 | 24 | 773 | 1562 | 1565 | 699 | 4599 | Pilot |
| Scallop Dredge | open | general | MA | all | 0 | 6 | 19 | 8 | 33 | 0 | 7 | 29 | 19 | 55 | 362 | 1487 | 1808 | 1133 | 4790 | impute |
| Scallop Dredge | closed | limited | NE | all | 90 | 214 | 200 | 301 | 805 | 90 | 214 | 200 | 301 | 805 | 24 | 41 | 25 | 2372 | 2462 |  |
| Scallop Dredge | closed | limited | MA | all | 21 | 145 | 124 | 83 | 373 | 21 | 145 | 124 | 83 | 373 | 57 | 63 | 75 | 510 | 705 |  |
| Scallop Dredge | closed | general | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 37 | 21 | 7 | 68 | Pilot |
| Scallop Dredge | closed | general | MA | all | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 2 | 13 | 75 | 274 | 341 | 703 | Pilot |
| Mid-water paired \& single Trawl | all | all | NE | all | 25 | 21 | 56 | 63 | 165 | 39 | 36 | 90 | 77 | 242 | 882 | 537 | 870 | 495 | 2784 |  |
| Mid-water paired \& single Trawl | all | all | MA | all | 14 | 0 | 19 | 6 | 39 | 14 | 0 | 22 | 6 | 42 | 364 | 40 | 22 | 1 | 427 | impute |
| Fish Pots/ Traps | all | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 294 | 538 | 156 | 988 | Pilot |
| Fish Pots/ Traps | all | all | MA | all | 0 | 5 | 1 | 0 | 6 | 2 | 6 | 1 | 0 | 9 | 70 | 651 | 568 | 544 | 1833 | Pilot |
| Purse Seine | all | all | NE | all | 0 | 4 | 22 | 7 | 33 | 0 | 6 | 38 | 9 | 53 | 0 | 58 | 384 | 91 | 533 |  |
| Purse Seine | all | all | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 36 | 21 | 24 | 81 | Pilot |
| Hand Line | all | all | NE | all | 0 | 0 | 4 | 2 | 6 | 0 | 0 | 15 | 3 | 18 | 273 | 743 | 1967 | 598 | 3581 | Pilot |
| Hand Line | all | all | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 0 | 11 | 152 | 1514 | 3350 | 1623 | 6639 | Pilot |
| Scottish Seine | all | all | NE | all | 0 | 3 | 1 | 1 | 5 | 0 | 4 | 2 | 2 | 8 | 3 | 40 | 39 | 11 | 93 | Pilot |
| Scottish Seine | all | all | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |  |
| Clam Quahog Dredge | all | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 437 | 780 | 624 | 646 | 2487 | Pilot |
| Clam Quahog Dredge | all | all | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 862 | 1239 | 1115 | 963 | 4179 | Pilot |
| Crab Pots | all | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 124 | 172 | 223 | 200 | 719 | Pilot |
| Crab Pots | all | all | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 412 | 647 | 102 | 1168 | Pilot |
| Lobster Pots | all | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3699 | 7701 | 16980 | 13154 | 41534 | Pilot |
| Lobster Pots | all | all | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 193 | 1397 | 2034 | 835 | 4459 | Pilot |
| Quota Monitored Longline | all | all | NE | all | 0 | 0 | 0 | 110 | 110 |  |  |  |  |  |  |  |  |  |  |  |
| Quota Monitored Otter Trawl (U/C) | all | all | NE | large | 0 | 175 | 318 | 201 | 694 |  |  |  |  |  |  |  |  |  |  |  |
| Quota Monitored Otter Trawl (U/C) | all | all | NE | small | 0 | 10 | 30 | 19 | 59 |  |  |  |  |  |  |  |  |  |  |  |
| Quota Monitored Otter Trawl (B) | all | all | NE | large | 0 | 0 | 0 | 126 | 126 |  |  |  |  |  |  |  |  |  |  |  |
| Quota Monitored Otter Trawl (B) | all | all | NE | small | 0 | 0 | 0 | 6 | 6 |  |  |  |  |  |  |  |  |  |  |  |
| TOTAL |  |  |  |  |  |  |  |  | 6908 |  |  |  |  | 8429 | 40450 | 57282 | 71872 | 53459 | 223063 |  |

Table 41. Number of sea days in the 2004 NEFOP and FVTRs, by fishing mode and quarter. The comments indicate where imputation and pilot coverage were used (shading indicates the cells used in the imputation) in the fish and protected species datasets.

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Table 42. Number of observed trips in 2004 and the percent of observed trips with zero discard, by fishing mode, for fish species groups. Note: Gray-shade cells indicate unlikely species/gear combinations; U/C = US/Canada; B = B-DAS.

## SBRM Omnibus Amendment

| Gear Type | Access Area (OpenClosed) | Trip Category (General/ Limited) | Region | $\begin{gathered} \text { mesh } \\ \text { groups } \end{gathered}$ |  |  |  |  |  | $55^{8}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 119 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 96.6\% |
| Longline | all | all | MA | all | 2 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Otter Trawl | all | all | NE | small | 200 | 100.0\% | 100.0\% | 99.5\% | 97.5\% | 99.0\% |
| Otter Trawl | all | all | NE | large | 539 | 100.0\% | 100.0\% | 99.8\% | 98.5\% | 99.1\% |
| Otter Trawl | all | all | MA | small | 205 | 98.5\% | 100.0\% | 100.0\% | 98.5\% | 99.5\% |
| Otter Trawl | all | all | MA | large | 76 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 98.7\% |
| Scallop Trawil | open | limited | MA | all | 3 | 66.7\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Scallop Trawi | open | general | MA | all | 39 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Shrimp Trawil | all | all | NE | all | 12 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Shrimp Trawl | all | all | MA | all | 2 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 1 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 772 | 100.0\% | 96.6\% | 100.0\% | 99.1\% | 98.3\% |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 569 | 100.0\% | 94.0\% | 100.0\% | 97.7\% | 99.5\% |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 358 | 99.4\% | 100.0\% | 100.0\% | 100.0\% | 98.9\% |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 81 | 97.5\% | 100.0\% | 100.0\% | 100.0\% | 97.5\% |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | 142 | 97.2\% | 98.6\% | 100.0\% | 99.3\% | 98.6\% |
| Scallop Dredge | open | limited | NE | all | 36 | 88.9\% | 100.0\% | 100.0\% | 100.0\% | 97.2\% |
| Scallop Dredge | open | limited | MA | all | 78 | 97.4\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Scallop Dredge | open | general | NE | all | 20 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Scallop Dredge | open | general | MA | all | 39 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Scallop Dredge | closed | limited | NE | all | 86 | 98.8\% | 100.0\% | 100.0\% | 100.0\% | 98.8\% |
| Scallop Dredge | closed | limited | MA | all | 35 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Scallop Dredge | closed | general | NE | all | 0 |  |  |  |  |  |
| Scallop Dredge | closed | general | MA | all | 1 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Mid-water paired \& single Trawil | all | all | NE | all | 99 | 100.0\% | 100.0\% | 99.0\% | 99.0\% | 97.0\% |
| Mid-water paired \& single Trawl\| | all | all | MA | all | 14 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Fish Pots/ Traps | all | all | NE | all | 0 |  |  |  |  |  |
| Fish Pots/ Traps | all | all | MA | all | 8 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Purse Seine | all | all | NE | all | 26 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Purse Seine | all | all | MA | all | 2 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Hand Line | all | all | NE | all | 9 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Hand Line | all | all | MA | all | 3 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Scottish Seine | all | all | NE | all | 8 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Scottish Seine | all | all | MA | all | 0 |  |  |  |  |  |
| Clam Quahog Dredge | all | all | NE | all | 0 |  |  |  |  |  |
| Clam Quahog Dredge | all | all | MA | all | 0 |  |  |  |  |  |
| Crab Pots | all | all | NE | all | 0 |  |  |  |  |  |
| Crab Pots | all | all | MA | all | 0 |  |  |  |  |  |
| Lobster Pots | all | all | NE | all | 3 | 100.0\% | 100.0\% | 100.0\% | 100.0\% | 100.0\% |
| Lobster Pots | all | all | MA | all | 0 |  |  |  |  |  |

Table 43. Number of observed trips in 2004 and the percent of observed trips with zero incidental takes, by fishing mode, for protected species groups.

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Table 44. Summary of correlation (rho) of the ratio estimate (discard to kept estimator), by fish species group and fishing mode.

SBRM Omnibus Amendment

| Gear Type | Access Area (OpenClosed) | Trip Category (General/L imited) | Region | mesh groups |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all |  |  |  |  | 0.002 | 0.208 |  |  |
| Longline | all | all | MA | all |  |  |  |  |  |  | pilot |  |
| Otter Trawl | all | all | NE | small |  |  | 0.102 | 0.255 | 0.080 | 0.411 |  |  |
| Otter Trawl | all | all | NE | large |  |  | 0.042 | 0.210 | 0.111 | 0.470 |  |  |
| Otter Trawl | all | all | MA | small | 0.044 |  |  | 0.110 | 0.108 | 0.099 |  |  |
| Otter Trawl | all | all | MA | large |  |  |  |  | 0.064 | 0.415 |  |  |
| Scallop Trawl | open | limited | MA | all | 0.981 |  |  |  |  |  | pilot |  |
| Scallop Trawl | open | general | MA | all |  |  |  |  |  | 0.266 | pilot |  |
| Shrimp Trawl | all | all | NE | all |  |  |  |  |  | 0.592 |  |  |
| Shrimp Trawl | all | all | MA | all |  |  |  |  |  | 1.000 | pilot |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | small |  |  |  |  |  |  | pilot |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | large |  | 0.014 |  | 0.014 | 0.292 | 0.265 |  |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg |  | 0.006 |  | 0.018 | 0.108 | 0.244 |  |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 0.006 |  |  |  | 0.042 | 0.977 | pilot for fish |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 0.090 |  |  |  | 0.073 | 0.636 | pilot for fish |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | 0.031 | 0.125 |  | 0.034 | 0.093 | 0.238 | pilot for fish |  |
| Scallop Dredge | open | limited | NE | all | 0.077 |  |  |  | 0.025 | 0.389 |  |  |
| Scallop Dredge | open | limited | MA | all | 0.091 |  |  |  |  | 0.394 |  |  |
| Scallop Dredge | open | general | NE | all |  |  |  |  |  | 0.452 | pilot |  |
| Scallop Dredge | open | general | MA | all |  |  |  |  |  | 0.353 |  |  |
| Scallop Dredge | closed | limited | NE | all | 0.230 |  |  |  | 0.143 | 0.112 |  |  |
| Scallop Dredge | closed | limited | MA | all |  |  |  |  |  | 0.446 |  |  |
| Scallop Dredge | closed | general | NE | all |  |  |  |  |  |  | pilot |  |
| Scallop Dredge | closed | general | MA | all |  |  |  |  |  |  | pilot |  |
| Mid-water paired \& single Trawl | all | all | NE | all |  |  | 0.003 | 0.139 | 0.182 | 0.272 |  |  |
| Mid-water paired \& single Trawl | all | all | MA | all |  |  |  |  |  | 0.203 |  |  |
| Fish Pots/ Traps | all | all | NE | all |  |  |  |  |  |  | pilot |  |
| Fish Pots/ Traps | all | all | MA | all |  |  |  |  |  | 0.686 | pilot |  |
| Purse Seine | all | all | NE | all |  |  |  |  |  | 0.098 |  |  |
| Purse Seine | all | all | MA | all |  |  |  |  |  |  | pilot |  |
| Hand Line | all | all | NE | all |  |  |  |  |  | 0.521 | pilot |  |
| Hand Line | all | all | MA | all |  |  |  |  |  |  | pilot |  |
| Scottish Seine | all | all | NE | all |  |  |  |  |  | 0.109 | pilot |  |
| Clam Quahog Dredge | all | all | NE | all |  |  |  |  |  |  | pilot |  |
| Clam Quahog Dredge | all | all | MA | all |  |  |  |  |  |  | pilot |  |
| Crab Pots | all | all | NE | all |  |  |  |  |  |  | pilot |  |
| Crab Pots | all | all | MA | all |  |  |  |  |  |  | pilot |  |
| Lobster Pots | all | all | NE | all |  |  |  |  |  |  | pilot |  |
| Lobster Pots | all | all | MA | all |  |  |  |  |  |  | pilot |  |

Table 45. Summary of correlation (rho) of the ratio estimate (discard to kept estimator), by protected species group and fishing mode.

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Table 46. The coefficient of variation (CV) of composite annual total discards, by fleet and species group (bold font indicates CV is less or equal to 30 percent) derived from 2004 NEFOP data; see Appendix B, Table B-1 for all species. Note, when bycatch ratio = 0, CV = null(*); blank = no observer coverage.

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Table 47. The coefficient of variation (CV) of composite annual total discard, by fleet and species group (bold font indicates CV is less or equal to $\mathbf{3 0 \%}$ ) derived from 2004 NEFOP data; see Appendix B, Table B-1 for all species. Note, when bycatch ratio = 0, CV = null (*); blank = no observer coverage.

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Table 48. Rank of total discard weight within fleet for fish species groups derived from 2004 NEFOP data; see Appendix B, Table B-2 for all species. Note, "*" indicates no discards of these species occurred.

SBRM Omnibus Amendment


Table 49. Rank of total number of incidental takes within fleet for protected species groups derived from 2004 NEFOP data; see Appendix B, Table B-2 for all species. Note, "*" indicates no discards of these species occurred.

SBRM Omnibus Amendment

| Gear Type | Access <br> Area <br> (Open- <br> Closed) |  | Region | $\begin{aligned} & \begin{array}{l} \text { mesh } \\ \text { groups } \end{array} \end{aligned}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 14 | 13 | - * | 11 | 19 | 21 | 21 | 6 | 16 | 17 | 10 | 22 | 11 | 5 |  |
| Longline | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Otter Trawl | all | all | NE | small | 2 | 2 | * | 2 | 13 | 1 | 4 | 2 | 1 | 3 | 4 | 1 | 8 | 1 |  |
| Otter Trawl | all | all | NE | large | 4 | 5 | * | 1 | 11 | 6 | 3 | 1 | 3 | 1 | 3 | 5 | 6 | 2 |  |
| Otter Trawl | all | all | MA | small | 3 | 7 | * | 6 | 10 | 3 | 11 | 10 | 2 | 6 | 7 | 3 | 5 | 4 |  |
| Otter Trawl | all | all | MA | large | 8 | 9 | * | 11 | 7 | 4 | 10 | 4 | 9 | 5 | 5 | 4 | 3 | 5 |  |
| Scallop Trawl | open | limited | MA | all | 14 | 13 | * | 11 | 3 | 13 | 13 | 5 | 19 | 8 | 23 | 12 | 11 | 5 |  |
| Scallop Trawl | open | general | MA | all | 11 | 13 | * | 3 | 8 | 15 | 14 | 18 | 13 | 10 | 13 | 17 | 11 | 5 |  |
| Shrimp Trawl | all | all | NE | all | 14 | 3 | * | 11 | 16 | 20 | 19 | 12 | 5 | 18 | 22 | 22 | 11 | 5 |  |
| Shrimp Trawl | all | all | MA | all | * | * | * | * | * | * | * | * | * | * | * | * | * | + |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 14 | 13 | * | 11 | 19 | 12 | 21 | 23 | 19 | 22 | 20 | 22 | 11 | 5 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 7 | 6 | * | 4 | 17 | 11 | 15 | 3 | 10 | 15 | 2 | 18 | 11 | 5 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | x 1 g | 5 | 8 | * | 5 | 15 | 9 | 5 | 7 | 11 | 11 | 8 | 10 | 11 | 3 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 14 | 13 | * | 11 | 19 | 5 | 21 | 23 | 19 | 22 | 6 | 14 | 11 | 5 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 1 | 13 | * | 11 | 19 | 21 | 21 | 15 | 19 | 16 | 1 | 22 | 11 | 5 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | $\times \mathrm{lg}$ | 6 | 13 | * | 11 | 14 | 21 | 12 | 23 | 19 | 14 | 12 | 16 | 11 | 5 |  |
| Scallop Dredge | open | limited | NE | all | 14 | 13 | * | 7 | 2 | 7 | 1 | 8 | 4 | 2 | 16 | 6 | 1 | 5 |  |
| Scallop Dredge | open | limited | MA | all | 14 | 13 | * | 8 | 1 | 10 | 2 | 11 | 7 | 4 | 14 | 7 | 2 | 5 |  |
| Scallop Dredge | open | general | NE | all | 14 | 13 | * | 11 | 9 | 19 | 6 | 16 | 12 | 13 | 19 | 15 | 7 | 5 |  |
| Scallop Dredge | open | general | MA | all | 14 | 13 | * | 11 | 6 | 18 | 9 | 14 | 15 | 7 | 21 | 11 | 4 | 5 |  |
| Scallop Dredge | closed | limited | NE | all | 10 | 12 | * | 9 | 4 | 14 | 7 | 9 | 8 | 9 | 17 | 8 | 9 | 5 |  |
| Scallop Dredge | closed | limited | MA | all | 13 | 11 | * | 10 | 5 | 16 | 8 | 19 | 17 | 12 | 18 | 9 | 10 | 5 |  |
| Scallop Dredge | closed | general | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Scallop Dredge | closed | general | MA | all | 14 | 13 | * | 11 | 12 | 21 | 16 | 23 | 19 | 19 | 23 | 19 | 11 | 5 |  |
| Mid-water paired \& single Trawl | all | all | NE | all | 9 | 1 | * | 11 | 18 | 2 | 17 | 13 | 6 | 20 | 9 | 21 | 11 | 5 |  |
| Mid-water paired \& single Trawl | all | all | MA | all | 12 | 10 | * | 11 | 19 | 8 | 18 | 22 | 18 | 22 | 15 | 20 | 11 | 5 |  |
| Fish Pots/ Traps | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fish Pots/ Traps | all | all | MA | all | 14 | 13 | * | 11 | 19 | 21 | 20 | 23 | 19 | 22 | 23 | 2 | 11 | 5 |  |
| Purse Seine | all | all | NE | all | 14 | 4 | * | 11 | 19 | 17 | 21 | 21 | 19 | 22 | 11 | 22 | 11 | 5 |  |
| Purse Seine | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Hand Line | all | all | NE | all | 14 | 13 | * | 11 | 19 | 21 | 21 | 17 | 19 | 22 | 23 | 22 | 11 | 5 |  |
| Hand Line | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Scottish Seine | all | all | NE | all | 14 | 13 | * | 11 | 19 | 21 | 21 | 20 | 14 | 21 | 23 | 13 | 11 | 5 |  |
| Clam Quahog Dredge | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Clam Quahog Dredge | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Crab Pots | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Crab Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lobster Pots | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lobster Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Table 50. Rank of total discard weight within species group for fish species groups derived from 2004 NEFOP data; see Appendix B, Table B-3 for all species. Note, "*" indicates no discards of these species occurred.


Table 51. Rank of total number of incidental takes within species group for protected species groups derived from 2004 NEFOP data; see Appendix B, Table B-3 for all species. Note, "*" indicates no discards of these species occurred.


Table 52. Number of sea days needed to achieve a 30 percent CV based on the composite annual total discards and the 2004 observed sea days for fish species, by fishing mode and species group; see Appendix B, Table B-4 for all species.

| Gear Type | Access <br> Area <br> (Open- <br> Closed) | Trip Category (General/ Limited) | Region | $\begin{gathered} \text { mesh } \\ \text { groups } \end{gathered}$ | 2004 OB PSPP sea days |  |  |  |  | s" $5^{s^{\prime}}$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 133 | 35 | 53 | 35 | 35 | 267 | 57 |  |
| Longline | all | all | MA | all | 11 | 76 | 76 | 76 | 76 | 76 | 76 |  |
| Otter Trawl | all | all | NE | small | 577 | 211 | 211 | 3082 | 2265 | 1870 | 183 |  |
| Otter Trawl | all | all | NE | large | 1947 | 730 | 730 | 10526 | 2111 | 3237 | 159 |  |
| Otter Trawl | all | all | MA | small | 499 | 1229 | 196 | 196 | 1164 | 1880 | 250 |  |
| Otter Trawl | all | all | MA | large | 186 | 342 | 342 | 342 | 342 | 727 | 55 |  |
| Scallop Trawl | open | limited | MA | all | 22 | 95 | 95 | 95 | 95 | 95 | 95 |  |
| Scallop Trawl | open | general | MA | all | 71 | 51 | 51 | 51 | 51 | 51 | 38 |  |
| Shrimp Trawl | all | all | NE | all | 12 | 42 | 42 | 42 | 42 | 42 | 39 |  |
| Shrimp Trawl | all | all | MA | all | 2 | 76 | -76 | 76 | 76 | 76 | 55 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 1 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 876 | 141 | 531 | 141 | 1398 | 1306 | 82 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 701 | 144 | 470 | 144 | 806 | 2661 | 59 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 375 | 1259 | 62 | 62 | 62 | 880 | 62 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 85 | 653 | 29 | 29 | 29 | 311 | 95 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | 152 | 468 | 804 | 68 | 1272 | 806 | 51 |  |
| Scallop Dredge | open | limited | NE | all | 457 | 1261 | 269 | 269 | 269 | 3194 | 123 |  |
| Scallop Dredge | open | limited | MA | all | 675 | 3956 | 329 | 329 | 329 | 329 | 89 |  |
| Scallop Dredge | open | general | NE | all | 24 | 92 | 92 | 92 | 92 | 92 | 88 |  |
| Scallop Dredge | open | general | MA | all | 55 | 96 | 96 | 96 | 96 | 96 | 14 |  |
| Scallop Dredge | closed | limited | NE | all | 805 | 414 | 139 | 139 | 139 | 407 | 130 |  |
| Scallop Dredge | closed | limited | MA | all | 373 | 108 | 108 | 108 | 108 | 108 | 61 |  |
| Scallop Dredge | closed | general | NE | all | 0 | 24 | 24 | 24 | 24 | 24 | 24 |  |
| Scallop Dredge | closed | general | MA | all | 2 | 21 | 21 | 21 | 21 | 21 | 21 |  |
| Mid-water paired \& single Trawl | all | all | NE | all | 242 | 56 | 56 | 1606 | 1464 | 808 | 193 |  |
| Mid-water paired \& single Trawl | all | all | MA | all | 42 | 35 | 35 | 35 | 35 | 35 | 111 |  |
| Fish Pots/ Traps | all | all | NE | all | 0 | 20 | 20 | 20 | 20 | 20 | 20 |  |
| Fish Pots/ Traps | all | all | MA | all | 9 | 40 | 40 | 40 | 40 | 40 | 37 |  |
| Purse Seine | all | all | NE | all | 53 | 19 | 19 | 19 | 19 | 19 | 143 |  |
| Purse Seine | all | all | MA | all | 2 | 9 | - 9 | 9 | 9 | 9 |  | 9 |
| Hand Line | all | all | NE | all | 18 | 72 | 72 | 72 | 72 | 72 | 137 |  |
| Hand Line | all | all | MA | all | 11 | 133 | 133 | 133 | 133 | 133 | 133 |  |
| Scottish Seine | all | all | NE | all | 8 | 12 | -12 | 12 | 12 | 12 | 20 |  |
| Clam Quahog Dredge | all | all | NE | all | 0 | 50 | 50 | 50 | 50 | 50 | 50 |  |
| Clam Quahog Dredge | all | all | MA | all | 0 | 84 | -84 | 84 | 84 | 84 | 84 |  |
| Crab Pots | all | all | NE | all | 0 | 101 | 101 | 101 | 101 | 101 | 101 |  |
| Crab Pots | all | all | MA | all | 0 | 28 | 28 | 28 | 28 | 28 | 28 |  |
| Lobster Pots | all | all | NE | all | 3 | 439 | 439 | 439 | 439 | 439 | 439 |  |
| Lobster Pots | all | all | MA | all | 0 | 89 | 89 | 89 | 89 | 89 | 89 |  |
| Total Sea Days |  |  |  |  | 8,429 | 12,721 | 6,025 | 18,791 | 13,507 | 20,503 | 3,513 |  |
| Total Sea Days excluding shaded cells |  |  |  |  |  | 12,721 | 4,742 | 17,714 | 13,507 | 20,503 | 3,513 |  |

Table 53. Number of sea days needed to achieve a 30 percent CV based on the composite annual total discards and the 2004 observed sea days for protected species, by fishing mode and species group; see Appendix B, Table B-4 for all species.


Table 54. Number of trips needed to achieve a 30 percent CV based on composite annual total discards and the 2004 observed trips of fish species, by fishing mode and species group; see Appendix B, Table B-5 for all species.

SBRM Omnibus Amendment

| Gear Type | Access Area (OpenClosed) | Trip Category (General/ Limited) | Region | $\begin{gathered} \text { mesh } \\ \text { groups } \end{gathered}$ |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 119 | 26 | 26 | 26 | 26 | 208 | 44 |
| Longline | all | all | MA | all | 2 | 12 | 12 | 12 | 12 | 12 | 12 |
| Otter Trawl | all | all | NE | small | 200 | 70 | 70 | 1016 | 747 | 617 | 60 |
| Otter Trawl | all | all | NE | large | 539 | 304 | 304 | 4435 | 890 | 1364 | 67 |
| Otter Trawl | all | all | MA | small | 205 | 654 | 104 | 104 | 620 | 1001 | 133 |
| Otter Trawl | all | all | MA | large | 76 | 177 | 177 | 177 | 177 | 377 | 29 |
| Scallop Trawl | open | limited | MA | all | 3 | 12 | 12 | 12 | 12 | 12 | 12 |
| Scallop Trawl | open | general | MA | all | 39 | 25 | 25 | 25 | 25 | 25 | 18 |
| Shrimp Trawl | all | all | NE | all | 12 | 42 | 42 | 42 | 42 | 42 | 38 |
| Shrimp Trawl | all | all | MA | all | 2 | 13 | 13 | 13 | 13 | 13 | 9 |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 1 | 12 | 12 | 12 | 12 | 12 | 12 |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 772 | 104 | 392 | 104 | 1032 | 964 | 61 |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 569 | 94 | 308 | 94 | 528 | 1742 | 38 |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 358 | 1195 | 58 | 58 | 58 | 835 | 58 |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 81 | 604 | 27 | 27 | 27 | 288 | 91 |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | 142 | 351 | 604 | 51 | 955 | 605 | 39 |
| Scallop Dredge | open | limited | NE | all | 36 | 115 | 25 | 25 | 25 | 292 | 11 |
| Scallop Dredge | open | limited | MA | all | 78 | 439 | 36 | 36 | 36 | 36 | 10 |
| Scallop Dredge | open | general | NE | all | 20 | 71 | 71 | 71 | 71 | 71 | 69 |
| Scallop Dredge | open | general | MA | all | 39 | 69 | 69 | 69 | 69 | 69 | 10 |
| Scallop Dredge | closed | limited | NE | all | 86 | 48 | 15 | 15 | 15 | 47 | 15 |
| Scallop Dredge | closed | limited | MA | all | 35 | 12 | 12 | 12 | 12 | 12 | 7 |
| Scallop Dredge | closed | general | NE | all | 0 | 12 | 12 | 12 | 12 | 12 | 12 |
| Scallop Dredge | closed | general | MA | all | 1 | 15 | 15 | 15 | 15 | 15 | 15 |
| Mid-water paired \& single Trawl | all | all | NE | all | 99 | 21 | 21 | 612 | 558 | 308 | 73 |
| Mid-water paired \& single Trawl | all | all | MA | all | 14 | 12 | 12 | 12 | 12 | 12 | 32 |
| Fish Pots/ Traps | all | all | NE | all | 0 | 19 | 19 | 19 | 19 | 19 | 19 |
| Fish Pots/ Traps | all | all | MA | all | 8 | 37 | 37 | 37 | 37 | 37 | 34 |
| Purse Seine | all | all | NE | all | 26 | 10 | 10 | 10 | 10 | 10 | 71 |
| Purse Seine | all | all | MA | all | 2 | 9 | 9 | 9 | 9 | 9 | 9 |
| Hand Line | all | all | NE | all | 9 | 68 | 68 | 68 | 68 | 68 | 129 |
| Hand Line | all | all | MA | all | 3 | 126 | 126 | 126 | 126 | 126 | 126 |
| Scottish Seine | all | all | NE | all | 8 | 12 | 12 | 12 | 12 | 12 | 20 |
| Clam Quahog Dredge | all | all | NE | all | 0 | 69 | 69 | 69 | 69 | 69 | 69 |
| Clam Quahog Dredge | all | all | MA | all | 0 | 69 | 69 | 69 | 69 | 69 | 69 |
| Crab Pots | all | all | NE | all | 0 | 12 | 12 | 12 | 12 | 12 | 12 |
| Crab Pots | all | all | MA | all | 0 | 27 | 27 | 27 | 27 | 27 | 27 |
| Lobster Pots | all | all | NE | all | 3 | 353 | 353 | 353 | 353 | 353 | 353 |
| Lobster Pots | all | all | MA | all | 0 | 75 | 75 | 75 | 75 | 75 | 75 |
| Total Trips |  |  |  |  | 3,587 | 5,397 | 3,360 | 7,975 | 6,887 | 9,877 | 1,992 |
| Total Trips excluding shaded cells |  |  |  |  |  | 5,397 | 3,023 | 7,720 | 6,887 | 9,877 | 1,992 |

Table 55. Number of fishing trips needed to achieve a 30 percent CV based on composite annual total discards and the 2004 observed trips for protected species, by fishing mode and species group; see Appendix B, Table B-5 for all species.

SBRM Omnibus Amendment

| Gear Type | Access Area (OpenClosed) | Trip Category (General/L imited) | Region | $\begin{aligned} & \text { mesh } \\ & \text { groups } \end{aligned}$ | $\begin{array}{\|\|l\|} 2004 \text { OB } \\ \text { FISH } \\ \text { sea days } \\ \hline \end{array}$ | $\begin{aligned} & 2004 \text { OB } \\ & \text { PSPP } \\ & \text { sea days } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 12 | 133 |
| Longline | all | all | MA | all | 0 | 11 |
| Otter Trawl | all | all | NE | small | 449 | 577 |
| Otter Trawl | all | all | NE | large | 1076 | 1947 |
| Otter Trawl | all | all | MA | small | 471 | 499 |
| Otter Trawl | all | all | MA | large | 183 | 186 |
| Scallop Trawl | open | limited | MA | all | 11 | 22 |
| Scallop Trawl | open | general | MA | all | 56 | 71 |
| Shrimp Trawl | all | all | NE | all | 12 | 12 |
| Shrimp Trawl | all | all | MA | all | 2 | 2 |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 1 | 1 |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 657 | 876 |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 533 | 701 |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 3 | 375 |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 4 | 85 |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | 30 | 152 |
| Scallop Dredge | open | limited | NE | all | 344 | 457 |
| Scallop Dredge | open | limited | MA | all | 591 | 675 |
| Scallop Dredge | open | general | NE | all | 11 | 24 |
| Scallop Dredge | open | general | MA | all | 33 | 55 |
| Scallop Dredge | closed | limited | NE | all | 805 | 805 |
| Scallop Dredge | closed | limited | MA | all | 373 | 373 |
| Scallop Dredge | closed | general | NE | all | 0 | 0 |
| Scallop Dredge | closed | general | MA | all | 2 | 2 |
| Mid-water paired \& single Trawl | all | all | NE | all | 165 | 242 |
| Mid-water paired \& single Trawl | all | all | MA | all | 39 | 42 |
| Fish Pots/ Traps | all | all | NE | all | 0 | 0 |
| Fish Pots/ Traps | all | all | MA | all | 6 | 9 |
| Purse Seine | all | all | NE | all | 33 | 53 |
| Purse Seine | all | all | MA | all | 0 | 2 |
| Hand Line | all | all | NE | all | 6 | 18 |
| Hand Line | all | all | MA | all | 0 | 11 |
| Scottish Seine | all | all | NE | all | 5 | 8 |
| Clam Quahog Dredge | all | all | NE | all | 0 | 0 |
| Clam Quahog Dredge | all | all | MA | all | 0 | 0 |
| Crab Pots | all | all | NE | all | 0 | 0 |
| Crab Pots | all | all | MA | all | 0 | 0 |
| Lobster Pots | all | all | NE | all | 0 | 3 |
| Lobster Pots | all | all | MA | all | 0 | 0 |
| Total Sea Days |  |  |  |  | 5,913 | 8,429 |


| BASELINE |  |
| :---: | :---: |
| Sea days needed for 20 species groups by fleet | Sea days needed for 15 species groups by fleet |
| 267 | 185 |
| 76 | 76 |
| 3822 | 3822 |
| 26644 | 26644 |
| 5417 | 5417 |
| 3625 | 3625 |
| 95 | 95 |
| 443 | 443 |
| 364 | 364 |
| 76 | 76 |
| 12 | 12 |
| 4357 | 4357 |
| 3266 | 3266 |
| 1259 | 1259 |
| 653 | 653 |
| 1272 | 468 |
| 3194 | 1596 |
| 8713 | 8713 |
| 204 | 204 |
| 293 | 293 |
| 3861 | 3861 |
| 1777 | 1777 |
| 24 | 24 |
| 21 | 21 |
| 1793 | 1793 |
| 557 | 557 |
| 20 | 20 |
| 103 | 103 |
| 219 | 219 |
| 9 | 9 |
| 137 | 137 |
| 133 | 133 |
| 30 | 30 |
| 50 | 50 |
| 84 | 84 |
| 101 | 101 |
| 28 | 28 |
| 439 | 439 |
| 89 | 89 |
| 73,524 | 71,041 |


| FILTER APPLIED |  |
| :---: | :---: |
|  |  |
| Sea days needed for 20 species groups by fleet | Sea days needed for 15 species groups by fleet |
| 267 | 185 |
| 76 | 76 |
| 3082 | 2024 |
| 26644 | 26644 |
| 3057 | 3057 |
| 3625 | 3625 |
| 95 | 95 |
| 443 | 443 |
| 364 | 364 |
| 76 | 76 |
| 12 | 12 |
| 3767 | 3767 |
| 2661 | 2059 |
| 1259 | 1259 |
| 653 | 653 |
| 1272 | 468 |
| 3194 | 1596 |
| 3956 | 3956 |
| 204 | 204 |
| 124 | 124 |
| 1473 | 1473 |
| 1136 | 1136 |
| 24 | 24 |
| 21 | 21 |
| 1606 | 1218 |
| 492 | 492 |
| 20 | 20 |
| 40 | 40 |
| 219 | 219 |
| 9 | 9 |
| 137 | 137 |
| 133 | 133 |
| 30 | 30 |
| 50 | 50 |
| 84 | 84 |
| 101 | 101 |
| 28 | 28 |
| 439 | 439 |
| 89 | 89 |
| 60,959 | 56,427 |

Table 56. The maximum number of sea days (baseline and filtered) needed to achieve a 30 percent CV based on the composite annual total discards for any of the species groups ( 20 species groups) and for any of the fish and turtle species groups ( 15 species groups), by fishing mode. Filtered values exclude gray-shaded cells within a fishing mode. The 2004 observed sea days for fish species and protected species are presented for comparison.

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| Gear Type | Access Area (OpenClosed) | Trip Category (General/ Limited) | Region | mesh groups | 2004 OB FISH TRIPS | 2004 OB PSPP TRIPS |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 12 | 119 |
| Longline | all | all | MA | all | 0 | 2 |
| Otter Trawl | all | all | NE | small | 142 | 200 |
| Otter Trawl | all | all | NE | large | 386 | 539 |
| Otter Trawl | all | all | MA | small | 194 | 205 |
| Otter Trawl | all | all | MA | large | 75 | 76 |
| Scallop Trawl | open | limited | MA | all | 1 | 3 |
| Scallop Trawl | open | general | MA | all | 31 | 39 |
| Shrimp Trawl | all | all | NE | all | 12 | 12 |
| Shrimp Trawl | all | all | MA | all | 2 | 2 |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 1 | 1 |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 577 | 772 |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 445 | 569 |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 3 | 358 |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 4 | 81 |
| Sink, Anchor, Drift Gillnet | all | all | MA | x lg | 27 | 142 |
| Scallop Dredge | open | limited | NE | all | 26 | 36 |
| Scallop Dredge | open | limited | MA | all | 69 | 78 |
| Scallop Dredge | open | general | NE | all | 9 | 20 |
| Scallop Dredge | open | general | MA | all | 22 | 39 |
| Scallop Dredge | closed | limited | NE | all | 86 | 86 |
| Scallop Dredge | closed | limited | MA | all | 35 | 35 |
| Scallop Dredge | closed | general | NE | all | 0 | 0 |
| Scallop Dredge | closed | general | MA | all | 1 | 1 |
| Mid-water paired \& single Trawl | all | all | NE | all | 66 | 99 |
| Mid-water paired \& single Trawl | all | all | MA | all | 13 | 14 |
| Fish Pots/ Traps | all | all | NE | all | 0 | 0 |
| Fish Pots/ Traps | all | all | MA | all | 6 | 8 |
| Purse Seine | all | all | NE | all | 16 | 26 |
| Purse Seine | all | all | MA | all | 0 | 2 |
| Hand Line | all | all | NE | all | 6 | 9 |
| Hand Line | all | all | MA | all | 0 | 3 |
| Scottish Seine | all | all | NE | all | 5 | 8 |
| Clam Quahog Dredge | all | all | NE | all | 0 | 0 |
| Clam Quahog Dredge | all | all | MA | all | 0 | 0 |
| Crab Pots | all | all | NE | all | 0 | 0 |
| Crab Pots | all | all | MA | all | 0 | 0 |
| Lobster Pots | all | all | NE | all | 0 | 3 |
| Lobster Pots | all | all | MA | all | 0 | 0 |
| Total Trips |  |  |  |  | 2,272 | 3,587 |


| Trips needed for 20 species groups by fleet |
| :---: |
| 208 |
| 12 |
| 1260 |
| 11227 |
| 2885 |
| 1879 |
| 12 |
| 216 |
| 361 |
| 13 |
| 12 |
| 3216 |
| 2139 |
| 1195 |
| 604 |
| 955 |
| 292 |
| 966 |
| 149 |
| 210 |
| 449 |
| 194 |
| 12 |
| 15 |
| 683 |
| 160 |
| 19 |
| 97 |
| 108 |
| 9 |
| 129 |
| 126 |
| 30 |
| 69 |
| 69 |
| 12 |
| 27 |
| 353 |
| 75 |
| 30,450 |



| Trips needed for 20 species groups by fleet | Trips needed for 15 species groups by fleet |
| :---: | :---: |
| 208 | 144 |
| 12 | 12 |
| 1016 | 668 |
| 11227 | 11227 |
| 1628 | 1628 |
| 1879 | 1879 |
| 12 | 12 |
| 216 | 216 |
| 361 | 361 |
| 13 | 13 |
| 12 | 12 |
| 2780 | 2780 |
| 1742 | 1348 |
| 1195 | 1195 |
| 604 | 604 |
| 955 | 351 |
| 292 | 146 |
| 439 | 439 |
| 149 | 149 |
| 89 | 89 |
| 171 | 171 |
| 124 | 124 |
| 12 | 12 |
| 15 | 15 |
| 612 | 464 |
| 141 | 141 |
| 19 | 19 |
| 37 | 37 |
| 108 | 108 |
| 9 | 9 |
| 129 | 129 |
| 126 | 126 |
| 30 | 30 |
| 69 | 69 |
| 69 | 69 |
| 12 | 12 |
| 27 | 27 |
| 353 | 353 |
| 75 | 75 |
| 26,971 | 25,266 |

Table 57. The maximum number of trips (baseline and filtered) needed to achieve a 30 percent CV based on composite annual total discards for any of the species groups ( 20 species groups) and for any of the fish and turtle species groups ( 15 species groups). Filtered values exclude gray-shaded cells within a fishing mode. The 2004 observed sea days for fish species and protected species are presented for comparison.

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| Species | $\begin{array}{c\|} \hline \text { VTR - OB } \\ \text { Avg Kept } \\ \hline \end{array}$ | N | SE | t-value | $\operatorname{Pr}>\|t\|$ | $\begin{array}{r} \hline \text { VTR-OB SD } \\ \text { Kept } \end{array}$ | N | SE | t-value | $\operatorname{Pr}>\|t\|$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Bluefish | 192.04 | 89 | 127.171 | 1.51 | 0.135 | 324.19 | 79 | 157.262 | 2.06 | 0.043 |
| Dogfish | -15.70 | 89 | 17.962 | -0.87 | 0.385 | 30.65 | 79 | 14.318 | 2.14 | 0.035 |
| Fluke-Scup-Blk Sea Bass | -51.04 | 89 | 54.436 | -0.94 | 0.351 | 157.76 | 79 | 76.790 | 2.05 | 0.043 |
| NE Multi-species Large mesh | -357.86 | 89 | 134.004 | -2.67 | 0.009 | -476.10 | 79 | 220.113 | -2.16 | 0.034 |
| NE Multi-species Small mesh | 157.08 | 89 | 64.444 | 2.44 | 0.017 | 508.04 | 79 | 153.252 | 3.32 | 0.001 |
| Herring | -2317.45 | 89 | 1722.540 | -1.35 | 0.182 | -629.71 | 79 | 1485.460 | -0.42 | 0.673 |
| Monkfish | -152.02 | 89 | 79.585 | -1.91 | 0.059 | -231.12 | 79 | 167.885 | -1.38 | 0.173 |
| Red crab | 0.00 | 89 | 0.006 | 0.31 | 0.754 | 0.08 | 79 | 0.093 | 0.86 | 0.395 |
| Mackerel-Squid-Butterfish | -11705.74 | 89 | 8118.610 | -1.44 | 0.153 | 860.00 | 79 | 4483.930 | 0.19 | 0.848 |
| Scallop | -608.13 | 89 | 1730.680 | -0.35 | 0.726 | 5098.35 | 79 | 1631.770 | 3.12 | 0.003 |
| Surf Clam/Ocean Quahog | 0.00 | 89 | 0.007 | -0.73 | 0.466 | 0.00 | 79 | 0.060 | -0.02 | 0.986 |
| Skate Complex | -47.31 | 89 | 33.559 | -1.41 | 0.162 | 26.24 | 79 | 82.646 | 0.32 | 0.752 |
| Tilefish | 97.62 | 89 | 89.291 | 1.09 | 0.277 | 90.44 | 79 | 57.857 | 1.56 | 0.122 |
| All species | -16787.50 | 89 | 8372.200 | -2.01 | 0.048 | 1864.35 | 79 | 4740.290 | 0.39 | 0.695 |
|  |  |  |  |  |  |  |  |  |  |  |
|  | VTR - OB <br> Avg Trip <br> Duration | N | SE | t-value | $\operatorname{Pr}>\|t\|$ | VTR-OB SD <br> Trip Duration | N | SE | t-value | $\operatorname{Pr}>\|t\|$ |
|  | -0.2133396 | 89.000 | 0.15309 | -1.390 | 0.167 | 0.2989122 | 79.000 | 0.094976 | 3.150 | 0.002 |

Table 58. Summary of statistical comparisons of differences in average kept pounds, standard error of average kept pounds (SE), average trip duration, and standard deviation of average trip duration between 2004 FVTR and observer (OB) trips.

| Quarter | Gear | Acces Area | Region | Mesh | $\begin{gathered} \text { Trip } \\ \text { Duration } \\ \hline \end{gathered}$ | df | $\begin{aligned} & \text { Chi Sqr } \\ & \text { Test } \\ & \text { Statistic } \end{aligned}$ | Chi Sqr Crit Value | Signif Level |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 4 | Longline | N/A | MA | all | all | 3 | 0.215 | 7.815 | 0.9751 |
| 1 | Longline | N/A | NE | all | all | 7 | 2.844 | 14.067 | 0.8991 |
| 2 | Longline | N/A | NE | all | all | 4 | 2.500 | 9.488 | 0.6446 |
| 3 | Longline | N/A | NE | all | all | 10 | 5.291 | 18.307 | 0.8709 |
| 4 | Longline | N/A | NE | all | all | 10 | 40.599 | 18.307 | 0.0000 |
| 2 | Handline | N/A | MA | all | all | 18 | 92.581 | 28.869 | 0.0000 |
| 3 | Handline | N/A | NE | all | all | 21 | 5.024 | 32.671 | 0.9999 |
| 4 | Handline | N/A | NE | all | all | 13 | 2.267 | 22.362 | 0.9995 |
| 1 | Otter Trawl | N/A | MA | 1 g | all | 25 | 44.504 | 37.652 | 0.0095 |
| 1 | Otter Trawl | N/A | MA | sm | all | 19 | 63.025 | 30.144 | 0.0000 |
| 2 | Otter Trawl | N/A | MA | 1 g | all | 20 | 37.788 | 31.410 | 0.0094 |
| 2 | Otter Trawl | N/A | MA | sm | all | 22 | 228.933 | 33.924 | 0.0000 |
| 3 | Otter Trawl | N/A | MA | 1 g | all | 17 | 120.121 | 27.587 | 0.0000 |
| 3 | Otter Trawl | N/A | MA | sm | all | 22 | 271.477 | 33.924 | 0.0000 |
| 4 | Otter Trawl | N/A | MA | Ig | all | 21 | 16.469 | 32.671 | 0.7427 |
| 4 | Otter Trawl | N/A | MA | sm | all | 19 | 88.007 | 30.144 | 0.0000 |
| 1 | Otter Trawl | N/A | NE | lg | all | 23 | 242.863 | 35.172 | 0.0000 |
| 1 | Otter Trawl | N/A | NE | sm | all | 24 | 181.785 | 36.415 | 0.0000 |
| 2 | Otter Trawl | N/A | NE | lg | all | 24 | 155.561 | 36.415 | 0.0000 |
| 2 | Otter Trawl | N/A | NE | sm | all | 25 | 133.612 | 37.652 | 0.0000 |
| 3 | Otter Trawl | N/A | NE | lg | all | 23 | 302.233 | 35.172 | 0.0000 |
| 3 | Otter Trawl | N/A | NE | sm | all | 26 | 42.856 | 38.885 | 0.0200 |
| 4 | Otter Trawl | N/A | NE | Ig | all | 26 | 250.108 | 38.885 | 0.0000 |
| 4 | Otter Trawl | N/A | NE | sm | all | 26 | 152.285 | 38.885 | 0.0000 |
| 2 | Scallop Trawl | OPEN | MA | all | GEN | 11 | 310.000 | 19.675 | 0.0000 |
| 3 | Scallop Trawl | OPEN | MA | all | GEN | 10 | 4.431 | 18.307 | 0.9258 |
| 4 | Scallop Trawl | OPEN | MA | all | GEN | 10 | 120.884 | 18.307 | 0.0000 |
| 1 | Shrimp Trawl | N/A | NE | all | all | 7 | 33.307 | 14.067 | 0.0000 |
| 1 | Gillnets | N/A | MA | 1 g | all | 6 | 2.278 | 12.592 | 0.8925 |
| 1 | Gillnets | N/A | MA | sm | all | 12 | 10.915 | 21.026 | 0.5362 |
| 1 | Gillnets | N/A | MA | xlg | all | 12 | 76.243 | 21.026 | 0.0000 |
| 2 | Gillnets | N/A | MA | 1 g | all | 12 | 45.891 | 21.026 | 0.0000 |
| 2 | Gillnets | N/A | MA | sm | all | 13 | 358.693 | 22.362 | 0.0000 |
| 2 | Gillnets | N/A | MA | xlg | all | 16 | 36.796 | 26.296 | 0.0022 |
| 3 | Gillnets | N/A | MA | 1 g | all | 8 | 46.832 | 15.507 | 0.0000 |
| 3 | Gillnets | N/A | MA | sm | all | 16 | 55.543 | 26.296 | 0.0000 |
| 3 | Gillnets | N/A | MA | xlg | all | 9 | 4.674 | 16.919 | 0.8617 |
| 4 | Gillnets | N/A | MA | 1 g | all | 16 | 37.909 | 26.296 | 0.0016 |
| 4 | Gillnets | N/A | MA | sm | all | 14 | 28.583 | 23.685 | 0.0119 |
| 4 | Gillnets | N/A | MA | xlg | all | 12 | 8.187 | 21.026 | 0.7704 |
| 1 | Gillnets | N/A | NE | 1 lg | all | 9 | 9.442 | 16.919 | 0.3975 |
| 1 | Gillnets | N/A | NE | xlg | all | 11 | 14.015 | 19.675 | 0.2322 |
| 2 | Gillnets | N/A | NE | 1 lg | all | 13 | 85.201 | 22.362 | 0.0000 |
| 2 | Gillnets | N/A | NE | xlg | all | 19 | 54.954 | 30.144 | 0.0000 |
| 3 | Gillnets | N/A | NE | 1 g | all | 16 | 228.757 | 26.296 | 0.0000 |
| 3 | Gillnets | N/A | NE | xlg | all | 16 | 108.983 | 26.296 | 0.0000 |
| 4 | Gillnets | N/A | NE | lg | all | 15 | 102.635 | 24.996 | 0.0000 |
| 4 | Gillnets | N/A | NE | xlg | all | 15 | 83.781 | 24.996 | 0.0000 |


| Quarter | Gear | Acces Area | Region | Mesh | $\begin{aligned} & \text { Trip } \\ & \text { Duration } \end{aligned}$ | df | $\begin{aligned} & \hline \text { Chi Sqr } \\ & \text { Test } \\ & \text { Statistic } \end{aligned}$ | Chi Sqr Crit Value | Signif Level |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2 | Purse Seine | N/A | NE | all | all | 1 | 0.048 | 3.841 | 0.8257 |
| 3 | Purse Seine | N/A | NE | all | all | 3 | 1.673 | 7.815 | 0.6429 |
| 4 | Purse Seine | N/A | NE | all | all | 3 | 4.540 | 7.815 | 0.2087 |
| 1 | Scallop Dredge | CLOSE | MA | all | LIM | 1 | 6.722 | 3.841 | 0.0095 |
| 2 | Scallop Dredge | CLOSE | MA | all | LIM | 1 | 0.727 | 3.841 | 0.3938 |
| 3 | Scallop Dredge | CLOSE | MA | all | LIM | 1 | 5.009 | 3.841 | 0.0252 |
| 4 | Scallop Dredge | CLOSE | MA | all | GEN | 1 | 19.083 | 3.841 | 0.0000 |
| 4 | Scallop Dredge | CLOSE | MA | all | LIM | 3 | 14.834 | 7.815 | 0.0020 |
| 1 | Scallop Dredge | CLOSE | NE | all | LIM | 1 | 8.000 | 3.841 | 0.0047 |
| 2 | Scallop Dredge | CLOSE | NE | all | LIM | 1 | 11.701 | 3.841 | 0.0006 |
| 3 | Scallop Dredge | CLOSE | NE | all | LIM | 1 | 10.000 | 3.841 | 0.0016 |
| 4 | Scallop Dredge | CLOSE | NE | all | LIM | 3 | 412.873 | 7.815 | 0.0000 |
| 1 | Scallop Dredge | OPEN | MA | all | LIM | 9 | 2.266 | 16.919 | 0.9865 |
| 2 | Scallop Dredge | OPEN | MA | all | GEN | 15 | 2.931 | 24.996 | 0.9997 |
| 2 | Scallop Dredge | OPEN | MA | all | LIM | 14 | 37.021 | 23.685 | 0.0007 |
| 3 | Scallop Dredge | OPEN | MA | all | GEN | 14 | 20.087 | 23.685 | 0.1274 |
| 3 | Scallop Dredge | OPEN | MA | all | LIM | 15 | 18.187 | 24.996 | 0.2530 |
| 4 | Scallop Dredge | OPEN | MA | all | GEN | 12 | 10.077 | 21.026 | 0.6092 |
| 4 | Scallop Dredge | OPEN | MA | all | LIM | 15 | 6.035 | 24.996 | 0.9792 |
| 1 | Scallop Dredge | OPEN | NE | all | GEN | 12 | 1.175 | 21.026 | 1.0000 |
| 1 | Scallop Dredge | OPEN | NE | all | LIM | 15 | 28.176 | 24.996 | 0.0205 |
| 2 | Scallop Dredge | OPEN | NE | all | LIM | 17 | 15.682 | 27.587 | 0.5464 |
| 3 | Scallop Dredge | OPEN | NE | all | GEN | 17 | 75.386 | 27.587 | 0.0000 |
| 3 | Scallop Dredge | OPEN | NE | all | LIM | 15 | 34.112 | 24.996 | 0.0033 |
| 4 | Scallop Dredge | OPEN | NE | all | GEN | 15 | 30.304 | 24.996 | 0.0109 |
| 4 | Scallop Dredge | OPEN | NE | all | LIM | 14 | 20.032 | 23.685 | 0.1291 |
| 1 | Mid-water Trawls | N/A | MA | all | all | 9 | 3.455 | 16.919 | 0.9435 |
| 1 | Mid-water Trawls | N/A | NE | all | all | 13 | 12.966 | 22.362 | 0.4505 |
| 2 | Mid-water Trawls | N/A | NE | all | all | 12 | 6.588 | 21.026 | 0.8836 |
| 3 | Mid-water Trawls | N/A | NE | all | all | 10 | 10.498 | 18.307 | 0.3979 |
| 4 | Mid-water Trawls | N/A | NE | all | all | 11 | 8.442 | 19.675 | 0.6732 |
| 2 | Fish Pots/Traps | N/A | MA | all | all | 13 | 34.188 | 22.362 | 0.0011 |
| 3 | Fish Pots/Traps | N/A | MA | all | all | 11 | 14.444 | 19.675 | 0.2094 |
| 3 | Lobster Pots | N/A | NE | all | all | 28 | 3.031 | 41.337 | 1.0000 |
| 4 | Lobster Pots | N/A | NE | all | all | 25 | 4.020 | 37.652 | 1.0000 |
| 2 | Scottish Seine | N/A | NE | all | all | 2 | 1.476 | 5.991 | 0.4780 |
| 3 | Scottish Seine | N/A | NE | all | all | 2 | 0.238 | 5.991 | 0.8880 |
| 4 | Scottish Seine | N/A | NE | all | all | 1 | 0.750 | 3.841 | 0.3865 |

Table 59. Summary of contingency table analyses of spatial distribution of 2004 FVTR and observed trips. Expected value of observed trips is based of proportions of FVTR trips by Statistical Areas. Critical value of Chi-Square statistics is based on alpha level of 0.05 . Degrees of freedom as based on number of Statistical Areas reported in the FVTR database. Shading indicates p-value greater than $\mathbf{0 . 0 5}$.


Table 60. The number of sea days needed to monitor fish/invertebrates (FISH) and loggerhead turtles (TURS), and combined species groups (COMBINED) by fleet for the April 2012 through March 2013 time period.

# Chapter 6 Proposed Action and Other Alternatives Considered 

This chapter presents the alternatives for the SBRM for Greater Atlantic Region FMP fisheries, including those preferred alternatives identified as the proposed action, considered during the development of this amendment. Following the public review of the process, the Councils selected preferred alternatives. This chapter has been revised to reflect the final preferred alternatives (i.e., the proposed action).

According to NMFS (2004), an SBRM is the "combination of data collection and analyses that [is] used to estimate bycatch in a fishery." However, it is important to distinguish between analytical techniques and procedures used to determine the precision of estimates of total discards and the appropriate observer sea day allocation levels from those analytical techniques and procedures used to incorporate discard data into and conduct stock assessments. Different analytical tools and models are used for these purposes, and the techniques and models used for stock assessments vary by species and stocks assessed. ${ }^{38}$

For the purposes of this amendment, the SBRM to be established for the FMPs of the Greater Atlantic Region would specify how the relevant data are to be collected and how those data, once collected, would be analyzed to develop estimates of the precision associated with discard estimates and to determine the appropriate allocation of observer coverage. Further, the amendment would establish standards for the SBRM, per the Court findings in Oceana v. Evans I, Oceana v. Evans II, and Oceana v. Locke. Therefore, based on NMFS's definition and Court findings, there are three principal components of the SBRM for which alternatives are presented: (1) The suite of reporting and monitoring mechanisms used to collect bycatch-related data; (2) the analytical techniques or procedures used to develop estimates of the precision associated with bycatch data; and (3) the performance measure (standard) used to determine the adequacy of the data collected. Per the Court findings in Oceana v. Locke, the amendment would provide details of a prioritization process that identifies how funding for at-sea observers is evaluated and limits the discretion of NMFS in setting observer coverage levels. The SBRM Omnibus Amendment includes additional supporting elements regarding a process by which bycatch data collected under the SBRM will be evaluated and reported, framework adjustment procedures, and provisions for industry-funded observer programs.

[^26]The presentation of alternatives in this chapter is structured around the seven components identified above. For each component, or element, two to four alternatives are presented: The status quo alternative, which reflects the current bycatch monitoring and reporting program; and an action(s) that could be taken to modify, supplement, or replace the relevant component of the current bycatch monitoring and reporting program. In some cases, there are options available for consideration within an alternative. In addition to the alternatives presented for each of the seven components identified above, there is a brief description and discussion of the alternatives that were considered but rejected from formal consideration during the development of this amendment.

In many fishery management actions, the "no action alternative" represents the outcome if the Councils and NMFS take no action to address the relevant issue (no FMP, amendment, framework adjustment, or annual specifications are prepared). In some cases, the current regulations would continue; but in other cases, the current regulations would expire or no longer be relevant. ${ }^{39}$ In cases where current regulations or specifications would expire or no longer be relevant, the no action alternative can be distinguished from the status quo, which would represent a continuation of regulations or specifications from one year to the next. In cases where the current regulations would continue without interruption, and no other changes would occur, the no action alternative and the status quo would not be distinguished.

In this amendment, the "no action alternative" is considered to be an outcome in which the Councils and NMFS fail to develop, submit, approve, and implement an SBRM Omnibus Amendment that documents and establishes those components of a bycatch reporting program required under the law. However, because the MagnusonStevens Act requires that an SBRM be established for each FMP, and because the Court, in rulings regarding Oceana v. Evans I, Oceana v. Evans II, and Oceana v. Locke remanded to the Secretary of Commerce Amendment 13 to the Northeast Multispecies FMP, Amendment 10 to the Sea Scallop FMP, and the 2007 SBRM Omnibus Amendment pending development or revision of said SBRM, such an outcome would be contrary to both law and the standing Court orders. Thus, the "no action alternative" is not a reasonable alternative for this action and will not be formally considered or analyzed in this document. However, for each element of the SBRM, the "status quo" is presented and analyzed.

Bycatch data are currently being collected by a variety of mechanisms on a variety of Greater Atlantic Region fisheries. These data are currently being utilized in stock assessments and are currently available to managers. Absent this amendment, these data would continue to be collected and utilized by managers and in stock assessments. Therefore, for the purposes of this amendment, the "status quo" is considered to represent the currently utilized data collection mechanisms or analytical procedures that provide data and information on bycatch in the Greater Atlantic Region. Furthermore, the status

[^27]quo alternatives will provide the baseline against which alternatives are compared and analyzed. This amendment would formally specify the data collection and analytical mechanisms currently in use, considers changes or additions to these mechanisms, discusses how these data are used and what constitutes standards of acceptability for these data, and would formally implement the resulting SBRM as an explicit element of each subject FMP.

The unique history of the SBRM Omnibus Amendment creates an unusual situation with regard to "status quo" alternatives. The Court in Oceana v. Locke only found fault with one of the seven largely independent elements of the 2007 SBRM Omnibus Amendment -- the prioritization process, but vacated the entire amendment. Thus all elements of the SBRM process must be reconsidered and readopted by the Councils. Both Councils expressed their intention to focus revisions on the prioritization process and to retain as much of the rest of the 2007 SBRM Omnibus Amendment as possible without change. During the development of the 2007 Amendment, scientific advances were made in how bycatch was monitored in the Greater Atlantic Region; including the adoption of a CV-based SBRM standard and use of an integrated allocation approach with importance filters for assigning observer sea days to fishing modes. When the 2007 SBRM Omnibus Amendment was vacated, these improvements to the bycatch monitoring process were largely retained by the scientists collecting and using bycatch data, even though these elements were not formally documented in an FMP, and therefore have become the "status quo" for purposes of this new amendment document.

The status quo is not limited to the methods by which at-sea observer trips and days are currently allocated. The status quo is the totality of all the ways in which data and information related to discards are currently collected, monitored, analyzed, and reported. Because all of the currently used data collection mechanisms are valid and contribute, at least in some way, to our understanding of discard rates in Greater Atlantic Region fisheries, all of the alternatives considered below represent modifications to the status quo. Thus, alternatives described below that would affirmatively and formally establish a current mechanism, procedure, or practice as a component of the SBRM are called the "status quo" alternatives. Alternatives that would modify, supplement, or replace the current program are named for their most distinguishing characteristic.

As fully described in each of the following subsections, the proposed action comprises the following preferred alternatives:

- Element 1: Alternative 1.1 - Status quo
- Element 2: Alternative 2.3 - Integrated allocation approach with importance filter (Option C)
- Element 3: Alternative 3.2 - Establish a CV SBRM standard
- Element 4: Alternative 4.2 - Specify an SBRM review process (Option D); and Alternative 4.3 - Require periodic discard reports (Option B)
- Element 5: Alternative 5.4 - Modify the framework adjustment and annual adjustment/specification procedures, allowing changes to fishing modes without formal Council action.
- Element 6: Alternative 6.1.2 - Identify specific SBRM funding sources; Alternative 6.2.3 - Adjust observer coverage using the penultimate cell approach; and Alternative 6.3.3 - Adjust for less than minimum pilot coverage by removing fleets with the highest ratio of minimum pilot coverage to days absent.
- Element 7: Alternative 7.2 - Authorize observer service provider approval and certification; and Alternative 7.3 - Addition of industry-funded observer and observer set-aside provisions as a measures that can be implemented through framework adjustments to the FMPs


### 6.1 Element 1: Bycatch Reporting and Monitoring Mechanisms

### 6.1.1 Alternative 1.1 - Status Quo (Preferred Alternative)

Under this alternative, the bycatch reporting and monitoring mechanisms currently utilized for the fisheries subject to this amendment would continue to be utilized. The data collection mechanisms are tiered based on the relevance of the data. The primary mechanisms (Tier 1) used to provide direct information on fishery discards would include:

- At-sea fishery observers; ${ }^{40}$
- Marine Recreational Information Program (MRIP);
- Vessel monitoring systems (VMS); and
- FVTRs (limited utility for discards).

These information collection and reporting mechanisms, as well as the mechanisms identified below, are fully described in Chapter 4. There are several information collection mechanisms that are currently in use, and would remain in use, that serve as primary sources of fishery-related information (Tier 2) but do not directly provide information on fishery discards (including information used in conjunction with discard information to complete stock assessments). These include:

[^28]- Fishery independent surveys (state and Federal);
- Dealer purchase reports;
- FVTRs; and
- Port sampling.

In addition, three sources of information currently contribute to the universe of fishery data that are used by scientists and managers in the Northeast to understand and address bycatch-related issues (Tier 3). Although these mechanisms are much more limited in scope and applicability than those identified above, they have been used and may continue to be used in the future as one among many sources of fishery-related information. These include:

- Industry-based surveys;
- Study fleets; and
- Alternate platforms.

Although not currently in use, other potential reporting and monitoring mechanisms may be developed and/or become sufficiently mature and cost-effective to be used to collect relevant data at some future time (Tier 4). These potential mechanisms include electronic monitoring and image processing systems. In addition, "specialized" bycatch monitoring to address specific issues that arise in particular fisheries may be developed and requested by a Council or implemented as part of a future FMP action. While these technologies or monitoring programs are not presently proposed to be implemented as a discrete part of the SBRM, this alternative would not preclude adoption and implementation of one or more of these technologies in the future.

As summarized in Table 61, the status quo alternative proposes four tiers of information collection and monitoring as part of the SBRM for use by fishery scientists and managers to better understand and address the scope and nature of bycatch in Greater Atlantic Region fisheries.

Tier 1: Primary Sources of Fishery Discard Information

- At-sea fishery observers
- Marine Recreational Information Program)
- Vessel monitoring system reports
- FVTRs (limited)

Tier 3: Supplemental Sources of Discard and Fishery-Related Information

- Industry-based surveys
- Study fleets
- Alternate platforms

Tier 2: Primary Sources of Fishery-Related Information

- Fishery-independent surveys
- Seafood dealer purchase reports
- Port Agent sampling
- FVTRs

Tier 4: Potential Future Sources of Discard and Fishery-Related Information

- Electronic monitoring
- Image capture and processing
- Specialized monitoring programs

Table 61. Status quo alternative fishery information collection and monitoring in the SBRM.

### 6.1.2 Alternative 1.2 - Implement Electronic Monitoring to Collect Bycatch Information

As described in chapter 4, there are a variety of mechanisms by which information on discards can be collected. Many of these mechanisms are already employed in the Greater Atlantic Region, and these would continue to be employed under the status quo alternative described above. However, this alternative would require that one additional bycatch information collection mechanism be implemented as part of the SBRM—electronic monitoring. This alternative does not propose replacing any status quo mechanism, but rather would reflect an expanded suite of data collection mechanisms to include some form of this developing technology.

For each electronic monitoring development and deployment within the Greater Atlantic Region, the type of data, system specifications, and the planned application of the data must be clearly established for an effective program to be administered. Should this alternative be selected, further refinement would be required. For example, in a hook and line fishery, an electronic monitoring program utilizing the off-the-shelf technology that currently exists could be developed and deployed to collect a wide array of data elements. Some examples of data that could be collected under the existing regulatory environment include:

- Detailed gear setting and retrieval information;
- Estimates of total effort through hook counts per set;
- Visual confirmation of seabird, marine mammal, and protected species interactions, incidental takes, and possibly mortality events;
- Species identification of discards that occur at the hauling station or as 'drop offs' before catch is brought onboard. Identification may be limited to species of concern, general species groups, or only performed for a subset of all hooks observed.

Additional data elements that may be possible with additional regulatory requirements that specify how retained catch and discards must be handled may include:

- Identification of retained and discarded catch. Identification may be limited to species of concern, general species groups, or only performed for a subset of all fishing time observed.
- Size estimates of catch and discards. May be limited to market category or general size groups (e.g., small, medium, large, extra-large) pending type of visual reference available to cameras for scaling.
- Logbook verification of vessel operator catch and discard information.

Development of electronic monitoring into a tool that is usable for bycatch and discard monitoring may well be possible but will take additional development effort, starting with the decision of what data electronic monitoring could provide and where electronic monitoring collection data could be most useful. NMFS has recently
established a formal policy on Electronic Technologies and Fishery-Dependent Data Collection (NMFS 2013b). Consideration of any future electronic monitoring program should be consistent with this policy.

Within the Greater Atlantic Region, an electronic monitoring pilot study has been conducted on hook and line vessels. A longer-term study across multiple gear types in the groundfish fishery is currently underway. Other fisheries may also be suitable for electronic monitoring development and deployments depending on the type(s) of data to be collected. Table 62 categorizes the degree of complexity considering the typical vessel size, gear type, and diversity of catch. The scale ranges from one to five, with one being the least complex and five being the most complex.

Electronic monitoring could, in theory, be developed to collect specific data elements in any fishery mode. There are limitations on how detailed the visual data can be and electronic monitoring is not capable of collecting biological data such as age or sex. Electronic monitoring may be well suited for applications such as monitoring discards in pelagic trawl fishery modes or for monitoring turtle interactions with fishery modes operating in the Mid-Atlantic area. Clear establishment of data needs and project goals would be essential in moving any concept forward into a formal component of the SBRM.

| Gear Type | Complexity Tier |
| :--- | :---: |
| Demersal Longline | 2 |
| Otter Trawl | 5 |
| Scallop Trawl | 5 |
| Scallop Dredge | 5 |
| Mid-water Trawl | 5 |
| Fish Pots/Traps | 1 |
| Crab Pots | 1 |
| Lobster Pots | 1 |
| Clam/Quahog Dredge | Unknown |
| Purse Seine | 4 |
| Hand Line | 2 |
| Gillnet (sink, anchor, or drift) | 4 |

Table 62. Evaluation of fishery modes complexity for Greater Atlantic Region electronic monitoring programs (complexity scale: 1-low to 5-high). The complexity tiers were assigned based on a review of the available information and consideration of the appropriateness of the technology to each type of fishing gear.

### 6.2 Element 2: Analytical Techniques and Allocation of Observers

### 6.2.1 Alternative 2.1 - Pre-2007 SBRM Omnibus Amendment Process

This alternative was the status quo in the 2007 SBRM Omnibus Amendment. In the time since the implementation of that amendment, the analytical techniques employed to estimate the precision of discard estimates and allocate at-sea fishery observer effort have evolved and improved. This alternative has been preserved in this action to comply with the request from both Councils to maintain as much of the 2007 amendment as possible. However, returning to the pre-2007 SBRM Omnibus Amendment process may no longer meet the purpose and need of this action.

Under this alternative, the analytical techniques employed to estimate the precision of discard estimates and allocate at-sea fishery observer effort for the fisheries subject to this amendment would revert to those in use prior to the adoption of the 2007 SBRM Omnibus Amendment. These analytical techniques and procedures are fully described in Rago et al. 2005 and address such issues as sampling units, response variables, definitions of appropriate strata, data sources, imputation, and tests for sources of bias. The procedures and analyses described in Rago et al. 2005 would be applied to three species groups (large-mesh multispecies; summer flounder, scup, and black sea bass; and monkfish) and three gear types (otter trawls, gillnets, and longlines). These are the only species and gear types for which this methodology would be applied in a formal manner. Observer coverage for other gear types and species would be allocated on an ad hoc basis, or as requested by the Councils, if funding is available.

In addition to the analytical techniques described in Rago et al. 2005, this alternative addresses the mechanisms by which observer coverage would be determined for the species and gear types addressed by these procedures. Under the pre-2007 SBRM Omnibus Amendment process approach, observers would be allocated using, among other means, the optimization tool described in Rago et al. 2005 (see Figure 44). As noted above, the optimization tool was initially designed for the large-mesh otter trawl, gillnet, and longline fisheries, but could be expanded to encompass all fishing modes subject to the SBRM. Under this alternative, available observer sea days would first be allocated to programs with prescribed observer coverage levels (e.g., Northeast multispecies fishery, sectors, SAPs and B-Regular DAS program). Remaining available observer sea days would then be allocated to the three fishing gear types noted above based on the optimization tool. Other factors, such as special requests of a Council (for example, the hagfish fishery information collection program) or an unforeseen circumstance or problem that arises in a fishery (such as increased monitoring of protected resources interactions), would be used to assign observer coverage to other fisheries on an ad hoc basis.

As the primary source of bycatch data in commercial fisheries, at-sea observer coverage applies to all commercial fishing modes affected by the SBRM Omnibus Amendment. Data on recreational fishing would be obtained through the MRIP program. These data would serve the same function for recreational fisheries as at-sea observer data serve for commercial fisheries.

Regarding the use of at-sea fisheries observers, in the Greater Atlantic Region existing regulations require that, as a condition of all Federal fishing vessel permits issued in the Region, fishing vessels carry an observer anytime they are requested to do so. The regulations at § 648.11(a) stipulate that "The Regional Administrator may request any vessel holding a permit for Atlantic sea scallops, [Northeast] multispecies, monkfish, skates, Atlantic mackerel, squid, butterfish, scup, black sea bass, bluefish, spiny dogfish, Atlantic herring, tilefish, or Atlantic deep-sea red crab; or a moratorium permit for summer flounder; to carry a NMFS-certified fisheries observer." A change in April 2007 extended this requirement to "any vessel . . . that fishes for, catches or lands hagfish, or intends to fish for, catch, or land hagfish in or from the [EEZ]." This requirement is reinforced in the "prohibitions" section of the regulations, which state at § 648.14(e)(2) that it is unlawful for a person to "refuse to carry an observer or sea sampler if requested to do so by the Regional Administrator."

### 6.2.2 Alternative 2.2 - Integrated Allocation Approach

Building on the techniques and procedures described in Rago et al. 2005 and utilized under the pre-2007 SBRM Omnibus Amendment alternative, this alternative would refine and expand the aforementioned methodology to apply to 56 separate fishing modes across 14 gear types and 15 species/species groups (including sea turtles). The refined and expanded methodology proposed under this alternative is described in detail in chapter 5 . In addition to being expanded to include all relevant gear types and applicable species, the bycatch variance assignment method also differs from the pre2007 SBRM Omnibus Amendment by the inclusion of the gray-cell filter (as described in section 5.3.3).

Under this alternative, there are two ways in which the observer coverage may be determined for any combination of fishing gear type and species: The math-driven approach, which calculates the number of observer sea days necessary to attain the CVbased performance standard, based on the results of analysis using data from prior years; or the pilot coverage approach, which estimates a baseline level of pilot coverage expected to provide sufficient data to use the math-driven approach in the future. Wherever possible, the math-driven approach is used. The pilot coverage approach is used when prior sampling levels were too low to provide sufficient data with which to use the math-driven approach (see section 5.3.3).

Because the math-driven approach requires data collected by at-sea fisheries observers as input-in order to calculate a CV and then project the number of observed sea days are required to attain the CV-based performance standard-if there were no observed trips of a fishing mode, there would be no data available to serve as input to the math-driven approach. Pilot coverage allocates an initial level of observer coverage equivalent to 2 percent of the trips that occurred in the year on which the analysis is based. For example, if, in 2004, there were an average of 300 3-day long fishing trips per quarter for a fishing mode that had no observer coverage in 2004, in order to begin to collect data on this fishing mode, pilot coverage equivalent to 2 percent of these trips, or 72 sea days, would be allocated to this fishing mode. The pilot coverage level of 2 percent was selected based on the most conservative recommendation of the National

Working Group on Bycatch, which suggested that pilot coverage, where needed, be based on a range of 0.5-2 percent of trips, with a minimum of 3 trips per quarter and a maximum of 100 trips per quarter (NMFS 2004).

Under this alternative, the target observer coverage allocation for each fishing mode would be the highest projected number of observer sea days needed to achieve the CV-based performance standard for each species or species group after the application of the gray-cell filter. The gray-cell filter is designed to eliminate combinations of fishing gear types and species under two scenarios: (1) The discards of a species in a gear type does not occur, either due to the area fished or to the design of the gear type (e.g., Atlantic salmon in Mid-Atlantic crab pots, sea scallops in longline gear, surfclams in mid-water trawls, etc.); or (2) the discards are extremely unlikely to occur, due to the nature of the gear and/or the nature/distribution of the species (e.g., deep-sea red crabs in New England large-mesh gillnets, surfclams in otter trawls, etc.). Either of these scenarios may be due to the nature/distribution of the species or its lack of interaction with a gear type, or may be due to specific regulations that have been implemented to reduce bycatch. The premise behind the gray-cell filter is to recognize that there are certain combinations of species and fishing gear types for which bycatch is infeasible or occurs so infrequently that it would be imprudent to derive observer coverage levels for these gear types based on these species.

As the primary source of bycatch data in commercial fisheries, at-sea observer coverage applies to all commercial fishing modes affected by the SBRM Omnibus Amendment. Data on recreational fishing would be obtained through the MRIP data collection program that resulted from the NRC-suggested and Congressionally-mandated changes to the MRFSS program. These data would serve the same function for recreational fisheries as at-sea observer data serve for commercial fisheries.

### 6.2.3 Alternative 2.3 - Integrated Allocation Approach with Importance Filter (Status Quo) (Preferred Alternative)

This alternative would function the same as the previous alternative for determining the appropriate allocation of observer effort, but with the substantial addition of an "importance filter" beyond the gray-cell filter to further refine the appropriate target allocation of observer effort within each fishing mode. ${ }^{41}$ Under the previous alternative, the necessary observer coverage allocation for each fishing mode would be the highest projected number of observer sea days to achieve the CV-based performance standard for each species or species group after the application of the gray-cell filter. However, one of the limitations of this method is that it does not account for the relevance of the discards of each species within each fishing mode. The intent is to distinguish between species for which the imprecision of the discard estimate may have the potential to affect a stock assessment, and those species for which it would not. The importance filter is

[^29]intended to serve as a tool to illuminate that distinction, and to aid in establishing observer sea day allocations that are more meaningful and efficient at achieving the overall objectives of the SBRM and the at-sea observer program.

An importance filter, in this context, is a criteria-based tool applied to the projected observer sea days needed to achieve the CV-based performance standard. It is specifically designed to "weed out" particular combinations of fishing gear and bycatch species where the infrequency and variable amounts of discards would result in high observer sea day coverage levels, in spite of the fact that the actual magnitude and frequency of discards may be low and of small consequence to the discarded species in the larger context of all Greater Atlantic Region fisheries. For example, based on the initial calculations of observer coverage levels needed to achieve the objective of a CV of no more than 30 percent, 12,864 observer sea days would be required to monitor Atlantic herring bycatch in the New England large-mesh otter trawl fishery (see page 25 in Appendix C). However, in 2004 a total of 563 lb of herring were observed to be discarded in this fishery (a fishery in which over 1,000 fishing sea days were observed) and 90 percent of observed trips had zero discards of herring. Specifically, out of 386 observed trips within this fishing mode, 38 had discards of herring, and the sum of the discards on those 38 trips was 563 lb (< 15 lb per trip). This 563 lb represents roughly 0.0003 percent of the 2004 commercial landings in the herring fishery, and 0.000085 percent of the 2004 allowable biological catch. Without the application of an importance filter, the target observer sea day coverage level in this fishing mode would be 12,864 days, which is more than one-third the total number of days actually fished in the New England large-mesh otter trawl fishery in 2004. As such, allocating this level of coverage, based solely on the observed discards of Atlantic herring, would be an inefficient use of observer coverage resources.

The use of an importance filter is intended to eliminate these cases from the final calculation of target observer sea days for each fishing mode, so the bycatch species driving the target coverage level are ones for which the implications of the discards in the fishery are not negligible. Within this alternative, three options are presented for the final form of the importance filter: Option A, which reflects the importance filter alternative originally presented in the public hearing draft of the 2007 SBRM Omnibus Amendment; Option B, the current status quo, which eliminates the CV-met filter and incorporates revisions to the third-level and fourth-level filters to address comments received during the public review and comment process; and Option C, which includes the revisions in Option B, while removing the gray-cell filter based on updated analysis of its utility. Option A is retained primarily to illustrate the differences between what was initially proposed in the public hearing draft of the 2007 SBRM Omnibus Amendment and the revised importance filter process in Option B.

Regardless of the option selected as the preferred alternative, there are several important issues that may require clarification. The options listed below function on three levels: As with the previous alternative, the gray-cell filter is designed to eliminate combinations of fishing gear types and species that either do not occur or occur so infrequently, due to the nature of the interaction between the gear and the species or due to regulations that have been implemented to reduce or eliminate the bycatch of certain
species, that it would be imprudent to derive observer coverage levels based on these species; the second is to eliminate combinations of fishing gear types and species where the contribution of that gear type to the total discards of that species is negligible; and the third is to eliminate combinations where the magnitude of discards of a species relative to the overall landings or total fishing mortality (landings plus discards) of that species is negligible. While the proposed gray-cell filter addresses both fish species and sea turtles, the consideration of total discards and total landings/mortality in Option A, Option B, and Option C focus solely on filtering observer coverage levels for commercially targeted fish species. The discards and landings/mortality based filters proposed in these options are not used to filter sea turtles as the basis for establishing the necessary observer coverage level in a fishing mode. This is explained further in each option below.

All three options presented below are designed to be used on an annual basis to determine the observer coverage levels necessary to achieve the CV-based performance standard annually. Prior to the start of each calendar year, scientists at the Center would utilize observer and landings data from the four most recent quarters for which data are available as input to the processes described in this amendment. These data would provide the basis to determine the number of sea days needed for each cell of the speciesgear type matrix. The importance filter selected as the preferred alternative would then be applied to refine the total number of observer sea days needed in each fishing mode. This information would then be used by the Center and the NEFOP to allocate observer coverage levels across all fishing modes for the coming year.

As the primary source of bycatch data in commercial fisheries, at-sea observer coverage applies to all commercial fishing modes affected by the SBRM Omnibus Amendment. Data on recreational fishing would be obtained through the data collection program(s) that result from the NRC-suggested and Congressionally-mandated changes to the MRFSS program. These data would serve the same function for recreational fisheries as at-sea observer data serve for commercial fisheries.

### 6.2.3.1 Importance Filter Option A

The first option for an importance filter is the original importance filter alternative described in the public hearing draft of the 2007 SBRM Omnibus Amendment. This option focuses on the encounter rate (the proportion of trips in which the species was encountered and discarded), the relative proportion of discards of that particular species compared to discards of other species within the fishing mode, the magnitude of the observed discards, and the proportion of the discards of the species within the fishing mode to the total landings of the species among all fisheries. Under this option, sea turtles are filtered only at the initial gray-cell filter (level 1) or the CV-met filter (level 2). The third and fourth level filters would not reduce the observer sea days in any fishing mode below the number necessary to achieve the performance standard for sea turtles.

An example of how this importance filter could be applied is demonstrated with the bycatch of Atlantic herring in the New England small-mesh otter trawl fishing mode (see page 23 in Appendix C): In 2004, 142 trips out of 3,484 were observed. On 74 percent of the observed trips (105 trips), there were no discards of herring; but on the
remaining 37 trips, herring totaling 13,687 lb were observed to be discarded. Relative to the 563 lb of discarded herring in the large-mesh otter trawl example above, this amount of discarded herring may appear to be substantial. However, even this amount of discarded herring only represents 1.24 percent of the total observed discards within the observed fishing mode, and is still less than 0.01 percent of the commercial landings of herring in 2004. Even though the 142 observed trips only represent 4 percent of all fishing trips in this mode in 2004, the total amount of herring discarded by this mode is estimated to be less than 0.3 percent of the commercial landings (which were only 28 percent of the total allowable biological catch for the year). So, the importance filter provides a way to identify that the 882 observer sea days calculated to be necessary to achieve a CV of 30 percent should not necessarily be used to determine the target observer coverage level for this fishing mode.

For each fishing gear mode, and for each of the 15 relevant species and species groups, a series of hierarchical filters would be applied to eliminate from consideration the species/species groups that fall below established thresholds for each relevant factor, and would function as follows (see Table 63):
(1) The first-level filter would be the gray-cell filter described in chapter 5 and in the previous alternative, which eliminates combinations of species and gear types in which encounters are infeasible or extremely unlikely;
(2) The second-level filter would eliminate species when the realized CV, based on the dataset analyzed to calculate the CV, is 30 percent or less (i.e., successfully achieved the performance standard), but the projected observer sea days exceeds the number of days actually observed in the year(s) in which the performance standard was achieved;
(3) The third-level filter would eliminate species when the discards of that species in a mode are less than a certain minimum percentage of the total discards for that mode (with the exception of protected species, for which none of the filters beyond the gray-cell filter would be applied); and
(4) The fourth-level filter would eliminate species when the total discards of that species in a mode are less than a certain minimum percentage of the total landings (commercial and recreational) of that species in all fisheries combined.

A potential fifth filter, which is not proposed at this time, would eliminate species when the total discards of that species in a mode are less than a certain minimum percentage of the total allowable catch, or, depending on the information available at the time, the total biomass, of the species. ${ }^{42}$

[^30]So, for example, in the Mid-Atlantic small-mesh otter trawl fishing mode (see page 23 in Appendix C), after eliminating the gray-celled salmon, red crab, and surfclam and ocean quahog, the importance filter could be used to eliminate sea scallops (with a total of $6,303 \mathrm{lb}$ of observed discards, 0.81 percent of all discards in this fishing mode), and then to eliminate the mackerel, squid, and butterfish complex (while the percent of all discards in the fishing mode may exceed the threshold for this filter, with total discards at less than 0.90 percent of total landings of herring, it would likely fall below the threshold established for the fourth-level filter). Eliminating bluefish, herring, and tilefish for similar reasons would reduce the target observer sea days for this fishing mode from 5,417 to no more than 944 . Given that the cost of each observer sea day is roughly $\$ 1,150$, the reduction in the necessary coverage represents over $\$ 5.1$ million.

The two most important aspects of the design and application of this importance filter option are the criteria selected as the filters (i.e., the discards of the species relative to the total discards in the fishing mode, and the discards of the species relative to the total landings of that species in all fisheries), and the threshold levels established within each filter. The thresholds considered ranged from 0.5 percent to 3.0 percent, and a final threshold would be selected in the final version of the SBRM Omnibus Amendment, after review by all appropriate technical groups and the two Councils, should this option be selected as the preferred alternative.

|  | Total Sea Days Required for All 15 <br> Species Groups (including sea turtles) |  |  |
| :--- | :---: | :---: | :---: |
|  | Example 1 <br> $0.5 \%$ | Example 2 <br> $1.0 \%$ | Example 3 <br> $3.0 \%$ |
| Baseline | 71,043 | 71,043 | 71,043 |
| 1. Gray-cell filter | 55,554 | 55,554 | 55,554 |
| 2. CV-met filter | 55,452 | 55,452 | 55,452 |
| 3. Discard ratio filter | 14,516 | 13,151 | 12,065 |
| 4. Landings ratio filter | 11,868 | 11,253 | 10,704 |
| 5. Discard \% of TAC/B filter <br> (potential future upgrade) | $\mathrm{N} / \mathrm{A}$ | $\mathrm{N} / \mathrm{A}$ | $\mathrm{N} / \mathrm{A}$ |

Table 63. Summary of the number of observer sea days needed to achieve a CV of 30 percent, based on the sequential application of the Option A importance filters at a variety of threshold levels.

It is important to understand that without the importance filter, as in the previous alternative, there would be no established protocol to refine the total target observer sea days to levels commensurate with the importance of the discard species within the overall fisheries observer program or within the context of the overall Greater Atlantic Region fisheries (see "baseline" row in Table 63). Again, consider red crab: Without any filter,
including the gray-cell process, for red crab alone the total number of sea days needed to observe the fishing modes in which red crabs are discarded (to achieve the target CV of 30 percent) would be 27,698 days. With the gray-cell filter, but without an importance filter, the number decreases to 5,547 days. The cost to implement this level of observer coverage, however, far exceeds the total value of the red crab fishery (the cost to observe 27,698 days would be $\$ 31.8$ million and the cost to observe 5,547 days would be $\$ 6.4$ million, while the ex-vessel value of all red crab landings average less than $\$ 4$ million annually). From a cost-benefit perspective, it does not appear appropriate to expend more than one and a half times the value of a fishery to monitor potential discards of the target species in other fisheries. To maximize the value and benefit of the observer program, the importance filter would provide a tool to limit the projected observer sea days needed to more reasonable and effective levels, commensurate with the relative importance of the potential bycatch events.

### 6.2.3.2 Importance Filter Option B (Status Quo)

The second option for an importance filter is a modification of the original importance filter alternative described in the public hearing draft of the 2007 SBRM Omnibus Amendment, based on comments received during the comment period on the original 2007 amendment. The differences between this and Option A are: (1) The CVmet filter is eliminated as unnecessary following the full incorporation of the finite population correction factor (see chapter 5); (2) the third-level filter is now based on the discards of a species in a fishing mode relative to the total discards of that species; and (3) the fourth-level filter is now based on the discards of a species in a fishing mode relative to the total known fishing mortality of that species (commercial landings, recreational landings, and discards). Under this option, sea turtles are filtered only at the initial gray-cell filter (level 1).

As noted above, the most significant differences between the revised filters in Option B and the original filters in Option A are the mechanisms by which the non-graycell filters are applied. Under Option A, the discard-to-discard (third level) filter was applied within a fishing mode; i.e., the filter operated on the proportion of discards of a species relative to the other species discarded by that fishing mode. In this way, if a species comprised a minor component of the discards of a fishing mode, it may have been filtered out, regardless of the proportion of the total discards of that species contributed by the subject fishing mode. Under Option B, there is still a comparison of discards to total discards, but instead of within a fishing mode and across species, it is within a species and across fishing modes. In this way, a species/fishing mode combination would only be filtered out at this stage if it contributed a minor amount of the total discards of that species.

The discards-to-landings filter in Option A operated by comparing the discards of a species in a fishing mode to the total landings (recreational and commercial) of that species. In this way, if the discards of a species were relatively minor in proportion to the landings of that species, it may have been filtered out. Under Option B, this filter expands the denominator of this function by adding discards so that the comparison is of the discards of a species relative to the total known fishing mortality on that species. In
this way, when the discards of a species in a fishing mode contribute a relatively minor amount to the total fishing mortality on that species, it may be filtered out.

The other significant change from the Option A filter and the revised filters is the basis for selecting an appropriate threshold level for the filters to operate. Under Option A, the filter thresholds operated independently of the cumulative effect of the discards or mortality contributed by the various fishing modes. This created the impression (based on the comments received on the draft 2007 SBRM Omnibus Amendment) that the threshold levels could be selected on an arbitrary basis because there was no apparent relationship between the thresholds considered and the implications of these threshold levels to the fishery or the stock. Instead, under Option B, the threshold levels are set based on the cumulative effect of all the subject fishing modes. Thus, under Option A, a threshold of 10 percent for the discards to discards filter would mean that any species that individually comprised less than 10 percent of the total discards within a fishing mode would be filtered out. If all but one species each contributed less than 10 percent of total discards within that fishing mode, then all but that one species would be filtered out. Conversely, with Option B, a threshold of 90 percent for the discards to discards filter means that the species would only be filtered for those fishing modes that contribute, on a cumulative basis, less than 10 percent of the total discards of that species.

As an example of the functional difference between these approaches, see Table 64. Under Option A, individual species are filtered out for each fishing mode based on the individual contribution of discards associated with that fishing mode. Using a threshold of 5 percent for illustration, all species but Species A and Species B would be filtered out as contributing less than 5 percent of total discards, even though cumulatively these species combine for 25 percent of the total discards. In contrast, under Option B, fishing modes are filtered out for each species based on the cumulative discards each fishing mode contributes for that species. Thus, at a threshold of 5 percent, all fishing modes but the two that together contribute less than 5 percent of total discards are retained and only these two are filtered.

| Option A |  |  | Option B |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Within Fishing Mode X |  |  | Within Species X |  |  |
|  | Individual \% of discards | Cumulative \% of discards |  | Individual \% of discards | Cumulative \% of discards |
| Species A | 50\% | 50\% | Mode 1 | 50\% | 50\% |
| Species B | 25\% | 75\% | Mode 2 | 25\% | 75\% |
| Species C | 4\% | 79\% | Mode 3 | 4\% | 79\% |
| Species D | 4\% | 83\% | Mode 4 | 4\% | 83\% |
| Species E | 4\% | 87\% | Mode 5 | 4\% | 87\% |
| Species F | 3\% | 90\% | Mode 6 | 3\% | 90\% |
| Species G | 3\% | 93\% | Mode 7 | 3\% | 93\% |
| Species H | 3\% | 96\% | Mode 8 | 3\% | 96\% |
| Species I | 2\% | 98\% | Mode 9 | 2\% | 98\% |
| Species J | 2\% | 100\% | Mode 10 | 2\% | 100\% |

Table 64. Example of the functional differences between the discard ratio importance filters proposed in Option A and Option B. The shaded rows represent the species/fishing modes that would be filtered under each option using a filter threshold of 5 percent.

An example of how this importance filter could be applied is demonstrated with the bycatch of mackerel, squid, and butterfish in the New England large-mesh gillnet mode. Almost all discards of these species come from three fishing modes (New England small-mesh otter trawl, New England mid-water trawls, and Mid-Atlantic smallmesh otter trawls), which together account for 98.75 percent of the total discards. On the other hand, New England large-mesh gillnets contribute only 0.03 percent of the total discards of these species, yet the observer sea days for these species in this fishing mode were calculated to be 3,758 days. The importance filter under Option B would be a way to identify that the 3,758 observer sea days calculated to be necessary to achieve a CV of 30 percent should not necessarily be used to determine the target observer coverage level for this fishing mode.

For each fishing gear mode, and for each of the 15 relevant species and species groups, a combination of filters would be applied to eliminate from consideration the species/species groups that fall below established thresholds for each relevant factor, and would function as follows (see Table 65):
(1) The first-level filter would be the gray-cell filter described in chapter 5 and in the previous alternative, which eliminates combinations of species and gear types in which encounters are infeasible or extremely unlikely;
(2) The second-level filter is no longer applicable;
(3) The third-level filter would eliminate fishing modes for a species that together contribute less than a threshold level of the cumulative discards of that species in all fisheries combined; and
(4) The fourth-level filter would eliminate fishing modes for a species when the total discards of that species in a mode are less than a threshold level of the cumulative fishing mortality (commercial and recreational landings plus known discards) of that species in all fisheries combined.

The potential fifth filter, which is described in Option A, is not proposed under this option as a potential future filter. Because the fourth filter under Option B is calculated as a mortality ratio, rather than just landings, it would not be appropriate to incorporate the TAC into the importance evaluation.

So, for example, in the Mid-Atlantic small-mesh otter trawl mode, the baseline observer sea days would be 5,417 days (to achieve a 30 percent CV for red crab). The gray-cell filter reduces this amount to 3,057 days (to achieve the CV for tilefish), by eliminating red crabs, surfclams, and Atlantic salmon from further consideration. Applying the discard ratio filter (third level) at a threshold of 95 percent further reduces this amount to 2,231 (for bluefish). At this threshold level, tilefish are filtered because Mid-Atlantic small-mesh otter trawls contribute only 0.25 percent of the total discards of tilefish. Atlantic herring (1,869 observer sea days, but only 0.12 percent of total herring discards) are also filtered from further consideration at this stage. Applying the mortality ratio filter (fourth level) at a threshold of 98 percent reduces the observer sea days necessary for this fishing mode to 1,229 days, which is the target level for sea turtles. Bluefish ( 2,231 sea days) is filtered at this stage as the discards of bluefish associated with this fishing mode contribute only 0.16 percent of the total fishing mortality on bluefish (including all commercial and recreational landings plus discards). The observer coverage level of 1,229 days is projected to achieve a CV of at least 30 percent for sea turtles; sea scallops; mackerel, squid, and butterfish; small-mesh multispecies; summer flounder, scup, and black sea bass; spiny dogfish; monkfish; large-mesh multispecies; and skates. Thus, the application of the Option B importance filters served to reduce the necessary sea day coverage level for this fishing mode from 5,417 days to 1,229 days.

The two most important aspects of the design and application of this importance filter option are the criteria selected as the filters (i.e., the discards of a species within a fishing mode relative to the total discards of that species across all 39 fishing modes, and the contribution to total fishing mortality represented by the discards of a species in the fishing mode), and the threshold levels established within each filter. The thresholds considered ranged from a cumulative percentage of 90 percent to 99 percent.

|  | Total Sea Days Required for All 15 <br> Species Groups (including sea turtles) |  |  |
| :--- | :---: | :---: | :---: |
|  | Example 1 <br> $99 \%$ | Example 2 <br> $95 \%$ | Example 3 <br> $90 \%$ |
| Baseline | 71,043 | 71,043 | 71,043 |
| 1. Gray-cell filter | 55,554 | 55,554 | 55,554 |
| 2. CV-met filter | $\mathrm{N} / \mathrm{A}$ | $\mathrm{N} / \mathrm{A}$ | $\mathrm{N} / \mathrm{A}$ |
| 3. Discard ratio filter | 42,995 | 38,749 | 14,208 |
| 4. Mortality ratio filter | 10,400 | 9,726 | 9,395 |

Table 65. Summary of the number of observer sea days needed to achieve a CV of 30 percent, based on the sequential application of the Option $B$ importance filters at a variety of threshold levels.

As indicated in Table 65, application of the Option B importance filters at the range of thresholds considered has the potential to reduce the total observer sea day requirements from a baseline level of 71,043 days to as low as 9,395 days. The threshold levels for the SBRM are as follows: Filter 3 - 95 percent of total discards; and Filter 4 98 percent of total mortality. At a discard ratio threshold of 95 percent and a mortality ratio threshold of 98 percent, and based on data from 2004, a total of 9,874 observer sea days would be needed. This set of importance filters provides a mechanism to account for the individual contributions of each fishing mode relative to the cumulative discards of each species across all fishing modes and the total fishing mortality of each species, filtering out those species (as the driving force behind setting the overall observer coverage levels for each fishing mode) for which the fishing mode contributes a relatively insignificant portion of the total discards of that species, the total fishing mortality of that species, or both.

At a discard ratio threshold of 95 percent and a mortality ratio threshold of 98 percent, a total of 9,874 observer sea days would be needed to be allocated across all 39 fishing modes (for the detailed allocation at these threshold levels, see Appendix C). Note that while this threshold level is intended to be implemented as a component of the SBRM, the specific level and allocation of observer coverage is not. The projected 9,874 observer sea days is the amount calculated based on implementation of the proposed SBRM using 2004 observer data as input values. Full and continued implementation of the SBRM would require annual updates using the most recent 4 quarters of data from the observer program. As new data are utilized in the SBRM following implementation, the overall number of projected observer days, as well as the fishing mode allocations, will change. This is analogous to establishing a survey index-based biological reference point that utilizes a 3-year moving average of the NEFSC survey weight per tow of the subject species. As new data are input into the calculation, the calculated reference point changes up or down to reflect the status of the stock. So, too, in the case of the SBRM,
will the calculated number of observer sea days change as new, updated information is input in the methodology.

### 6.2.3.3 Importance Filter Option C (Preferred Option)

The third option for an importance filter is a modification of the current status quo importance filter (Option B). The difference between Option B (status quo) and Option C is that Option C would not use the gray-cell (tier 1 or "unlikely") filter, based on analysis done as part of the 3-year evaluation of the 2007 SBRM Omnibus Amendment (Wigley et al. 2012b).

The initial determination of which cells would be considered unlikely was made by FMATs and Plan Development Teams (PDT) and was based on a review of the previous 16 years of observer data, general knowledge of gear, fish distribution, and abundance patterns. It was recognized during the development of the filters that the fishing patterns or species abundance and/or distribution may shift and the intent was that the unlikely filter would be evaluated as more data were collected.

The 3-year evaluation of the 2007 SBRM Omnibus Amendment was the first evaluation of the use of the gray-cell filter for all species since it was established. Since 2009, the gray-cell filter has been set to a default of "likely" for all new fishing modes and new species. For pilot fleets, the gray-cell filter has no impact on the final determination of SBRM standard sea days at the fishing mode level. In non-pilot fleets, the gray-cell filter influences the species group with the maximum number of sea days within a fishing mode, which will determine the SBRM standard sea days at the fishing mode level. Cases where the gray-cell filter indicates bycatch to be unlikely, but the discard ratio filter (tier 3) or the mortality ratio filter (tier 4) indicate that the fishing mode contributes a relatively significant portion of the total discards of that species, the total fishing mortality of that species, or both, should not occur and results could be screened to prevent this from happening.

Based on a review of analyses conducted on data collected during June 2007 through July 2011, no changes to the final determination of the SBRM standard sea days for these three years would have occurred if the gray-cell filter had been removed from the importance filter.

The refinement to the importance filter applies only to fish and invertebrate species, the species groups where design-based methods are used to estimate the number of sea days needed. The model-based methods adopted for turtles do not explicitly define or use a gray-cell filter - interactions between turtles and gillnet, dredge, and trawl gear in the Mid-Atlantic are considered likely. Sea day monitoring needs are not estimated for other gear types or in other regions (i.e. New England) because to date we have not had sufficient levels of observed turtle bycatch to estimate total bycatch in these gears or regions using model-based methods.

### 6.2.4 Alternative 2.4-Minimum Percentage Observer Coverage

This alternative would establish a minimum percentage observer coverage level for each fishery. One method to reduce bias in observer estimates of bycatch suggested in Babcock et al. (2003) is to establish sufficiently high coverage levels. Babcock et al. (2003) suggest that observer programs adopt coverage levels of at least 20 percent for common species and 50 percent for rare species. Under this alternative, the current observer sea day allocation procedure (including the optimization tool, among other means, to minimize the overall CV) would be replaced by a process whereby fisheries for which the bycatch species are all considered "common" would have a target observer coverage rate of 20 percent of all trips, and fisheries for which the bycatch species include "rare" species would have a target observer coverage rate of 50 percent of all trips.

To implement this alternative, one of the first steps would be to determine appropriate definitions of rarity of the bycatch species. Babcock et al. (2003) distinguish rare species as those for which the weight of the discards is 0.1 percent or less of the total catch (landings plus discards) in the fishery. In some ways, this approach is counterintuitive: In a relatively clean fishery with very low discards, each species that may occasionally be encountered would be considered rare and, therefore, the observer coverage level would be quite high (even if the magnitude of the discards is negligible). Other approaches to determine rarity could be: To look at the discards of each species proportional to the total discards of all species; to consider any species afforded protection under the Marine Mammal Protection Act and/or Endangered Species Act to be rare regardless of actual encounter rates; to set an upper and lower bound for nonprotected species, such as 0.5 to 1.0 percent of total discards; or to develop an algorithm that incorporates both the frequency of encounter with the magnitude of potential encounters relative to stock size or landings of that species. Implementation of this alternative would require further consideration of the most appropriate way in which to define rare versus common species.

Under this alternative, the discards estimation analyses would continue to use the techniques and procedures described in chapter 5 and Appendix A that comprise the other alternatives. As the primary source of bycatch data in commercial fisheries, at-sea observer coverage applies to all commercial fishing modes affected by the SBRM Omnibus Amendment. Data on recreational fishing would be obtained through the data collection program(s) that result from the MRIP. These data would serve the same function for recreational fisheries as at-sea observer data serve for commercial fisheries.

### 6.3 Element 3: SBRM Standard

### 6.3.1 Alternative 3.1 - No SBRM Standard

Under this alternative, the SBRM Omnibus Amendment would not specify a target CV as a performance measure or standard against which to judge the adequacy of the bycatch monitoring program described in the amendment. This alternative would not preclude the establishment of CV standards at some time in the future. While there
would be no requirement or expectation in this amendment that a standard be established, at any time target CVs could be established for all relevant fisheries, or could be established on an FMP-by-FMP basis in future management actions. This alternative represents the condition of the monitoring program before approval and implementation of the 2007 SBRM Omnibus Amendment.

### 6.3.2 Alternative 3.2 - Establish a CV SBRM Standard (Status Quo) (Preferred Alternative)

This alternative for the SBRM would establish a performance standard to ensure that the bycatch-related data collected under the SBRM and utilized in stock assessments and management is adequate for those tasks. In order to ensure that the SBRM is performing to the expected level, this alternative would establish a process to periodically review the adequacy of the SBRM, with consideration of how and when changes to the SBRM should be made.

The guidance provided in NMFS (2004) recommends establishing precision goals for a fishery as part of an SBRM. The recommended precision goals, as stated in the document (NMFS 2004) are as follows:

> For fishery resources, excluding protected species, caught as bycatch in a fishery, the recommended precision goal is a $20-30 \%$ CV for estimates of total discards (aggregated over all species) for the fishery; or if total catch cannot be divided into discards and retained catch then the goal is a $20-30 \%$ CV for estimates of total catch.

For marine mammals and other protected species, including seabirds and sea turtles, the recommended precision goal is a $20-30 \%$ CV for estimates of bycatch for each species/stock taken in a fishery.

This alternative would establish, as a performance measure of the SBRM, a standard that the SBRM be sufficient to attain a CV of no more than 30 percent for each applicable fishing mode. The 30-percent CV standard would apply, at least initially, to all applicable fishing modes for each species group (see Table 46 and Table 47). This SBRM standard addresses the precision of the estimates, not the accuracy of the estimates. For a full analysis and discussion of precision and accuracy, including a discussion of the ways in which accuracy can be improved, see Chapter 5 and Appendix A.

Although the proposed 30-percent CV standard is based on the recommendation in NMFS (2004), the proposed application of this standard differs in several important ways. First, the precision goal is recommended to apply to "a fishery," but in the proposed SBRM, the CV standard would apply at the level of the fishing mode. The Magnuson-Stevens Act defines "fishery" as "(A) one or more stocks of fish which can be treated as a unit for purposes of conservation and management and which are identified on the basis of geographical, scientific, technical, recreational, and economic characteristics; and (B) any fishing for such stocks." Thus, under the Magnuson-Stevens Act definition, the monkfish fishery, for example, would be treated as a single fishery
inclusive of all gillnet fishing, otter trawl fishing, scallop dredge fishing, and all other fishing regardless of gear type used and/or area fished, that catches monkfish. Employing the precision goal at the level of the fishery, then, could be inferred to mean that the precision of the estimate of monkfish discards across all types of fishing activities that catch monkfish should be between 20 and 30 percent.

In contrast, under this alternative the SBRM CV standard would apply not at the level of the fishery, but at the finer scale of the individual fishing modes (described in Chapter 3). In the monkfish example, there would be 6 primary fishing modes associated with the monkfish fishery within a total of over 25 fishing modes for which the SBRM CV standard of 30 percent would separately apply. For the purposes of defining the SBRM, this amendment classifies the relevant fishing activity into 56 fishing modes (as explained in Chapter 3 and Chapter 5).

Another way in which the proposed application of the SBRM standard differs from the NMFS (2004) guidance is that while the guidance document indicates that the precision goal of 20-30 percent should apply to total discards "aggregated over all species" [emphasis added], this preferred alternative proposes disaggregating all species to the level of individual species or groups of related species. Continuing the example of the monkfish fishery, among the gear types that catch monkfish, there are more than 29 other FMP species caught in those gears (along with many other non-FMP species). The guidance in NMFS (2004), therefore, recommends that the precision of the estimate of total discards of all 30+ species across all applicable fishing gears would be sufficient if the single estimate had a CV between 20 and 30 percent. The SBRM proposed under the preferred alternative would separately track the precision of the discard estimates for each individual species, except for a few limited cases where a species complex is more appropriate, managed under a Greater Atlantic Region FMP. Thus, rather than tracking a single discard estimate for the monkfish fishery across 30+ species, the proposed SBRM would separately track discard estimates for 15 individual species or species groups.

In total, the proposed SBRM would separately track and report the precision associated with the discard estimates of 14 individual fishery resource species or species groups and one protected species group across 56 separate fishing gear modes (see Table B-1 in Appendix B). In sum, this means that rather than trying to achieve a precision of 20-30 percent for a single estimate of total discards in each of 15 major fisheries (15 separate estimates), under this proposed SBRM, the Councils and NMFS will strive to achieve a precision of no more than 30 percent in each of up to 840 unique fishing gear mode and species combinations (see Table 46 and Table 47).

The proposed CV-based performance standard for the SBRM applies only to data collected by at-sea fisheries observers. Observer data are the primary sources of bycatch information in the commercial fisheries subject to an affected FMP. It is the intent of the agency to ensure that all future recreational fishing data collection programs minimize bias and maximize precision to the extent practicable, and to take all necessary steps, as suggested by the NRC and mandated by Congress, to develop and maintain a statistically valid and reliable recreational fishing data collection program.

### 6.4 Element 4: SBRM Review/Reporting Process

More than one alternative to the status quo could be selected from this section.

### 6.4.1 Alternative 4.1 - No Review or Reporting Requirements (Status Quo)

Under this alternative, the SBRM Omnibus Amendment would neither include any specific process or requirement to conduct periodic reviews of the effectiveness of the SBRM, nor would it specify or suggest any particular process to be used by the Councils and/or NMFS to determine whether a CV standard should be changed, or whether additional steps are necessary to improve the SBRM.

### 6.4.2 Alternative 4.2 - Specify an SBRM Review Process (Preferred Alternative)

This alternative would establish a periodic review and reporting process through which the Councils and NMFS would consider the effectiveness of the SBRM and, if necessary, take appropriate steps to improve the SBRM. The periodic review process established for the SBRM would specify how and when the Councils and NMFS would review information regarding the effectiveness of the SBRM relative to the CV standard. Note that the report specified under this alternative would be separate from the discard reporting process described in alternative 4.3. The SBRM Review Report is intended to provide the information necessary to evaluate whether the SBRM has been effective at meeting its objectives. The discard report (alternative 4.3) is intended to present the most recent information on discards occurring in the relevant fisheries.

The cornerstone of the review process would be a report (SBRM Review Report), prepared by an SBRM Review FMAT formed for this purpose, that would provide the following information: (1) A review of the recent levels of observer coverage in each applicable fishing mode; (2) a review of recent observed encounters with each species in each fishery (or by gear type for turtles), and a summary of observed discards by weight; (3) a review of the CV of the discard information collected for each fishery; (4) a review of recent estimates of the total amount of discards associated with each fishing mode (these estimates may differ from estimates generated and used in stock assessments, as different methods and stratification may be used in each case); (5) an evaluation of the effectiveness of the SBRM at meeting the performance standard for each fishery; (6) a description of the methods used to calculate the reported CVs and to determine observer coverage levels, if the methods used are different from those described and evaluated in this amendment; (7) an updated assessment of potential sources of bias in the sampling program and analyses of accuracy; and (8) an evaluation of the implications of the discard information collected under the SBRM. This last item would apply in cases where the evaluation performed for item 5 indicates that the performance standard is not met for certain combinations of fishing modes and species groups. In these cases, the report would evaluate the implications of not meeting the performance standard. It is expected that the evaluation would focus on whether the data remain sufficiently precise to conduct sound stock assessments and manage ACLs, whether the magnitude of the discards is such that the effect of less precise data is negligible, or whether the less precise data may actually compromise the stock assessment or management processes.

The information to be provided in the report for the purpose of determining the effectiveness of the SBRM in meeting the CV standards should not be confused with the level of information a Council may want or need to address specific management issues. More detailed discard-related information, structured in a way and at a scale meaningful for the particular management issue, can always be provided by the various PDTs and FMATs at the Councils' request. For example, the data collection programs within the SBRM could summarize bycatch data annually, by quarter, by month, for a region or by statistical area, by species groups or individual species, or other parameters requested by fisheries managers. Please note that the term "fishery" in the context of the SBRM Review Report maintains the usage indicated in this amendment, i.e., the fishing modes identified in chapter 3 based on the observable a priori attributes of a fishing trip. However, information requested by the Councils regarding discards occurring in specific fisheries, for the purpose of a fishery management action, may be organized based on primary species caught/targeted, area fished, trip length, or other feature of a fishing trip that would not be known until the trip is complete.

This alternative would also specify the frequency of the SBRM review process. There are four options relative to the frequency with which the review process is conducted: ${ }^{43}$

Option A - Annually. Under this option, the Councils would be presented with an annual SBRM Review Report that would address all fisheries for which the SBRM applies, including any new fisheries added to Council management since the last SBRM Review Report.

Option B - Every 5 years. Under this option, the Councils would be presented with an SBRM Review Report once every 5 years that would address all fisheries for which the SBRM applies, including any new fisheries added to Council management since the last SBRM Review Report. The structure of this review would be similar to the 5-year review of Council EFH designations, with NMFS providing the information needed by the Councils and the Councils each incorporating that information into their management process either in an omnibus SBRM Omnibus Amendment (as the New England Council is doing with an omnibus EFH amendment) or on a case-by-case basis in conjunction with each new management action (as the Mid-Atlantic Council is doing for EFH with all upcoming amendments).

Option C - SAFE Report schedule. Instead of a single SBRM Review Report generated for all applicable fisheries, information relevant to the effectiveness of the SBRM for a fishery would be presented in separate reports for each fishery, at a time interval appropriate for that fishery. This option could capitalize on review processes and timeframes already established for each FMP. For example, under the Red Crab FMP, there is a Stock Assessment and Fishery Evaluation (SAFE)

[^31]report prepared every 3 years, but the Skate FMP requires a SAFE report every 2 years and an annual report in the intervening years. Under this option, the SBRM Report for the red crab fishery could be incorporated into the Red Crab SAFE report and presented every 3 years, while the SBRM Report for the skate fisheries could be presented either annually or every 2 years.

Option D - Every 3 years. (Preferred Option) Under this option, the Councils would be presented with an SBRM Review Report once every 3 years that would address all fisheries for which the SBRM applies, including any new fisheries added to Council management since the last SBRM Review Report. This comprehensive report would address all items required of the report (see earlier paragraph) for all fisheries of both Councils.

The information provided to the Councils in the SBRM Review Report would indicate when and where any lack of precision around a bycatch estimate is different from the CV standard and whether this difference may be problematic for stock assessments or management decisions, including the monitoring of ACLs. With this information in hand, the Councils could initiate an action to change the appropriate SBRM standard and/or recommend additional management action(s) to address the problem. Under this alternative, the SBRM Review Report would identify pertinent issues to the Councils, and the Councils would choose whether and how to most effectively address the issues raised. The SBRM Review Report may warrant peer review, particularly if there have been substantial changes or updates to the models and analytical methods used to calculate the reported CVs and to determine observer coverage levels (as provided in item 6 of the report). The peer review may take the form of an independent external peer review such as for a formal stock assessment, or through the Councils' Scientific and Statistical Committees (SSCs), as was done for the 2007 SBRM Omnibus Amendment.

### 6.4.3 Alternative 4.3 - Require Periodic Discard Reports (Preferred Alternative)

This alternative would require, a periodic discard report prepared by the NEFSC on discards occurring in Council-managed fisheries. This report would be separate from any periodic report on effectiveness of the SBRM (considered under Alternative 4.2). This discard report would utilize information obtained from the NEFOP. The report would be presented to the Councils and would include catch and estimated discard based on data from all observed trips during a specified time period. Additional catch and effort data from other sources would be included as needed.

The discard reports would include summaries of the trips observed, fishing modes in the relevant time period, funding issues and other related issues and developments, and projections of coverage across fisheries for upcoming time period. More detailed information would be provided in tables and figures that addressed: The number of observer trips and sea days scheduled that were accomplished for each fishing mode and quarter, as well as the number of trips and sea days of industry activity; the kept weight from unobserved quarters and statistical areas summarized by fishing mode; the amount
kept and estimated discards of each species by fishing mode; and the relationship between sample size and precision for relevant fishing modes.

Examples as to how discard data could be summarized by fishery and presented to the Councils are illustrated in NEFSC Reference Document 12-17 (Wigley et al., 2012a) for 15 species groups of fish and NEFSC reference Document 12-26 (Murray 2012) for turtles. Turtle estimates are currently updated for each gear type on a 5 -year schedule to utilize a longer time series of data for these rare bycatch events. There are two options regarding the frequency with which the reports would be prepared:

Option A - Semi-annually. Under this option, the Councils would be presented with an SBRM Discard Report every 6 months. The report would address all fisheries for which the SBRM applies.

Option B - Annually. (Preferred Option) Under this option, the Councils would be presented with an SBRM Discard Report once every year. The report would address all fisheries for which the SBRM applies.

Under each option for turtles, the most recent average annual estimate of total bycatch would be reported until new estimates are generated.

### 6.5 Element 5: Changes to the Framework Adjustment and/or Annual Adjustment Provisions

### 6.5.1 Alternative 5.1 - Status Quo

Under the status quo, and notwithstanding the current framework adjustment provisions of any FMP, changes to the provisions of the SBRM implemented by this amendment could only be made through an amendment to the FMPs subject to this action. The SBRM Omnibus Amendment would not modify the current framework adjustment or annual adjustment/specification provisions of the subject FMPs to explicitly include any of the new SBRM provisions as items that may be modified through either a framework adjustment or an annual adjustment/specification.

### 6.5.2 Alternative 5.2 - Modify the Framework Adjustment Provisions

Under this alternative, certain provisions of the SBRM implemented under this amendment could be changed by the Councils through a framework adjustment to an affected FMP. Subject to the framework adjustment provisions established in each FMP, the following management measures or provisions of the SBRM may be implemented and/or modified through a framework adjustment to the applicable FMP:

- The CV-based performance standard. This includes changes to the CV level established as the SBRM performance standard for a particular fishery, fishing mode, or combination of species and fishing mode(s). The intent of this provision is to provide an efficient means for a Council to change the performance standard in certain circumstances when a higher level of
precision (i.e., reducing the CV to less than 30 percent) is desired for a particular fishery or management program (e.g., a Special Access Program (SAP) under the Northeast Multispecies FMP).
- The means by which discard data are collected/obtained in a fishery. This includes implementation of new data collection technologies or procedures and/or changing current data collection technologies or procedures. The intent of this provision is to provide an efficient means for a Council to implement new collection protocols, to the extent that such implementation would require changes to fishing regulations. Changes implemented through this provision could include electronic video monitoring or electronic catch reporting, in one or more fisheries when and if the technologies become sufficiently mature for such use and there is an appropriate need in the subject fishery.
- Fishery stratification for the SBRM. This includes adding to or removing from the list of fishing modes that comprise the analytical framework for the SBRM. The intent is to provide an efficient mechanism for a Council to modify the basis by which SBRM-related analyses are conducted and by which observer effort is allocated across all fisheries. These changes are necessary as management measures create, eliminate, or modify fishery programs identified as independent fishing modes for the purposes of applying the SBRM.
- SBRM reporting. This includes changes to the requirements for periodic reports of discards occurring in New England and/or Mid-Atlantic fisheries, as well as changes to the requirements for periodic reports on the effectiveness of the SBRM. The intent is to provide an efficient mechanism for a Council to change the frequency at which they receive SBRM-related reports, as well as to change the minimum required contents of all such SBRM-related reports.
- Industry-funded observers and/or observer set-aside programs. This change authorizes the establishment of an industry-funded observer program and observer set-aside provisions. For more information, see section 6.7.3.


### 6.5.3 Alternative 5.3 - Modify the Framework Adjustment and Annual Adjustment/Specification Procedures

Under this alternative, certain provisions of the SBRM implemented under this amendment could be changed by the Councils through a framework adjustment to an affected FMP or through the annual adjustment or annual or multi-year specification process established by an FMP. Subject to the appropriate framework adjustment, annual adjustment, annual specifications, and/or multi-year specifications provisions established in each FMP, the following management measures or provisions of the SBRM may be implemented and/or modified through one of these mechanisms of the applicable FMP:

- The CV-based performance standard. This includes changes to the CV level established as the SBRM performance standard for a particular fishery, fishing mode, or combination of species and fishing mode(s). The intent of this provision is to provide an efficient means for a Council to change the performance standard in certain circumstances when a higher level of precision (i.e., reducing the CV to less than 30 percent) is desired for a particular fishery or management program (e.g., a Special Access Program (SAP) under the Northeast Multispecies FMP).
- The means by which discard data are collected/obtained in a fishery. This includes implementation of new data collection technologies or procedures and/or changing current data collection technologies or procedures. The intent of this provision is to provide an efficient means for a Council to implement new collection protocols, to the extent that such implementation would require changes to fishing regulations. Changes implemented through this provision could include electronic video monitoring or electronic catch reporting, in one or more fisheries when and if the technologies become sufficiently mature for such use and there is an appropriate need in the subject fishery.
- Fishery stratification for the SBRM. This includes adding to or removing from the list of fishing modes that comprise the analytical framework for the SBRM. The intent is to provide an efficient mechanism for a Council to modify the basis by which SBRM-related analyses are conducted and by which observer effort is allocated across all fisheries. These changes are necessary as management measures create, eliminate, or modify fishery programs identified as independent fishing modes for the purposes of applying the SBRM.
- SBRM reporting. This includes changes to the requirements for periodic reports of discards occurring in New England and/or Mid-Atlantic fisheries, as well as changes to the requirements for periodic reports on the effectiveness of the SBRM. The intent is to provide an efficient mechanism for a Council to change the frequency at which they receive SBRM-related reports, as well as to change the minimum required contents of all such SBRM-related reports.
- Industry-funded observers and/or observer set-aside programs. This change would only be made to the framework adjustment provisions of relevant FMPs, and authorizes the establishment of an industry-funded observer program and observer set-aside provisions. For more information, see section 6.7.3.


### 6.5.4 Alternative 5.4 - Modify the Framework Adjustment and Annual Adjustment/Specification Procedures, Allowing Changes to Fishing Modes Without Formal Council Action (Preferred Alternative)

Under this alternative, certain provisions of the SBRM implemented under this amendment could be changed by the Councils through a framework adjustment to an affected FMP or through the annual adjustment or annual or multi-year specification process established by an FMP. However, unlike the provisions listed above under Alternative 5.3, adding to or removing from the list of fishing modes that comprise the analytical framework for the SBRM could be done annually without specific action by the Councils. The Councils would be informed each year if a specific fishing mode(s) is added or removed from the SBRM, and would have the opportunity to provide comment on the appropriateness of the change. The Councils could suggest specific fishing modes be considered for addition or removal from the SBRM. The intent is to provide an efficient mechanism to modify the basis by which SBRM-related analyses are conducted and by which observer effort is allocated across all fisheries. These changes are necessary as management measures or innovations by the fishing industry create, eliminate, or modify fishing operations identified as independent fishing modes for the purposes of applying the SBRM.

Subject to the appropriate framework adjustment, annual adjustment, annual specifications, and/or multi-year specifications provisions established in each FMP, the following management measures or provisions of the SBRM may be implemented and/or modified through one of these mechanisms of the applicable FMP:

- The CV-based performance standard. This includes changes to the CV level established as the SBRM performance standard for a particular fishery, fishing mode, or combination of species and fishing mode(s). The intent of this provision is to provide an efficient means for a Council to change the performance standard in certain circumstances when a higher level of precision (i.e., reducing the CV to less than 30 percent) is desired for a particular fishery or management program (e.g., a Special Access Program (SAP) under the Northeast Multispecies FMP).
- The means by which discard data are collected/obtained in a fishery. This includes implementation of new data collection technologies or procedures and/or changing current data collection technologies or procedures. The intent of this provision is to provide an efficient means for a Council to implement new collection protocols, to the extent that such implementation would require changes to fishing regulations. Changes implemented through this provision could include electronic video monitoring or electronic catch reporting, in one or more fisheries when and if the technologies become sufficiently mature for such use and there is an appropriate need in the subject fishery.
- SBRM reporting. This includes changes to the requirements for periodic reports of discards occurring in New England and/or Mid-Atlantic fisheries, as
well as changes to the requirements for periodic reports on the effectiveness of the SBRM. The intent is to provide an efficient mechanism for a Council to change the frequency at which they receive SBRM-related reports, as well as to change the minimum required contents of all such SBRM-related reports.
- Industry-funded observers and/or observer set-aside programs. This change would only be made to the framework adjustment provisions of relevant FMPs, and authorizes the establishment of an industry-funded observer program and observer set-aside provisions. For more information, see section 6.7.3.


### 6.6 Element 6: Prioritization Process for SBRM Observer Allocations

The Court order in Oceana v. Locke which vacated the 2007 SBRM Omnibus Amendment found fault with the prioritization process adopted in that action on two fronts. The Court found that NMFS had too much discretion in determining whether there were sufficient resources available to fully implement the estimated number of sea days needed to achieve the CV performance standard. In addition, the Court found that NMFS had too much discretion in how observer sea days were redistributed under the prioritization process. To address these two aspects of the court order, the alternatives in this section are divided into two groups. The first group of alternatives (6.1.1 and 6.1.2) proposes "funding triggers" that could be used to determine what resources are available and whether those resources are sufficient to fully implement the SBRM coverage in a given year. The second group of alternatives (6.2.1, 6.2.2, and 6.2.3) proposes alternative methods for redistributing the available observer sea days if resources are limiting. If there are sufficient funds to fully implement the SBRM in a given year, then the trigger would not be met and no redistribution of observer coverage would be necessary.

A third set of alternatives (6.3.1, 6.3.2, and 6.3.3) is presented to address the unlikely event that Federal observer funding is so restricted in a given year that there are not enough observer sea days to achieve the minimum pilot coverage in each fleet.

### 6.6.1 Funding Trigger Alternatives

### 6.6.1.1 Alternative 6.1.1 - Status Quo Funding Trigger

Observer sea days in the Greater Atlantic Region are funded from a number of funding lines. Some funding sources are dedicated to observers for specific species (e.g., sea turtles under the Endangered Species Act or marine mammals under the MMPA) or for bycatch in specific fisheries (e.g., mid-water trawls or groundfish sectors). Some national funding sources have more flexibility and can be targeted to Regions or fisheries that have a particular need or priority. When determining if sufficient funding is available to fully implement the target observer coverage levels, NMFS currently takes into account the range of available funds and the various restrictions and limitations on each source.

### 6.6.1.2 Alternative 6.1.2 - Identify Specific SBRM Funding Sources (Preferred Alternative)

Under this trigger alternative, the SBRM Omnibus Amendment would identify specific funding sources to be used to fund observer coverage under the SBRM each year. If this funding in a given year is sufficient to fully implement the observer coverage levels estimated to achieve the target performance standard, then no further prioritization would be necessary that year. If the funding available through these specified sources is not sufficient to fully implement the estimated observer coverage levels in a given year, then an additional prioritization process would be used to determine how the available observer sea days would be allocated across the fisheries.

| Funding Line | Average Proportion <br> to the Region (2010-2012) |
| :--- | :--- |
| Northeast Observers | 98 percent |
| Atlantic Coast Observers | 43 percent |
| National Observer Program | 43 percent |
| Reducing Bycatch - Observers | 13 percent |

Table 66. Example of recent average funding for Greater Atlantic Region observer coverage
Table 66 illustrates the levels of these funding sources that have been allocated to the Greater Atlantic Region for observer coverage in recent years. Future allocations to the Greater Atlantic Region may vary. The SBRM would form the foundation of observer coverage in the region. As such, the NEFOP would use funds allocated to the Region from these funding program lines to support SBRM consistent with historic practice. Funding for Atlantic Coast Observers is divided between the Greater Atlantic Region, Southeast Region, and NMFS Headquarters. In recent years the proportion that has been allocated to the Greater Atlantic Region to fund SBRM coverage has been 43 percent, on average. The National Observer Program funding line is divided among all of the NMFS regions and NMFS Headquarters. In recent years, the Greater Atlantic Region has received the largest portion of this funding, averaging 43 percent. Funding under the Reducing Bycatch-Observers line is directed to NMFS to fund a variety of bycatch observer-related work among all of the Regions and NMFS Headquarters. In recent years, an average of 13 percent of this funding has been allocated to SBRM coverage in the Greater Atlantic Region.

Under this alternative, the total available funds allocated to the Greater Atlantic Region from the Congressional appropriation funding lines listed in Table 66, would be used to support SBRM consistent with historic practice and thereby determine if there were sufficient funds available to fully implement the SBRM in a given year. These funding sources could be adjusted if Congress directs the use of these funds for other purposes; as such a directive would be binding on NMFS. If additional funds for observer sea days were available from another funding source, not listed here, those observer sea days could be allocated according to other priorities and would not necessarily be allocated according to the SBRM process. Such other funding sources could include funding for observers dedicated to monitoring at-sea interactions under the MMPA or the Endangered Species Act, or funding dedicated for management purposes,
such as monitoring catch share programs. In case final Congressional appropriations are not available at the time observer coverage rates are determined, it may be necessary to use an estimate of the funds that will ultimately be available. Subsequently adjusting coverage levels to match the final budget allocations may not be feasible.

### 6.6.2 Observer Sea Day Prioritization Alternatives

### 6.6.2.1 Alternative 6.2.1 - Council Consultation of Proposed SBRM Observer Allocations

Under this alternative, the Regional Administrator and Science and Research Director would be required to develop a proposed prioritization of how the available resources should be allocated across the fisheries should any external operational constraint exist. The Regional Administer and Science and Research Director would provide the Councils, at the earliest practicable opportunity: (1) The at-sea observer coverage levels required to attain the SBRM performance standard in each applicable fishery; (2) the coverage levels that would be available if the resource shortfall were allocated proportionately across all applicable fisheries; (3) the coverage levels that incorporate the recommended prioritization; and (4) the rationale for the recommended prioritization. The recommendation of the Regional Administrator and Science and Research Director should be based on: Meeting the immediate and anticipated data needs for upcoming stock assessments; legal mandates of the agency under other applicable laws, such as the Endangered Species Act or MMPA; meeting the data needs of upcoming fishery management actions, taking into account the status of each fishery resource; improving the quality of discard data across all fishing modes; and/or any other criteria identified by NMFS and/or the Councils. The Councils would consider the recommendations of the Regional Administrator and Science and Research Director at a public meeting, and may choose to recommend revisions or additional considerations to be considered by the Regional Administrator and Science and Research Director.

This alternative represents the alternative implemented by the 2007 SBRM Omnibus Amendment. This approach to prioritizing at-sea observer coverage was found to be legally deficient by the Court in Oceana v. Locke and was the basis for the decision to vacate the 2007 SBRM Omnibus Amendment. Therefore, this alternative would not meet the Court's directive to address this deficiency.

### 6.6.2.2 Alternative 6.2.2 -Adjust Observer Coverage Proportionally Across All Fishing Modes

Under this alternative, the number of observer sea days for each agency-funded fishing mode would be reduced by the same percentage as the funding shortfall, after the number of sea days needed for minimum pilot coverage has been deducted. It was recognized that in the process of proportionally reducing sea days to match available funds some fishing modes might result in coverage below a level that would be expected to produce meaningful discard information. The minimum pilot coverage has been incorporated into this formulaic approach to provide a minimum threshold for all fishing modes. The minimum pilot coverage level as described in 5.3.3.

To account for the minimum pilot coverage, total minimum pilot coverage sea days are subtracted from the total number of funded observer sea days and from the number of sea days needed to achieve the CV performance standard. Next, a ratio would be calculated by dividing the adjusted total number of funded observer sea days by the adjusted number of sea days needed to achieve the CV performance standard. This ratio would be applied to all of the fishing modes subject to the funding shortfall.

In the following example, the allocation process determined that 15,000 sea days were needed to achieve the CV performance standard and 2,000 sea days were needed for minimum pilot coverage, but funding was only available for 12,000 sea days. The 2,000 minimum pilot coverage sea days would be subtracted from the sea days needed to achieve the CV performance standard ( $15,000-2,000$ ), yielding 13,000 sea day needed. Similarly 2,000 minimum pilot coverage sea days would be subtracted from the 12,000 funded days, yielding 10,000 funded. Therefore, there would be a 3,000 day shortfall. These 10,000 funded sea days would be proportionally allocated to each fishing mode based on the ratio of 0.77 ( 10,000 funded days / 13,000 needed days). Within each agency-funded fishing mode, the proportionally allocated sea days would be added to the minimum pilot coverage sea days. Fleets with industry funded observer coverage, which is not specifically tied to SBRM coverage levels, would be excluded from these calculations. Therefore, the coverage levels in the scallop fishery would not necessarily be included in the calculation of the funding shortfall nor would coverage levels in the scallop fleet be reduced by the percent shortfall.

This alternative prioritization approach is applicable when the total agencyfunded sea days are greater than the total minimum pilot sea days needed. An illustrative example of this alternative is provided in Appendix H. All fleets will have some observer coverage.

### 6.6.2.3 Alternative 6.2.3 - Adjust Observer Coverage Using the Penultimate Cell Approach (Preferred Alternative)

Under this alternative, the available number of observer sea days would be prioritized across the various agency-funded fishing modes such that the fewest number of fishing mode and species group combinations have a CV that is higher than the CVbased performance standard. As described in 6.2.2, the necessary observer coverage for each fishing mode would be the highest projected number of observer sea days needed to achieve the CV-based performance standard for each species or species group after the application of the importance filters. In order to prioritize the available sea days, using this alternative, the species group sea days needed would be organized in descending ordered within each fishing mode for all modes, and the highest difference in needed sea days between adjacent species groups within the fishing modes would be identified. The sea days associated with the species group that represents the highest number of observer sea days from that fishing mode would be removed, with the constraint that the differences are taken in order within a fleet. Therefore, that fishing mode would then use the second highest (penultimate) projected number of observer sea days. This process of eliminating the highest difference in projected number of observer sea days within a fleet
would be repeated, as necessary, across all fishing modes until the total number of observer sea days needed is within that year's funding limit.

Table 67 shows an example of how the sea days needed are derived. In this example, the projected number of observer sea days needed to achieve the CV performance standard is determined for each fishing mode and species group combination. Several of the cells are filtered out by the importance filters as described under section 6.2.3, and are shown as zero sea days in the table. Of the cells that remain, the highest value in each fishing mode is used as observer coverage needed in that fishing mode to achieve the CV-based performance standard across all species groups. In this example, after the importance filter, 18,301 observer sea days would be needed to fully implement the SBRM.

In the penultimate approach, if the available funding resources could not fund this number of days, the fishing mode with the highest difference in the number of observer sea days between species groups within a fishing mode would be adjusted. Here, the highest difference between species groups occurs within the small mesh groundfish in the Mid-Atlantic large-mesh otter trawl fishery (Row 6). This fishing mode needs 5,551 observer sea days to achieve the CV performance standard and the next highest (penultimate) sea days needed is 2,952 for sea turtles, a difference of 3,091 days. If the small mesh groundfish cell is eliminated from consideration, then that fishing mode would then use 2,952 observer sea days based on the number needed for the sea turtle species group. This would drop the number of needed observer sea days from 18,301 to 15,210 . If additional reductions were necessary, the process would be repeated, each time using the difference in sea days between the highest value cell and the secondhighest value cell (penultimate cell) for each fishing mode, and comparing that difference across all fishing modes.

In this alternative the minimum pilot coverage is incorporated, and the sea days within a fishing mode would not be reduced below this number of sea days. The minimum pilot coverage level is described in 5.3.3. This alternative prioritization approach is applicable when the total agency funded sea days are greater than the total minimum pilot sea days needed. An illustrative example of this alternative is provided in Appendix H. All fishing modes would have some observer coverage.

| Row | Gear Type | Region | Mesh <br> Group | RCRAB | SBM | MONK | GFL | GFS | SKATE | DOG | FSB | TURS | Pilot days | Min <br> Pilot <br> Days | 2012 <br> Sea Days <br> Needed COMBINED |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 5 | Otter Trawl | MA | sm | 3,231 | 364 | 0 | 497 | 545 | 397 | 325 | 513 | 1,719 | 160 | 30 | 3,231 |
| 6 | Otter Trawl | MA | lg | 5,551 | 0 | 164 | 141 | 0 | 107 | 333 | 173 | 2,952 | 266 | 27 | 5,551 |
| 7 | Otter Trawl | NE | sm | 0 | 411 | 0 | 461 | 451 | 531 | 1,151 | 489 | - | 168 | 29 | 1,151 |
| 8 | Otter Trawl | NE | lg | 3,879 | 0 | 568 | 76 | 280 | 261 | 229 | 788 | - | 415 | 35 | 3,879 |
| 17 | Otter Trawl, Haddock Separator | NE | lg | 0 | 0 | 0 | 0 | 0 | 257 | 567 | 0 | - | 100 | 100 | 567 |
| 22 | Sink, Anchor, Drift Gillnet | MA | sm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 172 | 40 | 13 | 172 |
| 23 | Sink, Anchor, Drift Gillnet | MA | lg | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 172 | 43 | 13 | 172 |
| 24 | Sink, Anchor, Drift Gillnet | MA | xlg | 0 | 0 | 70 | 0 | 0 | 83 | 0 | 0 | 1,096 | 61 | 15 | 1,096 |
| 26 | Sink, Anchor, Drift Gillnet | NE | lg | 0 | 0 | 0 | 0 | 0 | 0 | 97 | 0 | - | 134 | 14 | 97 |
| 36 | Scallop Dredge | MA | all | 0 | 0 | 312 | 0 | 0 | 164 | 0 | 0 | 598 | 238 | 109 | 598 |
| 39 | Mid-water Paired \& Single Trawl | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 571 | 0 | - | 43 | 43 | 571 |
| 48 | Pots and Traps, Lobster | NE | all | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | - | 429 | 17 | 429 |
| . | : |  |  | : | : | : | : | : | : | : | : | : |  | : | : |

20,590
Table 67. Example of projected number of observer sea days; purple shading indicates an industry funded fleet.

### 6.6.3 Insufficient Funding for Minimum Pilot Coverage Alternatives

The use of minimum pilot coverage as described in section 5.3.3 ensures that a fleet is not allocated too few observer sea days such that meaningful discard estimations could not be generated. If the total of agency funded sea days is greater than the total minimum pilot coverage, then one of the prioritization alternatives in 6.6 .2 would be appropriate. If the funded days exactly equals the total minimum pilot coverage sea days then the sea days would be assigned to fishing modes according to the minimum pilot coverage. However, it is theoretically possible that the available funding for SBRM observers in a given year could be so restricted that the minimum pilot coverage for each fleet could not be achieved. In such a case, it would be necessary to determine which fleets would get enough observer coverage to reach the minimum pilot coverage and which would not. Three alternatives have been developed to ensure some meaningful discard estimations if SBRM funding is ever so restricted. To address all potential funding situations, one alternative from section 6.6.2 and one alternative from this section would be selected. Which of those two alternatives would apply in a given year would depend on the specific funding level.

It should be noted that an FMP may require a level of observer coverage to address management considerations other than SBRM, which is funded outside of the SBRM funding sources discussed in section 6.6.1. Current examples are the industry funded observer program in the scallop fishery, or the at-sea monitors in the NE multispecies sector program. Although these observers may not be specifically deployed for SBRM, the data they collect may be used to supplement SBRM data or to generate discard estimations in the absence of SBRM-funded observers.

### 6.6.3.1 Alternative 6.3.1 - Assign Coverage Ad-Hoc

Under this alternative the Regional Administrator and Science and Research Director would provide the Councils a proposal that provides details of the funding shortfall and recommends which fishing modes would receive minimum pilot coverage and which would not receive any coverage. The proposal should include the basis for these recommendations, including any legal mandates, management priorities, or data needs that were considered. The Councils would consider the proposal at a public meeting, and may choose to recommend revisions or additional considerations.

This alternative prioritization approach is applicable only when the agencyfunded sea days are less than the minimum pilot sea days needed. Under this alternative some fleets will necessarily not have observer coverage.

### 6.6.3.2 Alternative 6.3.2 - Assign Coverage Based on Minimum Pilot Coverage

Under this alternative, the number of agency-funded sea days would be assigned to each fishing mode by sequentially eliminating coverage in fleets that have the highest minimum pilot coverage days until the shortfall in minimum pilot coverage sea days is removed. Here, the MA shrimp trawl fleet (Row 36) requires the most minimum pilot sea days (120 days), thus this fleet would be assigned zero sea days. If necessary, the fishing mode with the next highest minimum sea days (Row 17 with 100 days) would be assigned zero sea days. This process would continue until the shortfall in minimum pilot coverage sea days is removed. Any remaining days would then be proportionally allocated among fleets with sea days assigned.

This alternative prioritization approach is applicable only when the agencyfunded sea days are less than the minimum pilot sea days needed. An illustrative example of this alternative (also referred to as the "Penultimate MPC Approach") is provided in Appendix H. Under this alternative some fleets will necessarily not have observer coverage.

### 6.6.3.3 Alternative 6.3.3 - Assign Coverage Based on Minimum Pilot Coverage Ratio (Preferred Alternative)

Under this alternative, the number of agency-funded sea days would be assigned to each fishing mode by sequentially eliminating coverage in fleets that had the highest ratio of minimum pilot coverage days to actual days absent from port, as reported by FVTRs from the previous year, until the shortfall in minimum pilot coverage days is removed. This process would continue until the shortfall in minimum pilot coverage sea days is removed. Any remaining days would then be proportionally allocated among fleets with sea days assigned.

This alternative prioritization approach is applicable only when the agencyfunded sea days are less than the minimum pilot sea days needed. An illustrative example of this alternative (also referred to as the "Penultimate MPC Ratio Approach") is provided in Appendix H. Under this alternative some fleets will necessarily not have observer coverage.

### 6.7 Element 7: Industry-Funded Observer Program Provisions

### 6.7.1 Alternative 7.1 - Status Quo

The only Greater Atlantic Region FMP currently with an industry-funded observer program is the Sea Scallop FMP. Beginning in 1999, a percentage of the TAC in scallop access areas has been set aside from the amount available to the fishery in order to generate funding for vessels required to carry an observer on a fishing trip. The scallop TAC set-aside was then allocated to scallop vessels in the form of increased trip limits on trips for which an observer is required. The increased trip limits are intended to offset the cost of carrying and paying for an observer. Amendment 10 to the Scallop FMP extended the set-aside program to include a DAS set-aside for fishing trips in the open areas. The scallop DAS set-aside was provided to scallop vessels in the form of a reduced DAS charge on fishing trips for which an observer is required. In either case, scallop vessels are required to carry and pay for observers when asked, regardless of the availability of either TAC set-aside or DAS set-aside; i.e., vessels are compensated for carrying an observer only to the extent that the set-asides are available, and once the setasides are exhausted, fishing vessels required to carry observers bear the entire cost.

Under the status quo alternative, similar provisions would not be created for any other FMP under the Councils' jurisdiction. Should a Council decide, at any point in the future, to require permitted fishing vessels to pay for at-sea observers and to develop an observer set-aside program to offset the costs to the vessels of carrying and paying said observers, a full amendment to the subject FMP would be required.

Under the status quo alternative, no changes would be made to the sea scallop observer set-aside program, which would continue to operate as established under Framework Adjustments 16 and 18 and Amendments 10 and 13 to the FMP.

### 6.7.2 Alternative 7.2 - Authorize Observer Service Provider Approval and Certification (Preferred Alternative)

Under this alternative, the sea scallop industry-funded observer regulations at 50 CFR 648.11(h) and (i) implemented via emergency rule would be modified and broadened to apply to all Council FMPs. This action would authorize observer service provider approval and certification for all applicable fisheries, should a Council develop and implement a requirement or option for an industry-funded observer program in other fisheries besides sea scallops. It would not, in itself, implement or obligate the Councils to develop an industry-funded observer program, but would create the process by which observer service providers can be approved and certified. This alternative should be considered a parallel to developing a Vessel Monitoring System (VMS) type approval process that applies to all fisheries implementing a VMS provision. The VMS type approval process requirements at $\S 648.9$ were established across all fisheries, but a separate action is required under each FMP to implement VMS provisions for each fishery. Similarly, only though a follow-on action for each FMP (either an amendment or framework adjustment, see alternative 7.3) could an industry-funded observer program, along with any observer set-aside provisions, be developed and implemented.

The June 13, 2007, final rule that implemented Amendment 13 to the Sea Scallop FMP made permanent the industry-funded observer regulations that were first implemented on December 28, 2006, via emergency rule. This action would not expand or modify the regulations at $\S 648(\mathrm{~g})$, which include the specific requirements for sea scallop vessels to obtain, carry, and pay for observers.

The intent of the current regulations at § 648.11(h) that would be expanded through this action is to allow any entity to become an observer service provider, provided it meets the established approval process and all the responsibilities stipulated. An application would be required to contain detailed information such as contact information; description of past experience with placing individuals in remote field and/or marine environments; evidence of adequate insurance to cover injury, liability, and accidental death for observers during employment; and proof of compensation for observers while employed that meet or exceed U.S. Department of Labor guidelines. NMFS would review and evaluate each application and, if approved, the observer service provider's name would be added to the list of approved observer service providers. An approved observer service provider would be required to maintain at least eight certified observers that have passed the NMFS NEFOP Fisheries Observer Training course. The observer service provider would be responsible for all necessary transportation, lodging expenses, and necessary equipment for the observer. An observer service provider would be required to be available for access by the fishing industry 24 hours per day, 7 days per week. Specific reporting requirements would apply, including the timing of reports to be provided to NMFS. Additional requirements are detailed in Appendix H to this amendment.

This action would include specific standards set by NMFS that an observer service provider would be required to meet in order to be certified, including that employees of observer service providers meet the NMFS National Minimum Eligibility Standards; ${ }^{44}$ and the observers would be required to pass the NMFS training course, be physically and mentally capable of carrying out the responsibilities of an observer, and hold a current CPR/first aid certification. NMFS would retain the authority to review observer certifications and issue observer certification probation and/or decertification if warranted. Additional requirements are detailed in Appendix H to this amendment.

### 6.7.3 Alternative 7.3 - Addition of Industry-Funded Observer and Observer SetAside Provisions as a Measure That Can Be Implemented Through Framework Adjustment to the FMPs (Preferred Alternative)

Under this alternative, the development of and/or modifications to an industryfunded observer program, including observer set-aside provisions, could be implemented through a framework adjustment to the relevant FMP. Absent this action, a full FMP amendment would be required for all fisheries, with the exception of the sea scallop fishery. This measure would include general language in the regulations of each FMP that would allow an industry-funded observer program and observer set-aside provisions to be implemented by framework adjustment.

[^32]Development of an industry-funded observer program, an observer set-aside program, or changes to either could be implemented by framework adjustment and could include measures such as the level of observer coverage required in the fishery, the basis for an observer set-aside program and the amount of the set-aside (e.g., quota, DAS, etc.), how the set-aside is allocated to vessels required to carry an observer (e.g., an increased trip limit, differential DAS counting, additional trips, an allocation of quota, etc.), the process for vessel notification, how funds are collected and administered from the industry to cover the costs of observer coverage, revisions to the observer service provider program (if adopted in this action), along with any other measures necessary to develop and implement either an industry-funded observer program or an observer setaside program.

### 6.8 Alternatives Considered but Rejected

Alternatives that were considered initially or during the development of this amendment but were rejected from further analysis do not meet the purpose and need of the SBRM Omnibus Amendment (section 1.4) for one or more reasons. The rationale for rejecting these alternatives is discussed in this section.

### 6.8.1 Incorporating Non-Managed Species into the SBRM

Much of the focus of the SBRM has been on two groups of species: Those subject to a Mid-Atlantic or New England Council FMP; and those afforded protection under the Marine Mammal Protection Act or the Endangered Species Act. During the development of this amendment, there was consideration of whether the SBRM needed to explicitly account for non-managed species (those that are neither subject to an FMP nor protected as above). A review of discard observations from 2012 provided insight into this issue. In 2012, observers reported discards of 255 unique species. ${ }^{45}$ Of these, 39 are managed under a Council FMP subject to this amendment. Another 43 species are subject to an FMP of the ASMFC or NMFS's Atlantic Highly Migratory Species Management Division. The remaining 173 species are either unmanaged or managed only at the level of the individual state.

An analysis of these data indicates that the 39 Council FMP species comprised 78.9 percent, by weight, of the observed discards in 2012. The addition of the Atlantic Highly Migratory Species and ASMFC species, to total 82 species, equaled 82.8 percent of the observed discards. Of the remaining 173 species that accounted for 17.2 percent of the observed discards, the top 15 non-managed species accounted for 16 percent of total discards, leaving 158 species that together comprised only 1 percent of the observed discards, by weight. Looking at the data another way, of the 255 recorded species, 97 species (roughly one-third of the reported species) accounted for 99 percent of the

[^33]discards by weight. Of these 97 species, 39 are managed under a Council FMP and 43 are managed under an ASMFC or Atlantic Highly Migratory Species FMP. Table 68 shows the top 15 non-managed discard species in the 2012 observer database.

| Species | Percent of total observed <br> discards |
| :--- | :---: |
| Sand dollar | $6.5 \%$ |
| Fish, species not known | $2.8 \%$ |
| Sponge | $1.7 \%$ |
| Starfish | $1.4 \%$ |
| Sea raven | $0.6 \%$ |
| Spotted hake | $0.6 \%$ |
| Northern sea robin | $0.6 \%$ |
| Jonah crab | $0.5 \%$ |
| Fourspot flounder | $0.5 \%$ |
| Herring, species not known | $0.4 \%$ |
| Longhorn sculpin | $0.3 \%$ |
| Striped sea robin | $0.3 \%$ |
| Rock crab | $0.2 \%$ |
| Sea robin, species not known | $0.1 \%$ |
| Seaweed | $0.1 \%$ |

Table 68. Top non-FMP species, by weight, of observed discards in 2012, and the percent of each relative to the total observed discards of all species.

Together, the species identified in Table 68 and the species managed under an FMP account for 99 percent of all discards in 2012. This indicates that the majority of discards (99 percent of observed discards) are comprised of relatively few species (38 percent of observed discard species).

More important than the relative proportion of discards of various species is that this analysis demonstrates that at-sea observers record information on all species encountered by the fishing vessel. Observers are trained and expected to record information regarding 670 species (this includes differentiating some species by market code), and observers do so for both discards and landed catch (NEFSC 2013a). For the purposes of designing an SBRM from which data can be extracted to serve a variety of information and analytical needs, the most important factor is to ensure that as wide an array as possible of data are being collected. This analysis confirmed that all possible discard species are being reported by the at-sea observers. This information is available for use by NMFS, Council, ASMFC, and/or state fishery biologists and managers.

Because the explicit inclusion of additional, non-FMP managed species (other than those required under the law), is not necessary to ensure that data on the discards of these species is collected and available for review and/or use in stock assessments, and is beyond the scope required for the SBRM Omnibus Amendment, the need to explicitly consider non-managed species in the design and development of the SBRM was eliminated from further consideration, other than to continue to ensure that all species (managed and non-managed) encountered by observed fishing vessels are reported either as landings or discards.

### 6.8.2 Use Additional Mechanisms to Collect Bycatch Information

Expanded use of Industry-Based Surveys for bycatch purposes.
Expanded use of industry-based surveys as a bycatch monitoring mechanism was considered but rejected from further analysis and consideration. Because of their focused design, compressed seasonality, and specialized fishing gears, industry-based surveys are poorly suited to formally replace or supplement current data sources for bycatch information in any fishery mode of the Greater Atlantic Region, except in an ad hoc or opportunistic way. The industry-based surveys are conducted in a manner that is different than commercial fishing practices, and so the data collected by these surveys cannot be used in a meaningful way to supplement, replace, or improve data collected from other sources. Industry-based surveys are not a means to directly collect bycatch and discard data, nor are industry-based surveys data suitable to use as imputed values for missing commercial fisheries bycatch data. The time series of industry-based surveys data may be susceptible to lapses or compression pending research priorities and funding availability within the Greater Atlantic Region.

Information from the industry-based surveys may be most valuable in providing insight to unique or unusual situations that may need further investigation though other means, similar to how fishery independent survey data may be used. For example, if an industry-based survey found that an unusually high concentration of a given species was seen in the survey area during a specified time but fishery dependent data from the same time and area did not, it may be desirable to increase observer coverage within that time and area. Alternatively, a pilot program for a new technology such as electronic monitoring could be used in fishing modes within the area to confirm the presence of the anomaly. Such a pilot program would need significant regulatory development as well as technological and personnel support from within the Greater Atlantic Region.

Using industry-based surveys as an indicator for areas of study for fishery dependent resources should be left to the discretion of groups that assess and monitor specific FMPs and need not be a formalized process laid out in this amendment. The groups that may choose to periodically review industry-based survey data for bycatch related information include the Plan Development Teams, Monitoring Committees, and assessment working groups. Otherwise, industry-based surveys have no specific utility as a bycatch monitoring mechanism for any of the Greater Atlantic Region fishery modes.

Expanded use of Study Fleets for bycatch purposes.
Expanded use of study fleets to monitor bycatch information was considered but rejected from further analysis and consideration primarily because the study fleet program is not fully matured and the long-term design of the program has yet to be determined (John Hoey, pers. comm., NMFS). Many of the technical issues related to the study fleet have only recently been resolved (John Hoey, pers. comm., NMFS); the program has only just passed beyond the proof of concept phase and it is a data collection in its infancy. Additionally, the current study fleet participants are volunteers who are
compensated for their participation in the program and these volunteers may not truly represent their fleet. A more representative fleet that is not potentially biased by compensation would be needed to ensure that the data are representative of the fleet as a whole. Only then could study fleet data be used for bycatch monitoring, in-season fisheries management, or as estimates to be expanded to an entire fishery mode.

Study fleet data are currently converted from tow-by-tow to trip level data for use in the various Northeast Regional data analyses. Thus, the study fleet information is the same as the data provided by the FVTR data collection. The increased resolution of tow data and improved location data may yield future utility, but for many of the reasons listed above, use of these data is currently limited.

The study fleet project is currently undergoing a detailed evaluation by NMFS and the Northeast Regional Research Steering Committee. It is, at this time, more appropriate that the Steering Committee make recommendations and changes to the study fleet program to further its utility as a regional data source, including bycatch and discard data, rather than implementing changes through this amendment. If revisions to the study fleet program yield usable data, they can be incorporated into updates of individual fishery mode SBRMs, as needed.

## Expanded use of Alternative Platforms for bycatch purposes.

Expansion of the alternative platform program was considered but rejected from further analysis and consideration because no additional fisheries or fishery modes in the region were suitable for this type of data collection. Several alternative platform programs already exist in most of the fisheries or fishery modes for which they are suited in the Greater Atlantic Region. These include near-shore, fixed gear fisheries such as the Chesapeake Bay pound net and the internal waters gillnet fisheries in North Carolina and Virginia. These programs enable observers to obtain visual sampling data from small vessels or static gear that would otherwise be unobservable.

Because an independently operated vessel is needed to deploy an observer and the data collected are limited in most cases to what can be confirmed visually (i.e., presence/absence information), alternative platform programs would be suitable only for expansion to open ocean fishery modes if the desired data were observations of marine mammal and protected species interactions. It remains more effective to continue to monitor open ocean fisheries for these types of interactions through the placement of onboard observers and by requiring such interactions to be reported in FVTRs for unobserved vessels. Therefore, there are currently no additional fisheries or fishery modes where the alternative platform program could be expanded to provide additional bycatch data.

## Implementation of Image Capture and Processing.

The implementation of image capture and processing or 'digital observer’ systems was considered but rejected from further analysis and consideration because the technology has yet to be perfected in worldwide development and deployment (Mark

Buckley, pers. comm., Digital Observer, Inc.). To date, successes in using this technology have been limited to trials in laboratory settings (Davis 2002). The systems are not yet capable of performing to an acceptable standard in the field, even when lighting is enhanced and catch and discards are handled in a prescribed manner at designated locations. It remains more effective for human observers to perform the data collection tasks these systems would provide or to use electronic image capture paired with human analysis of the raw image data. Given the current capabilities of these types of systems, they are not yet suitable for collecting bycatch or discard information in any Greater Atlantic Region fishery mode.

## Implementation of trawl monitoring devices.

The use of trawl monitoring devices was considered but rejected from further analysis and consideration because other means are more effective at providing the limited bycatch-related data that such systems would supply. Trawl monitoring devices have no direct applicability to collecting bycatch information. Their potential as a tool that assists in monitoring or as a means to reduce potential bycatch is also limited. This technology is primarily designed to assist fishermen in ascertaining how their gear is performing and when their nets are full. Fishery researchers have also made use of the technology to monitor performance parameters of trawl gear. The technology is often costly, may require complex installations and continual maintenance to ensure proper monitoring, and may require substantial electronic support onboard the deploying vessel (e.g., personal computer, GPS, fathometer, third wire, etc.).

Such devices may be most applicable to large-volume trawl fisheries such as the herring, squid, and mackerel trawl fishing modes, but would not be appropriate for collecting information on discards. Vessel operators, in an effort to maximize their operating efficiency, may capture and bring onboard more fish in their last set than the vessel can hold. Though this ensures that the vessel's hold will be filled to capacity before returning to port, it may result in discards. The extent to which 'topping off' occurs within the Greater Atlantic Region is not well understood, but is well documented in such fisheries as the Alaska walleye pollock and west coast hake fisheries (Carrie Nordeen, pers. comm., NMFS). The deployment of devices that signal when a codend is filling or full may be of use in helping vessel operators reduce any guess work related with trying to fill vessel holds to capacity.

If a program were designed that required the use of trawl monitors as a means to reduce potential for topping off, the devices would have to be rigorously tested for durability, failure rates, recording capabilities, tamper resistance, and performance standards. A significant regulatory environment would also need to be in place to support such a program. At this time, other approaches to reducing topping off discards are more practical. These may include such things as trip limits, limited access privilege programs, or observer coverage sufficient to characterize discards that do occur. In the scup fishery, for example, a transfer-at-sea provision was implemented to allow vessels with more scup in their net than the trip limit would allow to transfer the surplus to another fishing vessel, reducing the amount of scup that are discarded.

Other potential uses of trawl monitoring devices are limited. Though the technology is capable of monitoring such parameters as bottom contact, headrope height, and net spread, bycatch-related performance measures are better monitored as a function of observed and retained catch. For example, the correct use of a haddock separator trawl could be monitored by trawl devices. A more cost effective, practical way of monitoring separator trawls could be achieved by monitoring the catch of species such as cod or benthic organisms through onboard observers, FVTRs, and landing data.

### 6.8.3 Quarterly Discard Reports

The Councils considered requiring quarterly bycatch reports instead of semiannual or annual reports (described in section 6.4.3). This information, however, would only be useful if the Councils could take action on the same frequency to modify fishing regulations on a quarterly basis. Most Council FMPs provide for an annual or biennial adjustment or measures set on a 3-year basis. Although all Council FMPs allow for midseason changes to management measures through a framework adjustment, frameworks require at least two meetings of a Council to be approved, which generally means that framework adjustments take 4-6 months (or longer) to develop. Thus, it is not possible for a Council to make changes to management measures on a quarterly basis. Because the Councils generally operate on an annual basis, or less frequently, the potential value of quarterly reports is extremely limited. Quarterly reports would, however, require a significant investment of staff time and resources. Given the high cost staff time and resources, and the limited utility for directing Council action, this option was rejected from full consideration.

### 6.8.4 Alternative CV Levels

The Councils considered alternatives to the proposed CV of 30 percent applied to all combinations of fishing modes and species. In particular, the Councils considered an approach that would have attempted to establish a separate and distinct CV level for each particular combination of fishing mode and species (e.g., one CV level established for monkfish in New England small-mesh gillnets, a different CV level established for bluefish in Mid-Atlantic large-mesh otter trawls, etc.). The Councils also considered the basis for selecting 30 percent as the most appropriate CV level, and whether an alternative percentage ( 15 percent, 20 percent, 40 percent, etc.) should be selected instead. There are several reasons why these approaches were not pursued.

The primary reason for not considering a wide range of CV values is the lack of scientific justification for CV values outside the range recommended by the National Working Group on Bycatch. In NMFS (2004), a range of 20-30 percent was recommended for use in developing SBRMs. Even within this range, there is little scientific justification for choosing one CV level (e.g., 28 percent) over any other specific CV level (e.g., 27 percent). Given the lack of a scientific basis to select any one specific level over any other, the Councils focused on the extremes of this range (i.e., 20 percent and 30 percent). The reasons for utilizing the 30 percent CV level instead of the 20 percent CV level are explained in section 6.3.2.

Although briefly considered by the Councils early in the process to develop this amendment, establishing separate and distinct CV levels for each particular combination of fishing mode and species was not pursued further. As mentioned above, there was no scientific justification for choosing a CV level outside the range of 20-30 percent recommended in NMFS (2004). In addition, this approach was not pursued further due to a lack of information necessary to make informed decisions regarding the cell-by-cell CVs. In other words, the information that would be necessary to determine, for example, that monkfish in New England small-mesh gillnets should have a different CV level than that for bluefish in Mid-Atlantic large-mesh otter trawls, and whether that CV level should be higher or lower, is not available at this time.

Recognizing that as this information becomes available, the Councils may wish to establish different CV levels for certain combinations of fishing mode and species, this amendment provides the flexibility to the Councils to enable such changes to the CV level (see section 6.5.3). The global CV of 30 percent functions, in this case, as a baseline level of precision expected for all relevant fishing modes and species in the SBRM. If new information, or new management measures, indicate a need for improved precision for certain fishing modes and/or species, the Councils may change the CV levels to address these needs.

### 6.8.5 Alternative Prioritization Process

An alternative method of reallocating observer sea days by adjusting the filter cut points was considered but rejected. The Councils examined an alternative that would change the cut-point for the total discards (tier 3) and discard mortality (tier 4) filters discussed in alternative 2.3. The increased number of fishing modes that are filtered out would then be assigned pilot coverage levels instead of observer sea days based on the CV performance standard. The FMAT conducted analysis of this alternative, which showed that it would produce undesirable results, including eliminating coverage to some fishing modes where observer coverage was considered important for management. The reductions in observer sea days under this alternative occurred in discreet blocks of sea days. If an iteration of the adjustment required more observer sea days than could be funded, the next iteration could drop the number needed significantly below the available funds making adjusting the process to meet a given number of available observer sea days difficult. Given the limitations of this alternative and the availability of other alternatives that did not have this limitation, this alternative was rejected from further consideration.

### 6.8.6 Exclude protected species from the prioritization process

An alternative to exclude the estimated observer coverage needed to achieve the performance standard for protected species, including sea turtles, from the prioritization process was considered but rejected. The FMAT analyzed the potential impact of excluding sea turtles from the prioritization process. This analysis indicated that, under recent funding constraints, all available observer sea days would have been allocated to just a few fishing modes. This could result in no observer-collected discard information being collected in all other fishing modes. This would not meet the stated purpose and
objective of this amendment. As a result, this alternative was rejected from further consideration.

### 6.9 Evaluation of Alternatives

This section will evaluate the alternatives presented in the above sections. This technical evaluation will focus solely on the ability of each alternative to effectively achieve the primary purpose and objectives of this amendment. Chapter 5 provides a technical assessment of the status quo process to allocate observer effort. An evaluation of the environmental consequences of the alternatives is presented in chapter 7 to comply with the requirements of the National Environmental Policy Act, the guidelines of the Council of Environmental Quality (CEQ), and NOAA Administrative Order 216-6.

### 6.9.1 Item 1: Bycatch Reporting and Monitoring Mechanisms

For this item, two alternatives are considered: (1) The status quo; and (2) implementing electronic monitoring to collect bycatch information. Although detailed information about the bycatch reporting and monitoring mechanisms currently utilized in the Greater Atlantic Region is available (see chapters 4 and 5, and Appendix A,), less is known about the implications of electronic monitoring as a potential bycatch reporting and monitoring tool for Greater Atlantic Region fisheries.

Currently, NMFS is reviewing available information to determine whether electronic monitoring applications may be best developed on a national basis rather than through various uncoordinated regional approaches (e.g., this SBRM). Electronic monitoring technology has been determined to be able to function reliably in the marine environment to identify fishing events (e.g., gear set and retrieval times and locations), obtain images of catch as it is brought aboard, and to determine when discards are occurring. Several programs world-wide have demonstrated some of the capabilities of electronic monitoring in hook and line fisheries (e.g., demersal longline) and trawl fisheries with relatively homogeneous catches, but the overall degree of success for electronic monitoring programs has been variable. Electronic monitoring technology is only moderately capable of providing data to estimate the species composition and number of fish retained and discarded in hook and line catch, quantify the amount of discards on trawl vessels, and detect and identify protected species and bird bycatch. Some highly specialized programs with complex regulatory requirements that stipulate how retained catch and discards must be handled have yielded more detailed bycatch and discard related data. In general, the larger the vessel, complexity of the fishing gear and its operation, diversity of the catch, and the level of detail in the data collection, the higher the degree of complexity to the type of electronic monitoring system that must be designed and deployed.

While electronic monitoring is a promising tool for bycatch monitoring, it remains very much a work in progress. The technology and systems available cannot currently perform the same complex data collection supplied by onboard human observers. Its utility as a tool to supplement existing data collection programs depends largely on designing a system within the constraints of the known electronic monitoring capabilities
and ensuring the information collected is able to meet defined data needs. Smaller fishing vessels also present particular challenges to fitting and powering the required hardware, and to ensuring sufficient crew available to support the monitoring protocols.

To date, electronic monitoring has been demonstrated as most successful in providing presence/absence data or providing simple visual data (e.g., a marine mammal interacting with fishing gear). These types of data are of limited utility in the Greater Atlantic Region as most stock assessments require detailed biological data such as length-at-age develop estimates of total catch and discard. This does not mean that electronic monitoring could not be utilized effectively as a bycatch monitoring tool in the Greater Atlantic Region; however, it does mean that new ways of incorporating the type of data electronic monitoring could provide would first have to be designed and tested before an electronic monitoring program is implemented.

Some significant issues related to electronic monitoring program development have been very well characterized in a discussion paper on implementing electronic monitoring programs (Kinsolving 2006). In this paper, Kinsolving (2006) outlines the four primary regulatory scenarios that could be utilized in a large-scale electronic monitoring program:

- Full ownership by NMFS wherein the electronic monitoring equipment is purchased, owned, installed, maintained, and the data analyzed by the agency;
- Use of approved contractors that have been deemed to satisfy the regulatory requirements to administer some or all aspects of the electronic monitoring program;
- Type approval which would be similar to the current VMS operation model where certain types of electronic monitoring units are approved for installation and operation and /or contractors are approved to handle such things as installation and data analysis; and
- Performance standards where there are specifications of what an electronic monitoring system must do, but not how it must do it.

Within each of these scenarios, there are many additional issues that require consideration. Costs to all parties involved, data review and analysis, adaptation to technological advances, oversight on installation and operation, and enforceability could all be slightly different for each option and would require resolution before the development of an electronic monitoring program for the Greater Atlantic Region. Issues of data ownership, privacy, data error checking, and record storage are all equally significant and would also require detailed planning and solution for an electronic monitoring program. Interestingly, Kinsolving (2006) points out that the total costs of an electronic monitoring program currently may equal or surpass the cost of an onboard observer program—particularly in light of the startup costs associated with a new program.

### 6.9.2 Item 2: Analytical Techniques and Allocation of Observers

For this item, four alternatives are considered: A return to pre-2007 SBRM Omnibus Amendment approach; the integrated allocation approach; the integrated allocation approach with importance filters (the status quo); and establishing a minimum percentage observer coverage level. The data sources, fishery stratification, and analytical techniques described in detail in chapter 5 and Appendix A apply to the pre2007 SBRM Omnibus Amendment approach and the integrated allocation approach alternatives. The primary difference between the pre-2007 SBRM Omnibus Amendment approach method and the baseline integrated allocation approach is that the methodology described in chapter 5 is applied across all fisheries in a prescribed uniform manner under the integrated allocation approaches, while under the pre-2007 SBRM Omnibus Amendment approach it is applied consistently only to the trawl, gillnet, and longline gear types generally engaged in the Northeast multispecies, monkfish, and summer flounder, as described in Appendix A.

The benefits, concerns, and limitations associated with the pre-2007 SBRM Omnibus Amendment approach and two integrated allocation approach alternatives are well described in chapter 5 and Appendix A and so will not be repeated here. The sole difference between the two integrated allocation approaches is the addition of the "importance filter" described in section 6.2.3. As noted above, the importance filter functions to refine the observer sea days needed to achieve the SBRM performance standard by eliminating cases (cells) where the effect of the discards of a species in a fishing mode is likely to be minimal. Thus, the third alternative carries forward most of the same benefits, concerns, and limitations of the second alternative, with the additional benefit of being more selective as to the fishing mode-species combinations that drive the target level of observer sea days.

The primary benefit of the alternative with the importance filter is to ensure that the observer program can be applied to the subject fisheries in as cost effective a manner as possible. By eliminating combinations of fishing modes and species where (1) it is infeasible or exceedingly rare that the species would be encountered in the gear (Options A and B only), (2) the CV-based performance standard has been achieved for fewer days than projected (Option A only), or (3) the likely impact of the discards of the species in the gear is negligible, observer sea days would be more efficiently allocated across all fisheries. There is an element of cost-benefit to this exercise, however, as by "eliminating" species as the basis for determining the observer coverage level, the result would be to accept that the performance standard may not be met for the species filtered out. It is important to understand that the importance filter is designed to function without reference to annual budgets or available observer resources. The importance filter would be used to establish meaningful observer coverage allocations for each fishing mode. Budgets can, and often do, shift as a result of national priorities, and in any given year, the available resources may not support full implementation of the established targets.

The threshold levels determine the degree of filtering that occurs for the discard ratio filter (filter 3) and the mortality ratio filter (filter 4). Higher thresholds (95 percent
and up) reflect a more conservative approach that "accounts" for more of the total discards and mortality. Lower thresholds (less than 95 percent) reflect a less conservative approach. In order to most effectively utilize the SBRM proposed in this amendment, reasonable thresholds are necessary to focus observer resources in a meaningful way without sacrificing information on important fishery/discard interaction. The proposed thresholds of 95 percent of the discard ratio (filter 3) and 98 percent of the total mortality ratio (filter 4) provide a reasonable level of filtering that retains observer coverage for the fishing modes associated with nearly all of the discards and mortality of each species. This level of filtering is intended to eliminate the insignificant contributors of discards and mortality, while ensuring a robust and effective observer coverage allocation.

The fourth alternative considered for this item, establishing a minimum percentage observer coverage level of 20 percent of trips for common species and 50 percent of trips for rare species, is described in Babcock et al. (2003) and addressed in chapter 5 and Appendix A. This alternative is intended to address concerns regarding the potential for bias in the bycatch data and to ensure sufficient sampling levels to provide more precise and accurate bycatch data (Babcock et al. 2003). However, several concerns regarding this approach have been identified (Methot 2005; Rago et al. 2005). One specific criticism of the approach proposed in Babcock et al. (2003) is that the particular recommendation for a default level of coverage is not linked to any particular management need, performance evaluation, or set of funding or logistical constraints. The expectations for precision vary by the use of the data and realizations of precision vary by species.

Babcock et al. (2003) point to default observer coverage levels as a tool to address or minimize bias in the observer sampling. However, this presumes that there is a substantial bias in the data, and that the bias is not a direct result of the presence of the observer on the vessel but rather is of the type that may be mitigated by increases in sampling size. Analyses presented in chapter 5 and in Appendix A discuss the potential for bias in the observer data and conclude that any such bias is minimal. Also, if any such bias is actually due to the presence of the observer on the vessel, then neither improved randomization nor increased sample size (higher observer coverage levels) would remove the bias. In the extreme, a very high level of observer coverage could simultaneously change the behavior of the entire fleet while providing a measurement of the bycatch of the fleet, but provide little insight into the level of bycatch prior to the increased sampling levels (or after, if they were to abate). There is a strong concern that the use of default minimum percent observer coverage levels may mask the great diversity of requirements and logistical constraints faced by fisheries observer programs, and fails to recognize the great cost of achieving high levels of coverage.

Regardless of the approach selected, the at-sea observer program implemented in this amendment is designed to optimize the accounting and estimation of discards occurring in fisheries managed under the Greater Atlantic Region FMPs. If observers assigned to fishing vessels under the SBRM are utilized for other purposes, such as realtime quota monitoring, monitoring of marine mammal interactions, monitoring fishing gear operations, etc., these activities and competing priorities may degrade the sampling design developed and implemented through this amendment.

### 6.9.3 Item 3: Establish an SBRM CV Standard

For this item, two alternatives are considered: No SBRM standard and establishing an SBRM CV standard of 30 percent. While the first alternative represents the pre-2007 SBRM Omnibus Amendment process for optimizing the observer sea day allocation across fisheries for several fishing gear types (otter trawl, gillnet, and longline) using a CV of 30 percent as its target, this feature is neither explicitly specified nor considered a formal component of the SBRM. Under alternative 2, the CV standard would be explicitly specified for all relevant combinations of gear type and species or species group as a formal component of the SBRM. In evaluating these two alternatives, the primary consideration is the recognition by the Court, in Oceana v. Evans I, that Amendment 13 to the Northeast Multispecies FMP did not contain any standards as part of an SBRM. Therefore, only the second alternative would be consistent with the intent of the Court order in response to both Oceana v. Evans I and II and meet the purpose of this amendment.

### 6.9.4 Item 4: SBRM Review/Reporting Process

For this item, three alternatives were considered: (1) No SBRM review or reporting requirements (status quo/no action); (2) establishing an SBRM review process; and (3) requiring periodic discard reports. Under the first alternative, there is no requirement to prepare formal reports that evaluate the effectiveness of the SBRM at achieving its goals and objectives, or to prepare periodic reports that provide information on discards occurring in the fisheries. This information would be available upon request by a Council or NMFS, but there would be no standards for the type or level of information to be provided in response to any such request. It would be difficult to plan for and budget resources in advance for the preparation of any report requested in an adhoc manner by a Council.

With the second alternative, the frequency of the preparation of an SBRM Review Report would be specified, allowing for adequate planning and resource allocation, and the minimum expected contents of the review reports would be specified, providing for consistency of information and comparison across reports and across time. The second alternative would contribute to meeting the intent of the Court in Oceana v. Evans I and II in which the Court identified a "mandated" SBRM as a requirement of the MagnusonStevens Act. By mandating periodic reports evaluating the effectiveness of the SBRM implemented under this amendment, as well as the contents of such reports, a required element of the SBRM would become a reporting and evaluation feedback mechanism to determine whether modifications to the SBRM are required.

Within the second alternative to specify an SBRM review process, four options are presented for the periodicity of such review reports: Annually; every 3 years; every 5 years; and as part of an existing required reporting schedule (e.g., SAFE reports). Under the first three options, a single comprehensive report would present the required information for all species and fishing modes to allow both Councils and NMFS to evaluate the overall effectiveness of the SBRM. The primary concern with this approach (a single, all-encompassing report) is the significant staff time and resources required in
order to conduct such a review. In particular, the option for an annual review report does not reflect an effective use of available resources. In addition, there is concern that under any of the first three options, the SBRM review report may be presented out of sync with either the stock assessments utilizing the information, such that the information in the report would not represent the current status of how the information is being used in stock assessments, or the consideration of management measures for which the information may be useful. Lastly, the first three options add an additional reporting requirement, which may be perceived as redundant with other reports prepared for Greater Atlantic Region fisheries (including stock assessment reports, SAFE reports, annual reports, etc.)

The fourth option attempts to address these concerns by linking the presentation of the SBRM information to the development of reports already called for in the FMPs for the relevant fisheries. This could distribute the reporting requirement so that the analytical burden in any one year would be limited and more manageable, and incorporates the reporting requirement into an existing reporting requirement that is in sync with schedules for anticipated management actions (for example, the preparation and presentation of a SAFE report to a Council typically includes recommendations for changes to management measures to address any noted issues related to stock status, rebuilding, or changes in the affected fisheries). However, because there are so many interrelationships and overlaps among fisheries, this option may result in redundant reporting and additional analytical burden. For example, the Mid-Atlantic large-mesh otter trawl fleet encompasses the Northeast large-mesh multispecies, monkfish, and summer flounder fisheries; evaluating the effectiveness of the SBRM relative to this fishing mode (as a single example from among many) separately for each of the controlling relevant FMPs (which may be on independent reporting schedules) would require the NEFSC staff to perform the same analysis three separate times. Due to other priorities and limited resources, SAFE reports may not be developed as frequently as called for in the FMPs. This could result in no discard information being analyzed for a particular fishery until the next SAFE report.

Information collected through the NEFOP is the primary source of data for the Council's SBRM. As such, it is important that the Councils receive this information on a regular basis and in a consistent format, so that trends can be monitored, and potential problems and issues can be identified as they arise. A periodic report that provides detailed information for all observed trips in the Greater Atlantic Region, as proposed in alternative 4.3, would keep the Councils updated on the collection of discard information and may help to identify bycatch problems in a more timely manner. This should allow the Councils to respond more expeditiously and address problems before they worsen and potentially compromise stock rebuilding. Ultimately, reviewing these data regularly will improve fisheries management in the Region and help the Councils to better comply with the requirements of the Magnuson-Stevens Act.

It is possible, but not necessary, to adopt both alternative 4.2 and alternative 4.3, or to adopt either alone. Alternative 4.3 would provide for a periodic report of discards occurring in Council fisheries, while alternative 4.2 would provide for reporting on the
efficacy of the SBRM. The most robust reporting procedures would include both, but neither alternative depends upon the other.

Alternative 4.3 includes two options: A semi-annual discard report or an annual discard report. There are several potential benefits of requiring either a semi-annual or annual discard report. The discard report would highlight the on-going data collection program of the NEFOP, and would formalize a process to provide an ongoing summary of estimated discards by fishing modes or gear type for turtles. This information is not currently provided in one location at this level of detail across fisheries and species groups, although some stock assessment documents show discard rates by gear and quarter. A requirement for monitoring annual catch limits and attendant accountability measures may require more frequent discard estimates; however, the data collection programs within the SBRM can support the monitoring needs of annual catch limits. Currently, discard estimates are provided by NEFSC in stock assessments and by the GARFO Analysis and Program Support Division in quota monitoring reports. Some PDTs and monitoring committees review discard and discard rate information more frequently on an ad hoc basis. The discard report may help to identify discard issues at a temporal scale that is shorter than the assessment cycle or to identify emerging discarding event/issues if reporting is sufficiently timely.

Under current data collection, processing, and reporting requirement time frames, the time between an observed fishing trip and the date when the data from that trip would be available for inclusion in a semi-annual discard report could take months. Such a long time lag diminishes the usefulness of such a report if there is an expectation that the information presented would be more current than is possible. By the time the information is presented, any apparent discard problem or event may no longer be occurring. A discard report such as what has been proposed may invite attempts to micro-manage fisheries based on incomplete data. Requiring such a detailed discard report on a semi-annual basis would divert resources to prepare a report with limited utility from other tasks such as stock assessments and supporting the development of management actions. An annual reporting cycle mitigates some of the timing concerns associated with the proposed discard report, but cannot overcome the larger issues identified above. A semi-annual report would create more of an administrative burden than an annual report, and would seem to be more frequent than necessary given that it is unlikely the management system could respond quickly to any issues that may be identified in a semi-annual report.

Alternative 1 /status quo would be expected to result in a less effective SBRM program when compared to Alternative 2 because there would be no formalized, planned review of the program's performance. With this alternative, it is less likely that deficiencies would be periodically identified, brought to the attention of managers, and addressed through changes to the SBRM. Alternative 1 would also limit the information presented to managers when compared to Alternative 3. This would diminish the effectiveness for the program, because the data collected would not be routinely reported in a way that could lead to measures to address discard issues. Alternatives 2 and 3 are not directly comparable as they address separate issues, but the combined adoption the two alternatives would lead to a better program than if only one or the other was adopted

### 6.9.5 Item 5: Changes to the Framework Adjustment and/or Annual Adjustment Provisions

For this item, four alternatives are considered: (1) The status quo (no action); (2) authorizing changes to certain provisions of the SBRM through framework adjustments to the FMPs; (3) authorizing changes to certain provisions of the SBRM through framework adjustments, annual adjustments, and/or annual or multi-year specifications; and (4) authorizing changes to certain provisions of the SBRM through framework adjustments, annual adjustments, and/or annual or multi-year specifications, while authorizing fishing modes to be added or removed from the SBRM as needed to best characterize the fishery. None of these alternatives would affect the procedures already stipulated in each FMP regarding framework adjustments, annual adjustments, and/or annual or multi-year specifications. The only changes considered under this item relate to supplementing the lists of management measures that may be modified through one of these types of actions.

Under the status quo, any changes to the provisions of the SBRM would require another amendment to an affected FMP. Neither Council would be able to employ a more streamlined process, such as for framework adjustments, annual adjustments, or annual or multi-year specifications, to make changes to the provisions of the SBRM. This may create problems with the implementation and operation of future management programs that are developed and implemented through one of the more efficient processes, but which would rely upon concurrent changes to the SBRM to be effective.

With the second alternative, certain aspects of the SBRM could be modified via a framework adjustment to the affected FMP, including: (1) The CV-based performance standard; (2) the means by which discard data are collected/obtained in a fishery; (3) fishery stratification; (4) SBRM reporting; and (5) industry-funded observers and/or observer set-aside programs. The intent of this alternative is to ensure that as the Councils modify management measures through framework adjustments to adapt to changing conditions in the fisheries, that they retain the flexibility to make the needed changes to the SBRM to ensure adequate data on discards.

For example, under Amendment 13 to the Northeast Multispecies FMP, the New England Council may utilize the framework adjustment process to develop and implement new SAPs and/or new sector allocations. Under this alternative, the Council could use the framework developed for a new SAP to also modify the SBRM to ensure sufficient data are collected on the discards occurring in the SAP. Without this alternative, the Council could implement a new SAP through a framework, but would have to use the full amendment process to address the SBRM provisions associated with the SAP. This would create a substantial inconsistency in the process and a delay in the timeliness of implementing necessary management measures.

With the third alternative, all the changes proposed in the second alternative, with one notable exception, would also be authorized to be made through an annual adjustment or annual/multi-year specifications. This alternative would provide the Councils with more flexibility to update and/or modify the provisions of the SBRM as
conditions in the fisheries or management programs change. For FMPs that utilize an annual adjustment or specifications process (annual or multi-year), these actions may be a more appropriate vehicle to implement necessary changes to the SBRM. For example, the Mid-Atlantic Council often modifies the provisions of the scup gear restricted areas through the summer flounder, scup, and black sea bass specifications. This alternative would allow the Council to also incorporate appropriate changes to the SBRM to support the scup gear restricted area modifications in the subject action, without the need for a separate framework adjustment or amendment to modify the SBRM. The exception noted above is the industry-funded observers and/or observer set-aside programs, which would require a framework adjustment regardless of the alternative selected.

The fourth alternative is similar to the third alternative mentioned above: Select elements of the SBRM could be modified through an annual adjustment or annual/multiyear specifications, and changes to industry funded observers and/or observer set-aside programs would require a framework adjustment. However, the list of aspects of the SBRM that could be modified has one notable change from those specified in the second alternative. With the fourth alternative, the aspects of the SBRM that could be modified via a framework adjustment to the affected FMP or through an annual/multi-year specification would include: (1) The CV-based performance standard; (2) the means by which discard data are collected/obtained in a fishery; (3) SBRM reporting; and (4) industry-funded observers and/or observer set-aside programs. Under this alternative changes to "fishery stratification" (i.e., adding or removing fishing modes) could be done annually without specific action by the Councils, although the Councils would be notified of any changes. The intent of this alternative is to provide the Councils with the most flexibility to keep the SBRM updated as conditions in the fisheries or management programs change. By allowing fishing modes included in the SBRM to be adjusted without formal Council action, the SBRM process can include new fishing modes as soon as they are identified in the fishery without waiting an additional year or two to be included in a framework adjustment or specification action.

### 6.9.6 Item 6: Prioritization Process for SBRM Observer Allocation

For this item, eight alternatives within three groups were considered. Two alternatives address a funding "trigger" for determining when prioritization would be necessary: (1.1) The status quo (no action); and (1.2) specifying specific SBRM funding sources.

While the SBRM clearly identifies the methodologies to be used to calculate observer coverage levels needed to achieve the CV-based SBRM performance standard on an annual basis, these coverage levels can only be implemented if all necessary resources (budget, trained observers, etc.) are sufficient for NMFS to allocate the necessary coverage. The methodologies were established and are intended to function independently from any decisions regarding available budgets or other resources; however, the SBRM Omnibus Amendment would be remiss if it did not address the contingency of insufficient resources that impose external operational constraints on the GARFO and NEFSC.

Under the status quo funding trigger alternative, the GARFO and NEFSC would use available sources of funding for observer sea days, within the restrictions on certain funding sources, to determine if there were an external operational constraint that prohibited fully implementing the coverage levels needed to achieve the CV-based performance standard. This approach could be interpreted as insufficient under the Court order in Oceana v. Locke, which found the prioritization process in the 2007 SBRM Omnibus Amendment gave too much discretion to NMFS in determine when an external operational constraint prevents fully implementing the SBRM.

The second alternative addresses the Court's concern over how a funding constraint is defined by presenting a specific formula based on established budgetary funding lines that are available for observer sea days. Changes to the funding provided to the Agency through these budget items would have a direct effect on the number of observer sea days that are available to meet the coverage levels needed to achieve the CV-based SBRM performance standard.

Three alternatives were presented to address how observer sea day coverage would be adjusted if funds were insufficient to fully implement the SBRM to the performance standard: (Alternative 2.1) specifying a consultation process to provide the Councils the opportunity to review and comment on the priority observer sea day coverage allocations proposed by the Regional Administrator and Science and Research Director; (Alternative 2.2) automatically adjusting observer sea day coverage on all fishing modes by the amount of funding shortfall; and (Alternative 2.3) automatically adjusting observer sea day coverage by removing fishing mode/species group combinations that require the highest number of sea days to achieve the CV performance standard. The alternative selected under this item will be most important in years in which the available budget or other resources are insufficient to fully provide the observer coverage levels calculated through the SBRM.

Under the Council consultation alternative (Alternative 2.1), the SBRM Omnibus Amendment would establish a formal consultation process to provide the Councils and the public with the opportunity to review, and provide comment on, the proposed prioritization recommended by the Regional Administrator and the Science and Research Director. This approach recognizes the need for the agency to develop an initial prioritization based on the needs of stock assessments and other legal mandates requiring fisheries monitoring and reporting, but includes the Councils in the process to develop the observer coverage allocations that adjust for any external operational constraints. This approach could be interpreted as insufficient under the Court order resulting from Oceana v. Locke, which found that the 2007 SBRM Omnibus Amendment gave too much discretion to NMFS in how observer coverage was redistributed.

Alternative 2.2 would determine the percentage by which available funding falls short of the funding needed to fully implement the SBRM and would then reduce the observer coverage in each fishing mode by this same percentage. This would avoid the Agency discretion that the Court found fault with, but could have unintended effects on coverage. Some fishing modes are assigned high observer coverage rates to achieve the CV-based performance standard based on relatively rare bycatch of specific species. If
all fishing modes are reduced by the same percentage, these fleets would still have high coverage rates relative to other fishing modes. This may result in higher coverage for species and fleets of little concern to managers and unacceptably low coverage rates on fishing modes that are considered more important.

Alternative 2.3 would use a new method, referred to as the "penultimate approach" to reduce the number of observer sea days to meet a funding constraint, while resulting in the fewest cells with a CV above the performance standard. By using a defined formula to reduce the total number of needed observer sea days to meet funding constraints, this alternative would remove the Agency's discretion in adjusting observer coverage, which the Court found faulty in Oceana v. Locke. In addition, by maintaining the CV-based performance standard for as many fishing mode/species group combinations as possible, this alternative could minimize the impact of a funding shortfall on overall discard estimations.

For all of these proposed alternatives, if the adjustment to observer sea days for a particular fishing mode would result in too few sea days to provide useful discard information, the alternative minimum pilot coverage rates described in 5.3 .3 would apply.

In the unlikely event that Federal funding for SBRM observers is so restricted in a given year that there are not enough observer sea days to achieve the minimum pilot coverage in each fleet, an additional level of prioritization would be necessary. Three alternatives were considered for how to decide which fishing modes would not get coverage in this situation of extremely limited Federal observer funding. Alternative 3.1 would direct the Regional Administrator and the Science Research Director to develop an ad-hoc proposal for which fleets would not get coverage based on any applicable legal mandates, management priorities, or data needs and to present this proposal to the Councils for their consideration and recommendations. Alternative 3.2 would adjust for the funding shortfall by sequentially eliminating coverage in fleets which have the highest minimum pilot coverage days. This alternative would have the greatest impact on fleets with the longest average trip length, and would impact the fewest fleets overall. Finally, Alternative 3.3 would eliminate the shortfall by sequentially eliminating coverage in fleets that had the highest ratio of minimum pilot coverage to days absent from port based on FVTRs from the previous year. This alternative would eliminate coverage from fleets with low numbers of days absent from port.

### 6.9.7 Item 7: Industry-Funded Observer Program

For this item, three alternatives are considered: (1) The status quo (no action); (2) authorizing an observer service provider approval and certification process; and (3) adding industry-funded observer and observer set-aside provisions as measures that can be implemented through framework adjustments. It is possible, but not necessary, to adopt both alternative 7.2 and alternative 7.3 under this item. Alternatives 7.2 and 7.3 are somewhat independent of one another, such that if alternative 7.2 were implemented, but alternative 7.3 was not, then the observer service provider approval and certification procedures and requirements would be established, but each FMP would continue to require an amendment to establish a requirement to utilize these procedures and
requirements for an industry-funded observer program and/or observer set-aside program. This could be done to ensure consistent procedures and requirements across all fisheries for approving and certifying observer service providers, even if FMP-specific amendments would be required to establish the industry-funded observer program.

If, however, alternative 7.2 is not implemented, there is likely little benefit to alternative 7.3, as an amendment to each FMP would remain required to create the observer service provider approval and certification procedures and requirements necessary to implement an industry-funded observer requirement. This would be analogous to Amendment 13 to the Sea Scallop FMP: An amendment was required to establish the observer service provider approval and certification provisions even though the industry-funded observer requirements and observer set-aside provisions were adopted in earlier actions (Framework Adjustments 16 and 18 and Amendment 10 to the Sea Scallop FMP).

The most benefit would be derived if both alternatives 7.2 and 7.3 are adopted in this action. This would establish the observer service provider approval and certification procedures and requirements across all fisheries, and allow development and implementation of an industry-funded observer program, with or without observer setaside provisions, through a framework adjustment for each fishery.

One example in particular of why it would be prudent to adopt alternatives 7.2 and 7.3 in this action is to facilitate the development of new sector programs or special access programs (SAPs) under the Northeast Multispecies FMP. Amendment 13 to the FMP authorized the development and implementation of both sectors and SAPs through the framework adjustment process. Amendment 16 to the FMP significantly expanded the use of sectors. However, should the New England Council choose to require specialized levels of observer coverage, at industry expense (with or without an observer set-aside program to offset costs), as part of either the sector or the SAP, currently an amendment to the FMP would be required. Adoption of alternatives 7.2 and 7.3 would allow these provisions to be included in the framework adjustment to implement the sector or SAP. The New England Council has considered other actions that would similarly allow new sectors to be established under other FMPs through a framework adjustment, but adoption of alternatives 7.2 and 7.3 would be necessary for the Council to include in such a framework the provisions for an industry-funded observer program and observer set-aside. For the Mid-Atlantic Council, recent attempts to include industryfunded observer requirements on vessels fishing for squid, in return for access to the scup gear restricted areas, provide an example where these measures would have simplified the process to develop and implement the scup gear restricted area access program.

### 6.10 Rationale for Selecting the Preferred Alternatives

Fisheries management is a dynamic, responsive process, adapting to changing environmental, socio-economic, and legal conditions. The management measures implemented with the intention to rebuild an overfished stock may be completely inappropriate for that fishery once the stock is rebuilt. Similarly, as new information becomes available, management measures change to reflect this new information.

Similarly, because fisheries management itself is so dynamic, the techniques and mechanisms used to collect information to monitor fisheries and fishing activities cannot be static. Any SBRM established for the fisheries of the Greater Atlantic Region must be able to be modified as conditions in the fisheries and the management systems require. Thus, one cannot expect that the SBRM established through this amendment will be able to fulfill all potential information and monitoring needs into the future without some degree of adjustment.

The SBRM established through this amendment is intended to adequately and efficiently provide sufficient information collection and monitoring to comply with the existing requirements and management systems. The notion that this amendment should predict various possible future fisheries management systems and measures (e.g., ITQs in the monkfish fishery or a new FMP for the whelk fishery, etc.) and establish an SBRM that can reliably provide information and monitoring under these changed circumstances is neither realistic nor practicable. For one, because the Councils and NMFS cannot predict with any expected accuracy either how unforeseen future environmental changes may affect fish stocks (and how these changes may affect the relevant fisheries) or how future changes to fishery management law may affect our legal obligations, we cannot accurately predict what types of management actions may be necessary in the future. Second, the information collection and monitoring program should be tailored to the specific types of information collection and monitoring that are required, and these requirements cannot be known until the program needs are identified.

However, this does not mean that the SBRM necessarily needs to be changed every time there is a change in management. The SBRM established through this amendment is designed to be flexible and adapt to future changes as conditions in fisheries and fisheries management change. The most effective way to monitor discards in a fishery managed under a DAS system may not be the most effective way to monitor discards in a fishery with bycatch quotas. The SBRM implemented with this amendment will need to adapt as management strategies change in order to ensure that the appropriate information is being collected as effectively as possible.

As noted in chapter 5, statistical theory applicable to the estimation of fisheries bycatch is evolving and significant advances in techniques and methods are expected to improve the reliability of discard estimation. Much like stock assessments, which adapt to use the most effective and appropriate analytical techniques and models available at the time the assessment is conducted, the analytical underpinnings of the SBRM would and should change as more effective and appropriate methods are developed.

Thus, the preferred alternatives selected by the New England and Mid-Atlantic Councils would establish an SBRM that defines the primary data collection and monitoring mechanisms to be used for bycatch reporting, defines the analytical framework for estimating bycatch and allocating at-sea observer effort, establishes a performance standard for the SBRM program (a CV of no more than 30 percent), dictates a periodic review, evaluation, and reporting process, establishes framework adjustment provisions to enable changes to the SBRM to be made efficiently, establishes a process for annually determining the funds available for the SBRM and to subsequently prioritize
at-sea observer coverage allocations within the available funding, and establishes provisions to support the development of industry-funded observer programs. Table 69 identifies, for each element of the SBRM, the alternatives under consideration and highlights the preferred alternatives of the Councils.

| SBRM Element | Alternatives Under Consideration |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1. Bycatch Reporting and Monitoring Mechanisms | Status quo |  |  |  | Implement electronic video monitoring |  |  |
| 2. Analytical Techniques and Allocation of Observers | Pre-2007 SBRM Amendment |  | Integrated allocation approach |  | Integrated allocation approach w/ importance filter |  | Minimum percent observer coverage |
| 3.SBRM Performance Standard | No performance standard |  |  |  | Establish a CV standard |  |  |
| 4.SBRM Review/ Reporting Process | Status quo |  |  | Specify an SBRM review process |  | Require periodic discard reports |  |
| 5. Framework Adjustment Provisions | Status quo | Framework adjustment |  | Frameworks and annual adjustments |  | Frameworks and annual adjustments excluding fishing modes |  |
| 6. Prioritization Process |  |  |  |  |  |  |  |
| 6.1 Funding trigger | Status quo |  |  | Identify specific SBRM funding sources |  |  |  |
| 6.2 Reallocation | Council consultation |  |  | Proportional adjustment |  | Penultimate Cell Approach |  |
| 6.3 Less than Minimum Pilot Coverage | Ad hoc prioritization |  |  | Remove fleets with high MPC |  | Remove fleets with high MPC to days absent ratio |  |
| 7. Industry-Funded Observer Programs | Status quo |  |  | Observer provider approval |  | Framework provisions |  |

Table 69 Summary of alternatives under consideration for the SBRM Omnibus Amendment (Councils' preferred alternatives are shaded).

The specific rationale for the preferred alternatives can be summarized as follows:

- Bycatch Reporting and Monitoring Mechanisms - The Councils’ preferred alternative is the status quo, which represented all bycatch reporting and monitoring mechanisms currently employed in the Greater Atlantic Region. These mechanisms have been used successfully for several years and together
they form a comprehensive and mature data collection program. Although the Councils considered implementing electronic video monitoring to supplement at-sea observer coverage, this technology, while it appears promising, is not considered to be sufficiently mature for widespread implementation at this time.
- Analytical Techniques and Allocation of Observers - The Councils’ preferred alternative is the integrated allocation approach with the addition of the importance filters. The pre-2007 SBRM Omnibus Amendment procedures were used successfully in the Greater Atlantic Region for several years and were considered to provide an efficient and effective means to allocate observer effort. The integrated allocation approach represented an expansion and refinement of the pre-2007 SBRM Omnibus Amendment approach to address all applicable species groups and fishing gear modes. The addition of the importance filters incorporates the recommendation of the technical review by members of the two Council SSCs and this approach has been successfully used since the adoption of the 2007 SBRM Omnibus Amendment. Although the Councils initially considered a different approach to allocate observer coverage based on minimum percent levels, this approach was not considered to be sufficiently robust to effectively account for the many differences among the various Greater Atlantic Region fishing modes, nor does it directly employ the type of feedback mechanism that the preferred approach does. There was concern that the minimum percent observer coverage approach would lead to oversampling of some fishing modes, could lead to undersampling of other fishing modes, and would not ensure an efficient and effective allocation of resources. The Councils recommend that the importance filters be applied at the level of 95 percent of total discards and 98 percent of total mortality. These filter levels have been used since the 2007 SBRM Omnibus Amendment was first implemented. These levels are considered sufficiently conservative to retain observer coverage over the fishing modes responsible for nearly all of the discards and mortality of each species while providing a meaningful filter to address the intent of the SSC review. This level of filtering is intended to eliminate the insignificant contributors of discards and mortality, while ensuring a robust and effective observer coverage allocation. Removing the gray-cell (tier 1 or "unlikely") filter represents a refinement of the suite of importance filters that were initially developed for the 2007 SBRM Omnibus Amendment. Analysis conducted as part of the 3-year review of the SBRM found for 2009 through 2011, no changes to the final determination of the SBRM standard sea days would have occurred if the gray-cell filter had been removed from the importance filter (Wigley et al. 2012b).
- SBRM Standard - The Councils' preferred alternative is to establish a performance standard for the SBRM based on the CV of the discard estimate for each appropriate combination of fishing mode and species or species group. Implementation of the SBRM established with this amendment would require allocation of at-sea observer effort such that the resulting CV equals
no more than 30 percent. The Councils consider this alternative to be the only one under consideration that is consistent with the intent of the Court orders in the Oceana v. Evans I and II decisions.
- SBRM Review and Reporting Process - The Councils' preferred alternative is to specify a periodic SBRM review and reporting process in order to provide a means for the Councils to periodically evaluate the performance and effectiveness of the SBRM established with this amendment. This alternative is considered more appropriate than the status quo given the desire of the Councils to be able to ensure that the bycatch information being collected under this SBRM continued to meet the needs of the fishery scientists and managers. The Councils recommend that the proposed SBRM Review Report be required to be prepared once every 3 years. This interval is considered to represent a reasonable balance of the workload required to prepare such a report and the value and timeliness of the information to be provided. In addition, the Councils recommend that a report on the discards occurring in all Greater Atlantic Region fisheries be prepared annually and provided to the Councils by the NEFSC. These are two separate reports intended to provide different information on the implementation of the SBRM.
- Changes to the Framework Adjustment and/or Annual Adjustment Provisions - The preferred alternative of the Councils is to add provisions to the framework adjustment and annual adjustment regulations, as appropriate, for each subject FMP in order to enable changes to the SBRM to be made on an FMP-by-FMP basis, as needed. The preferred alternative also allows changes to the list of fishing modes without formal Council action. This approach was considered preferable to the status quo alternative, which would require all future modifications to the SBRM to be done only through amendments to the FMPs. Using the framework adjustment and/or annual adjustment processes provides a timely, efficient, and effective tool to address future issues and management needs. Allowing changes to fishing modes on an annual basis provides the most efficient mechanism to adjust this aspect of the SBRM to developments in fishing gear technology.
- Prioritization Process for SBRM Observer Allocation - The Councils’ preferred alternative for the funding trigger is to specify observer funding lines dedicated for SBRM. This approach was considered preferable to the status quo alternative, which would have left NMFS with some discretion in determining when funding was insufficient because it more completely addresses the Court's concern about Agency discretion in Oceana v. Locke.

The preferred alternative for prioritization of observer sea day coverage is the penultimate-cell approach. This alternative is considered preferable to the proportional reduction method because it would affect the CV of fewer cells (fishing mode/species or species group combinations), and therefore potentially allow more cells to achieve the CV-based performance standard. The penultimate-cell approach is also considered preferable to the Council
consultation alternative. The Council consultation approach would allow for a similar level of discretion on the part of the Agency as the prioritization process that was found deficient by the Court in Oceana v. Locke.

The Councils' preferred alternative for adjusting coverage levels below minimum pilot coverage would eliminate the funding shortfall by sequentially removing coverage in fleets that had the highest ratio of minimum pilot coverage to days absent from port based on FVTR reports in the previous year. Because the number of days absent from port is typically much larger than the minimum pilot coverage for a fishing mode, this alternative would maintain at-sea observer coverage on the most active fishing modes. Under the non-preferred ad-hoc alternative, in the event of extremely limited funding the NMFS would, in consultation with the Councils, develop a proposal for which fishing modes would receive observer coverage. This alternative is considered non-preferred by the Councils because it would allow a level of discretion on the part of NMFS that might run counter to the Court's ruling in Oceana v. Locke. The other non-preferred alternative would assign coverage based on the minimum pilot coverage, and thereby maximize the number of fishing modes that receive a useful level of bycatch monitoring under an extremely limited budget scenario. However, because minimum pilot coverage is based on the average length of a fishing trip, fishing modes with the longest average trip length, often very active and important fishing modes from a management perspective, would not receive at-sea observer coverage to monitor bycatch.

- Industry-Funded Observer Program - The preferred alternatives of the Councils would establish uniform observer service provider approval and certification procedures and requirements across all fisheries, and allowed the development and implementation of an industry-funded observer program on an FMP-by-FMP basis, with or without observer set-aside provisions, through a framework adjustment for each fishery. Under the non-preferred status quo alternative for this element, a full FMP amendment would have been required in each case in which a Council proposed either an industry-funded observer program or an observer set-aside program, with the exception of the sea scallop fishery. The preferred alternatives would streamline the development of such a program should a Council elect to propose one, and provide a uniform mechanism to retain observer service providers to support all such new programs.


# Environmental Consequences of the Alternatives Under Consideration 

### 7.1 Description of the Affected Environment

This amendment examines the analytical procedures and information reporting and data collection mechanisms that are currently used to assess the types and quantities of bycatch occurring in the Greater Atlantic Region. This amendment documents how those procedures and mechanisms apply to the variety of fisheries prosecuted by federally permitted fishing vessels operating under one or more of the FMPs developed by the Mid-Atlantic and/or New England Councils. The objective of this amendment is to ensure that the analytical procedures and information reporting and data collection mechanisms, which together comprise the current SBRM for the applicable fisheries, comply with the SBRM requirements of the Magnuson-Stevens Act. This amendment also considers alternatives to the current approach for collecting, monitoring, and analyzing information regarding bycatch to determine whether the current approach should be replaced, modified, and/or supplemented.

Earlier chapters of this document provide specific information on the FMPs subject to this amendment (see Chapter 2), on the fishing modes covered by the SBRM (see Chapter 3), and on the types of monitoring and information collections mechanisms addressed in this amendment (see Chapter 4). This chapter will diverge from these previous discussions that examined each FMP or fishing mode on a case-by-case basis, and summarize the relevant environmental features at a broader scale that crosses all subject FMPs and their constituent fisheries.

Because this amendment is wholly concerned with the procedures and mechanisms by which data and information on the types and rates of bycatch are obtained and utilized by scientists and fishery managers, the scope of the "environment" affected by this amendment is atypical for an FMP amendment. Most FMP amendments (and related actions) focus on changes to fishing regulations, which have a direct impact on fishing vessel operations (by modifying where, when, and/or how fishing may take place). These impacts on fishing vessel operations almost always affect the ways in which these fishing activities directly or indirectly interact with living marine resources, marine habitat, and the socio-economic constructs of the human environment. Thus, generally, for a fishery management action or an amendment of this type, the "Affected Environment" section would include specific, detailed information on the particular fishery and non-fishery species, the habitats of these species, and the fishing businesses and communities expected to be directly or indirectly affected by the proposed action.

However, as the focus of this amendment is on the methodology by which bycatch information is obtained, analyzed, and utilized, the impacts of the preferred alternatives are wholly procedural in nature. Therefore, a detailed description of the environmental components including the biological resources, physical environment, and socio-economic structure that could be affected by the alternatives under consideration is not necessary. Instead, this section of the amendment will include a brief overview of the
areas in which the fishing activities affected by the subject FMPs occur, a brief overview of the primary ports engaged in the subject fishing activities, and a brief overview of the fishery and non-fishery living marine resources most frequently encountered by the subject fishing activities. This section will also include references for more detailed information on these topics, should any reader wish to become more familiar with the features of the environment in which the subject fisheries occur.

### 7.1.1 Physical Environment

The fishing activities affected by the FMPs subject to this amendment occur off the Atlantic coast of the U.S., primarily from Cape Hatteras, NC, to the U.S./Canada border. This area of the Northwest Atlantic Ocean is also known as the Northeast U.S. Continental Shelf Large Marine Ecosystem (Sherman et al., 1996) and includes the subsystems known as the Gulf of Maine, Georges Bank, and the Mid-Atlantic Bight. For more information about the physical characteristics of the environment described below, reference NEFMC (2004a); NEFMC (2004b); Sherman et al. (1996); and Stevenson et al. (2004). See Figure 45 for a map of the Greater Atlantic Region with the three major subsystems identified.


Figure 45. Map of the Gulf of Maine, Georges Bank, and Mid-Atlantic Bight.

### 7.1.1.1 Gulf of Maine

The Gulf of Maine is an enclosed coastal sea characterized by relatively cold waters and deep basins. The Gulf of Maine is bounded on the east by Browns Bank, on
the north by Maine and Nova Scotia, on the west by Maine, New Hampshire, and Massachusetts, and on the south by Cape Cod and Georges Bank. Retreating glaciers (18,000-14,000 years ago) formed a complex system of deep basins, moraines, and rocky protrusions, leaving behind a variety of sediment types including silt, sand, clay, gravel, and boulders. These sediments are patchily distributed throughout the Gulf of Maine, and are largely related to the topography of the bottom.

Water patterns in the Gulf of Maine exhibit a general counterclockwise current, influenced primarily by cold water masses moving in from the Scotian Shelf and offshore. Although large-scale water patterns are generally counterclockwise around the Gulf, many small gyres and minor currents do occur. Freshwater runoff from the many rivers along the coast of the Gulf of Maine influences coastal circulation, as well. These water movements feed into and affect the circulation patterns on Georges Bank and in Southern New England, both of which are discussed below.

### 7.1.1.2 Georges Bank

Georges Bank is a shallow, elongate extension of the northeastern U.S. continental shelf, and it is characterized by a steep slope on its northern edge and a broad, flat, and gently sloping southern flank. The Gulf of Maine lies to the north of Georges Bank, the Northeast Channel (between Georges Bank and Browns Bank) is to the east, the continental slope lies to the south, and the Great South Channel separates Georges Bank and Southern New England to the west. Although the top of Georges Bank is predominantly sandy sediment, glacial retreat during the late Pleistocene era resulted in deposits of gravel along the northern edge of the Bank, and some patches of silt and clay can be found.

The most dominant oceanographic features of Georges Bank include a weak but persistent clockwise gyre that circulates over the whole of the Bank, strong tidal flows (predominantly northwest and southeast), and strong but intermittent storm-induced currents. The strong tidal currents result in waters over the Bank that are well-mixed vertically. The clockwise Georges Bank gyre is in part driven by the southwestern flow of shelf and slope water that forms a countervailing current to the Gulf Stream.

### 7.1.1.3 Mid-Atlantic Bight and Southern New England

The Mid-Atlantic Bight includes the continental shelf and slope waters from Georges Bank to Cape Hatteras, North Carolina. Occasionally discussed separately, most texts consider Southern New England a subregion within the Mid-Atlantic Bight. ${ }^{46}$ The basic morphology and sediments of the Mid-Atlantic Bight were shaped during the retreat of the last ice sheet. The continental shelf south of New England is broad and flat, dominated by fine grained sediments (sand and silt). Patches of gravel can be found in places, such as on the western flank of the Great South Channel.

[^34]The shelf slopes gently away from the shore out to 100-200 km offshore, where it transforms into the continental slope at the shelf break (at water depths of 100-200 m). Along the shelf break, numerous deep-water canyons incise the slope and into the shelf. The sediments and topography of the canyons are much more heterogeneous than the predominantly sandy top of the shelf, with steep walls and outcroppings of bedrock and deposits of clay.

The southwestern flow of cold shelf water feeding out of the Gulf of Maine and off Georges Bank dominates the circulatory patterns in this area. The countervailing Gulf Stream provides a source of warmer water along the coast as warm-core rings and meanders break off from the Gulf Stream and move shoreward, mixing with the colder shelf and slope water. As the shelf plain narrows to the south (the extent of the continental shelf is narrowest at Cape Hatteras), the warmer Gulf Stream waters run closer to shore.

### 7.1.2 Biological Resources

The biological resources of the Northeast Shelf Ecosystem can be categorized into three basic groups: Fishery resources; protected resources; and other non-fishery resources. Fishery resources are distinguished as those species both caught and landed for commercial sale or for recreational use; primarily the managed species identified in Table 1 and Table 70. ${ }^{47}$ Protected resources include whales and other marine mammals afforded protection under the Marine Mammal Protection Act and species afforded protection under the Endangered Species Act, including sea turtles, Atlantic salmon, two species of sturgeon, and Endangered Species Act-listed cetaceans. Other non-fishery resources include the vast majority of marine flora and fauna living in this environment, but which are neither landed for commercial or recreational purposes nor afforded any special protections under law. This section will provide summary descriptions of these biological resources, but additional, more detailed, information may be found in a variety of sources, including: Collette and Klein-MacPhee (2002); Stevenson et al. (2004); and Sherman et al. (1996).

### 7.1.2.1 Fishery Resources

The fishery resources of the Greater Atlantic Region include a variety of managed and non-managed species that are caught and landed by commercial and recreational fishermen operating in the region (see Table 70). These fishery resources include many species of both demersal and pelagic finfish, several species of crustaceans, mollusks, and other invertebrates. These species occupy broad ranges within the Greater Atlantic Region (see Table 70) and a wide variety of habitats from the pelagic waters of the open ocean to sand, mud, gravel, and rock beds in coastal waters.

In 2011, over 157 species were recorded in FVTRs as being landed. Of the 39 species that comprised the top 99 percent, by weight, of the reported landings, all but 4

[^35]are the subject of an FMP by the Mid-Atlantic Council, the New England Council, or the ASMFC. Of the four non-FMP species in this group, two are managed by at least one state (channeled whelk, and knobbed whelk), one is likely to be subject to a forthcoming Council FMP (Atlantic hagfish), and one may be considered for future Council FMPs (Jonah crabs).

The 40 species managed under the FMPs subject to this amendment comprised 81 percent, by weight, of the species reported as landed in the 2011 FVTR data. Additional information regarding these species, and the management programs established under the subject FMPs, can be found in chapter 2 of this document. An additional 17 percent, by weight, of all landed species incorporates the 15 species managed solely under ASMFC FMPs, and the federally managed Atlantic highly migratory species represent another 0.1 percent of total reported landings by vessels submitting FVTRs. In sum, 97.5 percent, by weight, of all reported landings in 2011 were comprised by species subject to either Federal or ASMFC FMPs. ${ }^{48}$

### 7.1.2.2 Protected Resources

There are many protected species inhabiting the Northeast Continental Shelf Large Marine Ecosystem. These include Atlantic salmon, two species of listed sturgeon, several species of endangered and threatened sea turtles, and several species of whales, small cetaceans, and pinnipeds. Although there may be many species that occur in this area, this section will focus on those protected species that may be caught in or otherwise interact with one or more of the fishing gears utilized in a fishery addressed in this amendment. For a complete list of protected species that occur in the Greater Atlantic Region, see Table 70. More detailed information on the range-wide status of marine mammal and sea turtle species that occur in the area can be found in a number of published documents. These include sea turtle status reviews and biological reports (Conant et al. 2009; NMFS and USFWS 1995, 2007a, 2007b, 2007c, 2007d; Hirth 1997; Turtle Expert Working Group (TEWG) 1998, 2000, 2007, 2009), recovery plans for Endangered Species Act-listed sea turtles and marine mammals (NMFS 1991; NMFS and USFWS 1991a, 1991b, 2008; NMFS et al. 2011; USFWS and NMFS 1992; NMFS 2005b), the marine mammal stock assessment reports (e.g., Waring et al. 2011), and other publications (e.g., Clapham et al. 1999; Perry et al. 1999; Wynne and Schwartz 1999; Best et al. 2001; Perrin et al. 2002). Additional background information on the Gulf of Maine Distinct Population Segment of Atlantic salmon and the five distinct population segments of Atlantic sturgeon can be found in the respective status reviews (Fay et al. 2006; ASSRT 2007) and listing determinations for Atlantic salmon (74 FR 29344; June 19, 2009) and Atlantic sturgeon (77 FR 5880 and 77 FR 5914; February 3, 2012)

The wild populations of Atlantic salmon whose freshwater range covers the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, including the Penobscot and Kennebec rivers, are listed as endangered under the
${ }^{48}$ For additional information regarding species managed by the ASMFC, see the ASMFC's web page at www.asmfc.org/managedSpecies.htm. For additional information regarding species managed under the Atlantic highly migratory species FMPs, see the NMFS Highly Migratory Species Division web page at www.nmfs.noaa.gov/sfa/hms/.

Endangered Species Act (74 FR 29344, June 19, 2009). This status also applies wherever these fish occur in these rivers' estuaries and the marine environment. Atlantic salmon are highly migratory, undertaking long marine migrations from the mouths of U.S. rivers into the northwest Atlantic Ocean, where they are distributed seasonally over much of the region (Reddin 1985, Sheehan et al. 2012). Most of the salmon originating from the Gulf of Maine Distinct Population Segment spend two winters in the ocean before returning to streams for spawning (Fay et al. 2006).

Loggerhead, leatherback, Kemp's ridley, and green sea turtles occur seasonally in continental shelf waters north of Cape Hatteras. In general, turtles move up the coast from southern wintering areas as water temperatures warm in the spring (James et al. 2005; Morreale and Standora 2005; Braun-McNeill and Epperly 2004; Morreale and Standora 1998; Musick and Limpus 1997; Shoop and Kenney 1992; Keinath et al. 1987). The trend is reversed in the fall as water temperatures cool. By December, turtles have passed Cape Hatteras, returning to more southern waters for the winter (James et al. 2005; Morreale and Standora 2005; Braun-McNeill and Epperly 2004; Morreale and Standora 1998; Musick and Limpus 1997; Shoop and Kenney 1992; Keinath et al. 1987). Hard-shelled sea turtles are more commonly observed south of Cape Cod, but may occur in the Gulf of Maine. The more cold-tolerant leatherbacks range farther north than other sea turtles, feeding as far north as Canadian waters.

The western North Atlantic baleen whale species (North Atlantic right, humpback, fin, sei, and minke) follow a general annual pattern of migration from high latitude summer foraging grounds, including the Gulf and Maine and Georges Bank, and low latitude winter calving grounds (Perry et al. 1999; Waring et al. 2011). However, this is an oversimplification of species movements, and the complete winter distribution of most species is unclear (Perry et al. 1999; Waring et al. 2011). Studies of some of the large baleen whales (right, humpback, and fin) have demonstrated the presence of each species in higher latitude waters even in the winter (Swingle et al. 1993; Wiley et al. 1995; Perry et al. 1999; Brown et al. 2002).

Waring et al. (2011) report that, in comparison to the baleen whales, sperm whale distribution occurs more on the continental shelf edge, over the continental slope, and into mid-ocean regions. However, sperm whales distribution in EEZ waters also occurs in a distinct seasonal cycle. Typically, sperm whale distribution is concentrated eastnortheast of Cape Hatteras in winter and shifts northward in spring when whales are found throughout the Mid-Atlantic Bight. Distribution extends further northward to areas north of Georges Bank and the Northeast Channel region in summer and then south of New England in fall, back to the Mid-Atlantic Bight.

Numerous small cetacean species (dolphins, pilot whales, harbor porpoise) occur within the area from Cape Hatteras through the Gulf of Maine. Seasonal abundance and distribution of each species in Mid-Atlantic, Georges Bank, and/or Gulf of Maine waters varies with respect to life history characteristics. Some species primarily occupy continental shelf waters (e.g., white sided dolphins, bottlenose dolphin, harbor porpoise), while others are found primarily in continental shelf edge and slope waters (e.g., Risso's dolphin), and still others occupy all three habitats (e.g., common dolphin, pilot whale).

Information on the western North Atlantic stocks of each species is summarized in Waring et al. (2005).

Of the four species of seals expected to occur in the area, harbor seals have the most extensive distribution with sightings occurring as far south as $30^{\circ} \mathrm{N}$ (Katona et al. 1993). Gray seals are the second most common seal species in EEZ waters of the United States, occurring primarily in New England (Katona et al. 1993; Waring et al. 2011). Pupping colonies for both species are also present in New England, although the majority of pupping occurs in Canada. Harp and hooded seals are less commonly observed in EEZ waters. Both species form aggregations for pupping and breeding off of eastern Canada in the late winter/early spring, and then travel to more northern latitudes for molting and summer feeding (Waring et al. 2011). However, individuals of both species are also known to travel south into EEZ waters and sightings as well as strandings of each species have been recorded for both New England and Mid-Atlantic waters (Waring et al. 2011).

Atlantic sturgeons belonging to the five distinct population segments use different rivers for spawning and exhibit differences in certain characteristics (e.g., age at maturity and timing of spawning) (Scott and Crossman 1973; Murawski and Pacheco 1977; Smith et al. 1982; Smith 1985; Bain 1997; Smith and Clugston 1997; Young et al. 1998; Caron et al. 2002). However, once the young have become sufficiently salt tolerant, they leave the natal estuary and undertake a migratory existence, ranging from Hamilton Inlet, Labrador, Canada to Cape Canaveral, Florida, USA (Scott and Scott, 1988; ASSRT, 2007). Numerous publications support the conclusion that Atlantic sturgeon of all five distinct population segments occur primarily in marine waters less than 60m, aggregate in certain areas, and exhibit seasonal northerly and southerly coastal movement to and from coastal estuaries (Vladykov and Greeley 1963; Murawski and Pacheco 1977; Dovel and Berggren 1983; Smith 1985; Collins and Smith 1997; Welsh et al. 2002; Savoy and Pacileo 2003; Stein et al. 2004; USFWS 2004; Laney et al. 2007; Dunton et al. 2010; Erickson et al. 2011; Wirgin et al. 2012; Waldman et al. 2013). The final listing rules provide additional information on the distribution of Atlantic sturgeon (77 FR 5880 and 77 FR 5914; February 6, 2012).

Shortnose sturgeons are listed as endangered under the Endangered Species Act. The species is listed as one unit throughout its range, with populations occurring from the Saint John River, New Brunswick, Canada, to the St. Johns River, Florida. Coastal migrations of shortnose sturgeon do occur, particularly in the Gulf of Maine and Southeast where shortnose sturgeon operate as metapopulations (Shortnose Sturgeon Status Review Team 2010).

There are no seabird species in the Greater Atlantic Region that would be subject to interactions with fishing gear from one or more of the relevant fisheries listed as either endangered or threatened under the Endangered Species Act.

Candidate species are those petitioned species that NMFS is actively considering for listing as endangered or threatened under the ESA. Candidate species also include
those species for which NMFS has initiated an ESA status review through an announcement in the Federal Register.

Candidate species 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).

Cusk (Brosme brosme) are NMFS "species of concern," as well as a "candidate species" under the ESA as NMFS is currently conducting a review of the species. 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 www.greateratlantic.fisheries.noaa.gov/protected/pcp/soc/cusk.html.

### 7.1.2.3 Other Non-Fishery Resources

In addition to the fishery resources caught and landed by commercial and recreational fishermen, and the protected resources subject to various levels of interactions with commercial and recreational fishing activities, there are a wide variety of other non-fishery resources that may be subject to interactions with fishing gear or operations. Although there may be other non-fishery resources that occur in the Northeast Continental Shelf Large Marine Ecosystem, the focus of this review remains on those species or taxa most likely to be encountered by one or more fishing gears utilized in a fishery addressed in this amendment. Table 70 lists examples of non-fishery resources known to be subject to interactions with fishing gear or operations. The nonfishery resources most likely subject to interactions with fishing activities represent many diverse taxa of invertebrates, finfish, and algae that occupy a broad range of habitats throughout the Gulf of Maine, Georges Bank, and the Mid-Atlantic Bight.

Based on the results of extensive benthic studies by Theroux and Wigley (1981 and 1998), the biomass and density of non-fishery resources in the Greater Atlantic Region tends to be dominated by five groups: Amphipods; annelids; arthropods;
echinoderms; and mollusks. In the Gulf of Maine and on Georges Bank, echinoderms and mollusks dominate the biomass, while mollusks dominate in the Mid-Atlantic Bight. In terms of density of individuals, annelids and mollusks dominate in the Gulf of Maine, while crustaceans and annelids dominate on Georges Bank and arthropods, mollusks, and annelids dominate in the Mid-Atlantic Bight. These groups vary by sediment type, as well, with amphipods dominating numerically in sand, gravel, and sand-gravel habitats in all three areas. Mollusks dominate the biomass in sand-shell, silty-sand, sand-gravel, silt, and, and clay habitats in the Mid-Atlantic Bight. Most of the mollusks in sand-gravel, sand-shell, and sand habitats are bivalves, although gastropods are important in silty sand, and annelids, hydroids, and bryozoans are important in sand-gravel habitats. Echinoderms (mostly sea cucumbers) dominate in silty-clay habitats of the Gulf of Maine and Georges Bank. In the Gulf of Maine and on Georges Bank, mollusks comprise 50 percent of the biomass in gravel habitats, but annelids, crustaceans, sea anemones, sponges, and tunicates are also important. In all areas, many of these groups, particularly the annelids and arthropods, serve as important prey items for fishery resources.

Seabirds with known fishing gear interactions in the Greater Atlantic Region include several species of gulls, shearwaters, Northern gannets, the common loon, cormorants, and brown pelicans. For more information on seabirds, see Endicott and Tipling (1997), Ward (1995), and Tove (2000).

## SBRM Omnibus Amendment

| Species | Gulf of Maine | Georges Bank | Middle Atlantic Bight |
| :---: | :---: | :---: | :---: |
| American lobster | X | X | X |
| American plaice | X |  |  |
| Atlantic bluefish | X |  | X |
| Atlantic cod | X | X |  |
| Atlantic croaker |  |  | X |
| Atlantic halibut | X |  |  |
| Atlantic herring | X | X | X |
| Atlantic mackerel | X | X | X |
| Atlantic sea scallop |  | X | X |
| Atlantic surfclam | X | X | X |
| Atlantic wolffish | X | X |  |
| Black sea bass |  | X | X |
| Blue crab |  |  | X |
| Butterfish |  | X | X |
| Clearnose skate |  |  | X |
| Deep-sea red crab | X | X | X |
| Golden tilefish |  |  | X |
| Haddock | X | X |  |
| Hagfish | X | X | X |
| Horseshoe crab | X | X | X |
| Jonah crab | X | X |  |
| King whiting |  |  | X |
| Little skate |  | X | X |
| Longfin squid |  | X | X |
| Menhaden | X | X | X |
| Monkfish | X | X | X |
| Ocean pout | X | X | X |
| Ocean quahog | X | X | X |
| Offshore hake |  | X | X |
| Pandalid shrimp | X |  |  |
| Pollock | X | X |  |
| Red hake | X | X | X |
| Redfish | X |  |  |
| Rock crab | X | X | X |
| Rosette skate |  |  | X |
| Scup |  |  | X |
| Shortfin squid | X | X | X |
| Silver hake | X | X | X |
| Smooth dogfish |  | X | X |
| Spiny dogfish | X | X | X |
| Spot |  |  | X |
| Striped bass | X | X | X |
| Summer flounder |  | X | X |
| Whelks | X | X | X |
| White hake | X | X | X |
| Windowpane |  | X | X |
| Winter flounder | X | X | X |
| Winter skate | X | X | X |
| Witch flounder | X |  |  |
| Yellowtail flounder | X | X | X |


|  | Species | Gulf of Maine | Georges Bank | Middle Atlantic Bight |
| :---: | :---: | :---: | :---: | :---: |
|  | North Atlantic right whale | X | X | X |
|  | Humpback whale | X | X | X |
|  | Fin whale | X | X | X |
|  | Blue whale ${ }^{49}$ |  |  |  |
|  | Sei whale | X | X |  |
|  | Sperm whale |  | X | X |
|  | Minke whale | X | X | X |
|  | Risso's dolphin |  | X | X |
|  | Short-finned pilot whale |  |  | X |
|  | Long-finned pilot whale | X | X | X |
|  | White sided dolphin | X | X | X |
|  | Common dolphin | X | X | X |
|  | Spotted dolphin |  | X | X |
|  | Bottlenose dolphin |  | X | X |
|  | Harbor seal | X |  | X |
|  | Gray seal | X |  |  |
|  | Harp seal | X |  |  |
|  | Hooded seal | X |  |  |
|  | Leatherback sea turtle | X | X | X |
|  | Kemp's ridley sea turtle | X |  | X |
|  | Green sea turtle | X |  | X |
|  | Loggerhead sea turtle |  | X | X |
|  | Atlantic sturgeon | X | X | X |
|  | Atlantic salmon | X |  |  |
|  | Cusk (candidate species) | X | X | X |
|  | Amphipods (spp.) | X | X | X |
|  | Annelid worm (spp.) | X | X | X |
|  | Barndoor skate |  | X |  |
|  | Brittle star (spp.) | X | X | X |
|  | Coral (spp.) | X | X | X |
|  | Greater shearwater | X |  |  |
|  | Grenadier (spp.) | X | X | X |
|  | Hermit crab (spp.) | X | X | X |
|  | Jellyfish (spp.) | X | X | X |
|  | Kelp (spp.) | X | X | X |
|  | Lumpfish | X | X | X |
|  | Northern gannet | X | X | X |
|  | Northern stone crab | X | X | X |
|  | Sand dollar (spp.) | X | X | X |
|  | Sand lance (spp.) | X | X | X |
|  | Sculpin (spp.) | X | X | X |
|  | Sea anemone (spp.) | X | X | X |
|  | Sea cucumber (spp.) | X |  | X |
|  | Sea raven | X | X | X |
|  | Sea robin (spp.) | X | X | X |
|  | Sea squirt (spp.) | X | X | X |
|  | Snail (spp.) | X | X | X |
|  | Spider crab (spp.) | X |  | X |
|  | Sponge (spp.) | X | X | X |
|  | Spotted hake |  | X | X |
|  | Starfish (spp.) | X | X | X |
|  | Thorny skate | X | X |  |
|  | Zooplankton (spp.) | X | X | X |

Table 70. List of example biological resources and the geographic regions where the resources are most commonly found.

[^36]
### 7.1.3 Socio-Economic Considerations

Analyses of socio-economic impacts are generally conducted at three levels: The level of the individual fishing vessel, the level of the fishing sector or fleet (typically defined as all permit holders of one type - e.g., all commercial moratorium summer flounder permit holders), and at the level of the fishing community. Individual impacts of fishing regulations (changes to the cost of operations, changes to expected revenues, profits, etc.) occur at the level of the fishing vessel or permit holder, while cumulative impacts across the fishery occur at the level of the sector, fleet, fishing port and/or community. The relative impacts of any proposed regulatory change depend upon several factors: Whether a vessel holds a permit in the affected fishery; whether a vessel holds multiple permits (permits in addition to the affected fishery); the dependence on fishing, and on the affected fishery in particular, of the permit holder; the number of affected permit holders in a sector, fleet, or community; the number of permit holders in the affected fishery versus alternative fisheries; and the overall dependence on fishing, and on the affected fishery in particular, of the fishing community.

As described in chapter 2, most fisheries managed under FMPs subject to this amendment include both limited access permits as well as open access permits. Only the fisheries for Atlantic bluefish and skates remain entirely open access. ${ }^{50}$ In the Greater Atlantic Region, approximately 3,700 vessels hold at least one limited access permit. Of these, approximately 1,600 vessels hold only a limited access lobster permit and, therefore, are not subject to the regulations implemented under the FMPs affected by this amendment. This leaves approximately 2,100 vessels with at least one limited access permit issued under a subject FMP. In addition to these vessels, an additional 1,877 vessels hold at least one open access permit (but no limited access permits) in an FMP fishery.

In 2011, the dealer purchase report database includes 550 ports with recorded landings among the 12 states in the Greater Atlantic Region. Of these, the top 99 ports contribute 90 percent of the total ex-vessel value of all ports in the region, and 50 percent of the total ex-vessel value comes from only 10 ports. Nationally, 14 Greater Atlantic Region ports rank in the top 50 of all ports in the country for both quantity of fish landed and for total ex-vessel value of the fish landed (see Table 71).

New Bedford, MA, the top port nationally by value in recent years, is a primary port for Atlantic sea scallops, monkfish, and the large-mesh groundfish species (e.g., yellowtail flounder, winter flounder, haddock, and Atlantic cod). Cape May, NJ, is another leading sea scallop port, and is also a primary port for squid (Longfin and Illex) and Atlantic mackerel. The Hampton, VA, area (including Newport News, VA) is also a primary port for Atlantic sea scallops, as well as summer flounder and blue crabs. Gloucester, MA, is an important port for American lobster, groundfish, monkfish, and

[^37]Atlantic herring. Stonington, ME is similarly an important port for American lobster, Atlantic herring, Atlantic sea scallops, and groundfish. Point Judith, RI, is a primary port for American lobster, squid (Longfin and Illex), summer flounder, monkfish, and silver hake. Reedville, VA, one of the top ports in the country by weight of landings, deals primarily in menhaden as well as blue crabs, but does not feature as a primary port for any Greater Atlantic Region FMP species.

| Port | Quantity (million pounds) |  | Port | Value (million dollars) |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 2010 | 2011 |  | 2010 | 2011 |
| Reedville, VA | 426 | 414 | New Bedford, MA | 306 | 369 |
| New Bedford, MA | 133 | 117 | Cape May-Wildwood, NJ | 81 | 103 |
| Gloucester, MA | 89 | 77 | Hampton Roads Area, VA | 75 | 88 |
| Portland, ME | 38 | 61 | Gloucester, MA | 57 | 59 |
| Point Judith, RI | 36 | 41 | Stonington, ME | 45 | 48 |
| Cape May-Wildwood, NJ | 43 | 40 | Point Judith, RI | 32 | 40 |
| Rockland, ME | 23 | 38 | Reedville, VA | 34 | 36 |
| Wanchese-Stumpy Point, NC | 26 | 25 | Long Beach-Barnegat, NJ | 26 | 34 |
| Atlantic City, NJ | 24 | 23 | Portland, ME | 19 | 28 |
| Stonington, ME | 17 | 19 | Provincetown-Chatham, MA | 20 | 27 |
| Hampton Roads Area, VA | 16 | 18 | Point Pleasant, NJ | 23 | 27 |
| Provincetown-Chatham, MA | 16 | 18 | Rockland, ME | 11 | 24 |
| Point Pleasant, NJ | 21 | 15 | Wanchese-Stumpy Point, NC | 22 | 22 |
| Boston, MA | 12 | 13 | Montauk, NY | 18 | 19 |

Table 71. Commercial fishery landings and value at major Greater Atlantic Region ports, 2010-2011 (from NMFS 2012).

Figure 46 and Figure 47 display 2011 commercial fishing landings for major U.S. ports, both by weight and by value. These figures display the relative importance of Greater Atlantic Region ports compared to other major U.S. ports. Based on a classification scheme developed by Hall-Arber et al. (2001), the top-ranked ports in New England are: New Bedford, MA; Portland, ME; Gloucester, MA; Chatham, MA; Point Judith, RI; and Portsmouth, NH. This ranking accounts for overall fishery dependence and availability of fishing infrastructure. For a more detailed description of the fishing communities in the New England area, see Hall-Arber et al. (2001). This document provides profiles of many ports from Connecticut to Maine, and evaluates fishery dependence. For a more detailed description of the fishing communities of the MidAtlantic area, see McCay and Cieri (2000), for profiles of many ports from North Carolina to New York.

As noted earlier, economic impacts of a fishery management action are most directly seen at the level of the individual vessel, but larger scale economic impacts are also seen at the level of the fishing sector and fleet. Cumulative economic impacts are also often expected at the port or community level. Social impacts (as differing from purely economic impacts) can also be seen at the level of the individual vessel (sometimes differentiated based on position on the vessel - owner, captain, crew, etc.), the fishing sector, fleet, port, or community. Ports and communities with the highest degree of dependence on a fishery subject to a management action are the ones most likely to face social impacts as well as economic impacts resulting from a management action. The above mentioned references (Hall-Arber et al., 2001, and McCay and Cieri,
2000) provide detailed information of the social characteristics of New England and MidAtlantic ports and fishing communities.


Figure 46. 2011 commercial fishery landings, by weight, at major U.S. ports (from NMFS 2012).


Figure 47. 2011 commercial fishery landings, by value, at major U.S. ports (from NMFS 2012).

### 7.2 Consequences of the Alternatives Under Consideration

The National Environmental Policy Act requires that an EA briefly describe the probable environmental impacts of the proposed action and alternatives to the proposed
action considered by the action agency (NEPA, section 102(2)(E)). The following sections address the reasonably foreseeable direct, indirect, and cumulative effects of the alternatives being considered for the SBRM.

As noted above in the introduction to the affected environment (section 7.1), this amendment is wholly procedural in nature-focused on the methodology and mechanisms by which data and information on the types and rates of bycatch occurring in Greater Atlantic Region fisheries are obtained and utilized by scientists and fishery managers. Subsequently, there are no expected direct physical or biological impacts associated with the alternatives under consideration. As described below, there are some potential economic effects associated with an alternative for bycatch reporting and monitoring, but, overall and due to the nature of the program to be implemented through this amendment, there very few functional differences (as far as environmental effects generally considered in an EA are concerned) between the status quo alternatives and the other alternatives under consideration.

The expected direct effects are generally well-defined for most fishery management actions, but indirect effects are often less so. While NEPA requires consideration of "reasonably foreseeable effects," it does not require consideration of remote and speculative impacts; these effects remain outside the scope of a NEPA analysis (Bass et al. 2001). During the development of this amendment, there have been occasions when discussions began to diverge from how bycatch data may best be collected into discussions about the likely management implications of an "improved" data collection program. These discussions generally focused on the potential for improvements in stock assessments and on the types of management measures that may be necessary to address bycatch concerns where they may exist.

There are three reasons why these types of potential downstream effects (e.g., subsequent management measures to address bycatch issues) of this action are considered too remote and speculative to be appropriate for consideration in this amendment. First, while this amendment is focused on structuring an SBRM to obtain the highest quality bycatch data possible, implementation of this amendment does not, by itself, guarantee that there would be an improvement in data quality over the status quo. In some, if not many, cases, the analyses conducted in support of this amendment have demonstrated that the data currently being collected are of sufficient quality (i.e., precision and accuracy) to meet the objectives of the SBRM (i.e., the CVs associated with many fishing mode-species combinations are already at or less than the target proposed to be established by this amendment). Also, while increases in target observer coverage levels for some fisheries may be expected to improve data quality in those fishing modes, realization of an improvement in data quality is contingent upon sufficient funding for the observer program to fully staff the target coverage level on a continuing basis.

The second reason these types of potential effects are too remote and speculative to be appropriate for consideration in this amendment is that there is no way to predict the effect that an improvement in data quality would have for managing the affected fisheries. While any improvements in data quality would give assessment scientists and fishery managers more confidence in the data, there is no way to predict whether the
resulting data would indicate that future estimates of discards would be higher or lower than current estimates. Because any change in the direction of bycatch estimation cannot be predicted at this time, there is no way to predict whether changes in management would be required to address any potential issues that may arise.

The third reason is that the management measures that might be implemented, should action be determined to be necessary to address a bycatch concern, also cannot be predicted. Depending on the specific fishery, resource species, time, area, and manner of interaction leading to the bycatch concern, different types of management measures would be appropriate. Some types of bycatch concerns may best be addressed with a bycatch quota, others may best be addressed with an area or seasonal closure, and yet others may best be addressed through changes to the fishing gear used. As the actual environmental impacts of these potential management changes would vary with and depend upon the type of measure proposed, the management system to be changed, and the time, area, and species fished, there is no way to speculate as to what the most likely environmental impacts may be.

Therefore, because these types of potential management actions, which may eventually stem from implementation of the SBRM, are too remote and speculative to be adequately or meaningfully addressed in this amendment, this NEPA analysis focuses solely on the potential direct, indirect, and cumulative effects expected to be immediately associated with the proposed action and primary alternatives. Any future management actions that may result from the information collected under this SBRM would be subject to all the requirements of NEPA at the appropriate time.

The discussion of environmental effects that follows is organized to present separately the relevant biological, physical, and socio-economic considerations of the alternatives associated with each item described in chapter 6. Thus, for each item, the effects on biological resources of the alternatives are discussed, followed by the effects on the physical environment (habitat) of the alternatives, and then followed by the socioeconomic effects of the alternatives. In this way, full consideration may be given to all the potential impacts associated with a single item before proceeding to the next item. Due to the administrative nature of this action, by which is meant that the action is focused on establishing a procedural methodology, including analytical techniques used to determine the effectiveness of a bycatch monitoring program and the allocation of atsea fisheries observer coverage levels, rather than on implementing changes to fishing operations (e.g., gear, area, season, etc.), in many cases there are no environmental impacts associated with the elements of the SBRM under consideration. In these cases, an explanation for this conclusion is presented, but no separate discussion of the alternatives is provided. Separate discussion of the likely impacts of alternatives is only provided where there are measurable differences in impacts between the alternatives.

### 7.2.1 Environmental Consequences of Item 1: Bycatch Reporting and Monitoring Mechanisms

This item includes two alternatives addressing the mechanisms through which information on bycatch may be collected and reported. In addition to the status quo, an
alternative is considered that would supplement the status quo bycatch reporting and monitoring mechanisms with an electronic video monitoring program. Due to concerns regarding the state of the technology required to implement electronic monitoring, the level of detail of the information that can be obtained through this technology, and the appropriateness of this type of system to Greater Atlantic Region fisheries, the status quo is the preferred alternative for this item.

### 7.2.1.1 Effects on Biological Resources

Because the alternatives considered under this item deal entirely with the procedural and administrative mechanisms by which data and information regarding fishery discards are collected (e.g., FVTRs, at-sea observers, seafood dealer purchase reports, MRIP, etc.), neither of the alternatives would affect the level of fishing effort, fishing operations, the species targeted, or areas or times fished in the Greater Atlantic Region. The status quo alternative proposes maintaining the current bycatch collection mechanisms. As discussed in Chapter 5.6.2, in some fishing modes there is evidence for a difference between observed and unobserved fishing trips. However, current research does not indicate whether this observer effect would affect the accuracy of discard estimates. Recent analysis indicates that any bias in discard rates that may be present would have to be at least 5 to 10 times greater than currently observed in order to pose an appreciable risk of exceeding the ABC or OFL. The bias analyses conducted to date do not suggest behavioral differences of this magnitude. Current bycatch collection mechanisms are thought to have minimal if any direct impacts on biological resources. The electronic monitoring alternative, while it would introduce a new bycatch monitoring technology, would impose no regulatory changes or constraints to the how, where, what, or when of fishing operations, but would only require the purchase and installation of an additional piece of electronic equipment on fishing vessels. Therefore, there are expected to be minimal to no direct or indirect impacts on biological resources (including fishery resources, protected resources, and other non-fishery resources) associated with either alternative. The biases that could occur and result in potential impacts could occur under either alternative; thus, there are no expected differences in the potential biological impacts between the two alternatives.

### 7.2.1.2 Effects on the Physical Environment (Habitat)

Because neither the status quo alternative nor the electronic monitoring alternative would impose or result in any changes in fishing effort or behavior, fishing gears used, or areas fished, there are no potential impacts to the physical environment (including EFH) associated with the alternatives under consideration for this item. Similar to impacts on biological impacts, due to the nature of the alternatives considered for this item, there are no differences between alternatives as far as potential impacts on the physical environment (including EFH) of the Greater Atlantic Region.

### 7.2.1.3 Socio-Economic Effects

The electronic monitoring alternative, because it would introduce an additional fishing vessel monitoring technology into the fisheries for which it was required, can be
distinguished from the status quo alternative. There are financial costs associated with implementation of this new technology that would exceed those associated with the status quo. These potential socio-economic impacts are described below.

### 7.2.1.3.1 Alternative 1.1 -Status Quo (Preferred Alternative)

7.2.1.3.2 A number of small ongoing costs are associated with the status quo alternative, including but not limited to, costs for maintenance of electronic transmission devices such as eVTR and VMS, transmission fees, and costs associated with hosting an observer or at-sea monitor onboard the vessel. Generally these costs are low, and therefore have a minor, negative economic impact. Alternative 1.2 - Implement Electronic Monitoring

The economic impacts associated with the alternative to implement an electronic video monitoring program for one or more fisheries in the Greater Atlantic Region are derived directly from the expected costs to purchase, install, and maintain the electronic monitoring systems. These costs could be borne in either of two ways: A requirement that all permitted vessels participating in the subject fishery purchase, install, and maintain the equipment themselves (industry pays); or NMFS purchases the equipment for the industry participants and provides it for their use (government pays). Based on the various VMS programs implemented in the Greater Atlantic Region in recent years, it appears likely that implementation of any type of electronic monitoring program for bycatch would follow the industry-pays model and all costs associated with purchasing, installing, and maintaining the equipment would be borne by the affected vessel permit holders.

Based on cost estimates as of May 2006, it is likely that the cost to purchase a complete electronic video monitoring system would be approximately $\$ 7,200$ per vessel (Archipelago Marine Research, Ltd. 2006). ${ }^{51,52}$ Installation costs are highly variable and depend upon the size of the vessel, the number of cameras to be installed, and other complicating factors such as the need to retrofit the vessel to support the installation of the equipment. Kinsolving (2006) estimates installation costs as ranging from $\$ 650$ to $\$ 4,225$ per vessel, based on a service rate of $\$ 65$ per hour and the installation time ranging from 10 hours to as many as 65 hours per vessel, depending on the aforementioned complexity. In addition to the cost to purchase and install a system, it is expected that an annual registration fee would be required by the contractor providing the equipment and this is estimated to be approximately $\$ 600$ per year. Maintenance costs

[^38]would be expected to vary, but for the purposes of analysis, Kinsolving’s (2006) estimate of $\$ 975$ per year is used. The total first year costs would be approximately $\$ 10,200$ per vessel, with continuing costs of approximately $\$ 1,600$ per vessel per year for the second year and beyond (see Table 72).

|  | Year 1 (per vessel) | Year 2+ (per vessel) |
| :--- | :--- | :--- |
| Equipment purchase | $\$ 7,194$ | $\mathrm{~N} / \mathrm{A}$ |
| Installation costs (average) | $\$ 2,438$ | $\mathrm{~N} / \mathrm{A}$ |
| Annual program registration fee | $\$ 608$ | $\$ 608$ |
| Annual maintenance | $\mathrm{N} / \mathrm{A}$ | $\$ 975$ |
| Total | $\mathbf{\$ 1 0 , 2 4 0}$ | $\$ 1,583$ |

Table 72. Estimated costs per fishing vessel to purchase, install, and maintain an electronic video monitoring system (Archipelago Marine Research, Ltd. 2006; Kinsolving 2006).

The information presented above and in Table 72 provide an estimate of the per vessel costs of implementing the electronic monitoring alternative. The next step is to estimate the number of affected vessels within the fisheries for which this alternative would be considered. Table 73 below identifies the primary vessel permit categories established for each FMP, with the number of permit holders in 2012. By simply multiplying the cost information by the number of permit holders, an estimate of the overall cost to a fishery can be calculated.

Estimating total costs region-wide is more difficult if more than one fishery would be affected and required to implement electronic monitoring, because most fishing vessels hold permits in more than one fishery. Summing the totals presented in Table 73 for all affected fisheries would result in an over-estimation of the total costs (i.e., vessels with multiple permits would not have to obtain multiple systems). Also, imposition of this type of program in an open access fishery (such as bluefish) would most likely result in a decrease in permit holders, as it would not be cost effective for many participants to incur the expense in order to remain in the fishery. Table 73 does not include party/charter permits for any fisheries.

The costs discussed above address only the purchase, installation, and annual maintenance of the electronic video monitoring systems, but do not address the costs associated with extracting the data from the video recording systems, or storing, maintaining, editing, and reviewing the data. This would be a major component of the electronic monitoring program and must be addressed. For the purpose of this analysis, it is assumed that NMFS would bear these costs and perform all data-related tasks itself (or through a contractor). Thus, the individual vessel and fleet costs do not need to be adjusted to account for these aspects of implementing such a program. However, the costs to the government could be substantial (Kinsolving 2006).

| Type of Permit | Number of Permits | Fleet-wide Cost |  |
| :---: | :---: | :---: | :---: |
|  |  | Year 1 | Year 2+ |
| Atlantic Bluefish Open Access | 2,633 | \$26,961,920 | \$4,168,039 |
| Red Crab Limited Access | 5 | \$51,200 | \$7,915 |
| Red Crab Open Access | 1,490 | \$15,257,600 | \$2,358,670 |
| Atlantic Herring Limited Access | 93 | \$952,320 | \$147,219 |
| Atlantic Herring Open Access | 2,044 | \$20,930,560 | \$3,235,652 |
| Sea Scallop Limited Access | 824 | \$8,437,760 | \$1,304,392 |
| Black Sea Bass Limited Access | 764 | \$7,823,360 | \$1,209,412 |
| Dogfish Open Access | 2,639 | \$27,023,360 | \$4,177,537 |
| Monkfish Limited Access | 683 | \$6,993,920 | \$1,081,189 |
| Monkfish Open Access | 1,736 | \$17,776,640 | \$2,748,088 |
| NE Multispecies Limited Access | 1,172 | \$12,001,280 | \$1,855,276 |
| NE Multispecies Open Access | 1,351 | \$13,834,240 | \$2,138,633 |
| Scup Limited Access | 718 | \$7,352,320 | \$1,136,594 |
| Skate Open Access | 2,242 | \$22,958,080 | \$3,549,086 |
| Squid/Mackerel/Butterfish Limited Access <br> Squid/Mackerel/Butterfish Open Access | 400 2,212 | $\$ 4,096,000$ $\$ 22,650,880$ | $\$ 633,200$ $\$ 3,501,596$ |
| Summer Flounder Limited Access | 865 | \$8,857,600 | \$1,369,295 |
| Surfclam/Ocean Quahog Limited Access | 37 | \$378,880 | \$58,571 |
| Surfclam/Ocean Quahog Open Access | 720 | \$7,372,800 | \$1,139,760 |
| Tilefish Open Access | 2,061 | \$21,104,640 | \$3,262,563 |

Table 73. Number of permits by FMP permit category for 2012 calendar year, and the estimated total fleet costs associated with implementation of the electronic monitoring alternative.

Agency or contractor personnel would be required to obtain the video data from fishing vessels (either through dockside extraction or a mail-in hard drive exchange program), to review the video footage in order to document discard events, to oversee and perform quality control on the extracted data, and to archive and maintain the data. Video reviewing and data archiving equipment would also be required. Kinsolving (2006) estimates that data storage systems would be required to support approximately 20 terabytes of data per year, but this was an estimate solely for the Pacific rockfish pilot program, which has a fleet of approximately 25 vessels (consolidating to 18 active vessels) that make an average of seven fishing trips per year, with trips averaging 3 days each. Therefore, extrapolating to determine the data storage needs were this program implemented in the Greater Atlantic Region would most likely be orders of magnitude greater. Thus, the costs to the government to implement an electronic monitoring program would likely be substantial.

Comparatively, the costs associated with the electronic monitoring alternative appear much greater, therefore impacts are expected to be moderately negative when compared to the status quo alternative. Future consideration of electronic monitoring programs would need to weigh the benefits of such a program against the substantial costs to both the fishing industry and the Federal government, although as technologies
improve, costs may decrease. Although the cost basis used in this analysis is representative of current costs (using 2006 data), these costs are driven somewhat by the limited number of vendors currently operating in the market. The costs associated with electronic video monitoring would be expected to decrease as more vendors enter the market.

### 7.2.2 Environmental Consequences of Item 2: Analytical Techniques and Allocation of Observers

This item includes four alternatives addressing the processes by which the appropriate target levels of at-sea observer effort would be determined and how that observer effort would be allocated across the Greater Atlantic Region fishing modes. The alternatives considered under this item are: 1) a return to the allocation process used prior to the 2007 SBRM Omnibus Amendment; 2) an alternative that uses an integrated allocation approach to determine the initial target observer coverage levels; 3) the status quo, which uses the integrated allocation approach combined with an importance filtering process to refine the initial target observer coverage levels; and 4) an alternative that would establish baseline percent coverage levels based on the types of species (common or rare) expected to be encountered by participants in the fishing modes. While the coverage rate for fishery observers may change as a result of these alternatives, the requirement to carry an observer would not change. As is currently required, any fishing vessel holding one or more Federal permits that is asked to carry an observer must do so.

### 7.2.2.1 Effects on Biological Resources

Because the alternatives considered under this item deal entirely with the process by which target observer coverage levels are determined and allocated across fishing modes, none of the alternatives would affect the level of fishing activity, fishing operations, the species targeted, or areas or times fished in the Greater Atlantic Region. The differences between the alternatives would be in the target observer coverage levels set for each fishing mode, but the target observer coverage levels would be set prior to determining whether available resources could support such coverage so it is not possible to determine the degree to which realized coverage levels would vary among these three alternatives. Even so, the implications to biological resources of changes in observer coverage levels across the fishing modes that may be linked to differences in how observer effort is allocated are negligible. If some fishing vessels alter their behavior in the presence of a fishery observer (e.g., to avoid a bycatch "hot spot" when an observer is present), then there may be some tangential impacts to some species, but, as described in chapter 5 and Appendix A, evidence of such an "observer effect" is minimal for Greater Atlantic Region fisheries. Therefore, there are no direct or indirect impacts on biological resources (including fishery resources, protected resources, and other non-fishery resources) associated with any of the alternatives. As there are no biological impacts associated with these alternatives, there are no differences among them.

### 7.2.2.2 Effects on the Physical Environment (Habitat)

Because neither the status quo alternative nor the other alternatives would directly impose or likely result in any changes in fishing effort or behavior, fishing gears used, or areas fished, there are no potential impacts to the physical environment (including EFH) associated with the alternatives under consideration for this item. There are also no differences among the alternatives.

### 7.2.2.3 Socio-Economic Effects

Because the alternatives considered under this item focus entirely on the process by which target observer coverage levels are determined and allocated across fishing modes, the only socio-economic impacts that could be associated with these alternatives would be for fisheries in which the fishing industry itself pays for the at-sea observers. In the Greater Atlantic Region, the fisheries observer program operates entirely through a contract service funded by NMFS, with the single exception of the sea scallop industryfunded program. In this case, increases in target observer coverage levels would increase initial costs to the vessels carrying observers. However, under the provisions of the regulations establishing the sea scallop industry-funded observer program, any vessel required to carry an observer is authorized either to catch and retain additional sea scallops above the standard possession limit or to have their DAS charged at a reduced rate in order to offset the costs associated with carrying the observer. Both the increased possession limit and reduced DAS are subject to the continued availability of a set-aside from the annual total allowable catch and fleet DAS allocation. The intent of the observer set-aside is to offset all costs to the vessel of carrying an observer; however, should the set-aside be exhausted, fishing vessels carrying observers would bear the full costs.

Other than the sea scallop industry-funded observer program, no other industryfunded observer programs are authorized in the Greater Atlantic Region. The At-Sea Monitor Program was designed to be an industry-funded program to support the Northeast multispecies sector management program. Although the programs function similarly, the NEFOP and At-Sea Monitor Program are separate and each is tailored to meet specific monitoring objectives. The allocation and funding of at-sea monitors is separate and distinct from SBRM at-sea observers. Therefore, this action would not change the At-Sea Monitoring Program.

Returning to the allocation process used prior to the 2007 SBRM Omnibus Amendment could potentially decrease spending by the Federal Government from reduced levels of observer coverage and reduced statistical analyses and reports to be prepared for use by fishery managers. Using 2004 as the case study, there were 8,429 observer sea days utilized in 2004. Under the status quo alternative for this element, 9,874 observer sea days would have been required based on 2004 data. The status quo alternative represented an increase of 1,445 observer sea days. Given a per day total cost of $\$ 1,150$ to pay the observer and cover the cost of all associated overhead for the contractor and the Government, that equates to an increase of $\$ 1,661,750$ from the 2004 spending level (a 17 percent increase). Theoretically, a return to the allocation process
prior to the 2007 SBRM Omnibus Amendment could also result in a return to these lower costs. However, this alternative may not represent the best scientific information available and may no longer meet the purpose and need of this action.

As the four alternatives considered for determining appropriate observer coverage levels and allocating observer effort operate independent of the budget process used to determine the available resources for funding observer coverage in any given year, there are no effective differences among the four alternatives regarding the socio-economic impacts that may be associated with these alternatives.

### 7.2.3 Environmental Consequences of Item 3: SBRM Standard

This item includes two alternatives addressing whether an SBRM standard should be established as part of the SBRM. The first alternative would result in no SBRM standard, while the status quo alternative would establish a CV of 30 percent as the performance standard for the SBRM. The SBRM standard would be used as a gauge to determine whether observer coverage levels in a previous fishing year were sufficient to provide data of the desired precision (indicated by a CV of 30 percent). The SBRM standard would also be used as part of the process to determine target observer coverage levels for future fishing years (see Item 2).

### 7.2.3.1 Effects on Biological Resources

The status quo process wherein no SBRM standard is used still results in an administrative process designed to provide optimal observer allocation based on several concurrent fishery information needs that are responsive to statute and regulation. These include, but are not limited to bycatch and catch estimation and protected species interactions monitoring. Similarly, the establishment of a CV standard that relies on an estimated CV performance analysis before the year begins to allocate observers to meet information and SBRM requirements, is a largely administrative process. In both alternatives, there can be and has been year-to-year variability in observer allocation. Such variances could impact allocation of observers in future years; however, the distinction in processes are the key elements. The resultant allocation of observers could have some level of indirect impact in the form or more or less information on biological resources. However, the two alternative administrative processes do not have direct impact on biological resources. The fisheries and fishing behaviors are not likely to be significantly influenced by the status quo or establishment of an SBRM standard. The fisheries are more responsive to the limiting management system of available catch limits and fish availability, which in turn drive impacts on fishery, protected, and non-fishery related resources. The potential indirect effects on biological resources (fishery resources, protected resources, or other non-fishery resources) are expected to be low to nonexistent for either alternative.

### 7.2.3.2 Effects on the Physical Environment (Habitat)

7.2.3.3 Because neither the status quo alternative nor the CV standard would impose or result in any changes in fishing effort or behavior, fishing gears used, or areas
fished, there are no potential impacts to the physical environment (including EFH) associated with the alternatives under consideration for this item. The potential impacts on the physical environment is driven more by the potential fishery limitations of catch limits and fish availability. The observer allocation process is not expected to result in differences between alternatives as far as potential impacts on the physical environment (including EFH) of the Greater Atlantic Region. Socio-Economic Effects

Due to the nature of the alternatives under consideration for this item, which are limited to a decision on whether or not to establish a performance measure of a 30 percent CV standard for the SBRM, there are no direct or indirect socio-economic effects on fishing vessels, fleets, or ports anticipated for either alternative.

### 7.2.4 Environmental Consequences of Item 4: SBRM Review/Reporting Process

This item includes three alternatives addressing whether the SBRM should include a reporting/evaluation process to present information on bycatch rates in the Greater Atlantic Region fisheries, and also to compare the effectiveness of the SBRM against the performance standard. The status quo alternative would result in no requirements for an SBRM reporting process, while the other alternatives (either alone or in combination) would establish a periodic reporting and evaluation process as a formal component of the SBRM. The requirement to provide periodic reporting would specify the types of information to be provided in the reports, and time intervals for which the reports must be prepared (semi-annually, annually, every 3 years, every 5 years, or as part of an existing required reporting process).

### 7.2.4.1 Effects on Biological Resources

Due to the nature of the alternatives under consideration for this item, which are limited to a decision on whether or not to establish a requirement for a periodic reporting and evaluation process for the SBRM, there are no direct or indirect effects on any biological resources (fishery resources, protected resources, or other non-fishery resources) anticipated for any of the alternatives.

### 7.2.4.2 Effects on the Physical Environment

Due to the nature of the alternatives under consideration for this item, which are limited to a decision on whether or not to establish a requirement for a periodic reporting and evaluation process for the SBRM, there are no direct or indirect effects on the physical environment (including EFH) anticipated for any of the alternatives.

### 7.2.4.3 Socio-Economic Effects

Due to the nature of the alternatives under consideration for this item, which are limited to a decision on whether or not to establish a requirement for a periodic reporting and evaluation process for the SBRM, there are no direct or indirect socio-economic effects on fishing vessels, fleets, or ports anticipated for any of the alternatives.

### 7.2.5 Environmental Consequences of Item 5: Changes to the Framework Adjustment and/or Annual Adjustment Provisions

This item includes four alternatives addressing whether to authorize changes to certain aspects of the SBRM through actions other than a full amendment to an FMP. The status quo alternative would continue to require a full amendment to modify or update the provisions of the SBRM. The other alternatives would authorize changes to the SBRM through a framework adjustment to an FMP, or through a framework adjustment, annual adjustment, and/or annual/multi-year specifications. The provisions of the SBRM subject to such changes include: (1) The CV-based performance standard; (2) the means by which discard data are collected/obtained in a fishery; (3) fishery stratification (changes to this provision would be allowed without formal Council action under alternative 5.4); (4) SBRM reporting; and (5) industry-funded observers and/or observer set-aside programs.

### 7.2.5.1 Effects on Biological Resources

Due to the nature of the alternatives under consideration for this item, which are limited to decisions regarding the appropriate mechanisms that may be used to develop and implement potential changes to the SBRM, there are no direct or indirect effects on any biological resources (fishery resources, protected resources, or other non-fishery resources) anticipated for any of the alternatives. Any impacts that may be associated with actually implementing a change to the SBRM through one of these mechanisms (a full amendment, a framework adjustment, an annual adjustment, and/or an annual/multiyear specification) would be fully analyzed in the documents supporting the action.

### 7.2.5.2 Effects on the Physical Environment

Due to the nature of the alternatives under consideration for this item, which are limited to decisions regarding the appropriate mechanisms that may be used to develop and implement potential changes to the SBRM, there are no direct or indirect effects on any physical environment (including EFH) anticipated for any of the alternatives. Any impacts that may be associated with actually implementing a change to the SBRM through one of these mechanisms (a full amendment, a framework adjustment, an annual adjustment, and/or an annual/multi-year specification) would be fully analyzed in the documents supporting the action.

### 7.2.5.3 Socio-Economic Effects

Due to the nature of the alternatives under consideration for this item, which are limited to decisions regarding the appropriate mechanisms that may be used to develop and implement potential changes to the SBRM, there are no direct or indirect socioeconomic effects on fishing vessels, fleets, or ports anticipated for any of the alternatives. Any impacts that may be associated with actually implementing a change to the SBRM through one of these mechanisms (a full amendment, a framework adjustment, an annual adjustment, and/or an annual/multi-year specification) would be fully analyzed in the documents supporting the action.

### 7.2.6 Environmental Consequences of Item 6: Prioritization Process for SBRM Observer Allocations

This item includes eight alternatives across three components addressing how observer coverage allocations would be prioritized and determined to account for insufficient Federal budgets that would limit the Agency's ability to fully provide the observer coverage levels initially calculated under the SBRM. Two of the alternatives focus on a trigger mechanism for determining when there are insufficient funds available. The status quo funding trigger would allow NMFS, through its normal budgetary process, to determine the amount of funds available for SBRM. The alternative funding trigger would specify the proportions of identified funding sources used to fund observer coverage under the SBRM each year.

The funding available for SBRM in any given year is dependent on future allocation decisions of Congress. As such, it cannot be predicted whether, or to what extent, there will be a funding shortfall in any given year. The alternatives under consideration would determine the process to follow in order to prioritize available funding. The alternatives do not dictate a specific outcome of the reallocation of available sea days, nor do the alternatives dictate which fishing modes would receive fewer observer sea days.

Three alternatives provide methods for redistributing the available observer sea days if resources are determined to be limiting. The Council consultation alternative would establish a consultation process, whereby the Regional Administrator and Science and Research Director would develop a prioritization based on stock assessment needs and other legal mandates, and consult with the Councils. This alternative is very similar to what was implemented by the 2007 SBRM Omnibus Amendment and was found legally deficient by the Court in Oceana v. Locke. The two other alternatives propose formulaic methods to redistribute a limited number of observer sea days. The proportional reduction method would reduce the number of sea days assigned to each fishing mode by the same percentage as the funding shortfall. The penultimate cell method of prioritizing sea days would reduce the number of sea days required by using an iterative process of eliminating from consideration the cell that requires the highest number of projected sea days to achieve the SBRM performance standard.

The specific impact of redistributing observer sea days is largely dependent on the degree of funding shortfall in any given year. As mentioned, whether or to what extent available funding will fall short depends on future funding allocation decisions of Congress. Therefore, the degree of impact of each of these alternatives on the observer coverage for a specific fishing mode in a future year would be purely speculative. However, some general impacts may be discerned. The Council consultation alternative is an ad hoc approach to redistributing available observer sea days, and therefore the potential impact on observer coverage in specific modes would be speculative. The proportional reduction method reduces the coverage on all fishing modes by the percentage of the funding shortfall. Therefore all fishing modes would have at least one, and possibly more, species or species group, where the observer coverage would not be expected to achieve a CV-based performance standard. The penultimate approach would
focus on cells (fishing mode/species group combinations) that require a large number of observer sea days to achieve the CV-based performance standard. As a result, this alternative would result in the fewest number of cells that do not achieve the CV-based performance standard, and could result in fishing modes that still achieve the performance standard for all species/species groups. However, which specific fishing modes would be more likely to be affected in any given year would depend on the degree of any funding shortfall, and the sample size analysis as described in Chapter 5.
Therefore any potential impact would be a result of the total available funding and not the process used to prioritize it.

The final three alternatives address how observer coverage would be allocated if the available funding were ever so restricted that it could not provide observer sea days for the minimum pilot coverage for each fishing mode. The first alternative would direct the Regional Administrator and the Science Research Director to develop an ad-hoc proposal of which fleets would not get coverage based on any applicable legal mandates, management priorities, or data needs and to present this proposal to the Councils for their consideration and recommendations. The second alternative would remove the shortfall by sequentially eliminating coverage in fleets which have the highest minimum pilot coverage days. This alternative would have the greatest impact on fleets with the longest average trip length, and would impact the fewest fleets. In 2012, the five fleets with the highest minimum pilot coverage were Mid-Atlantic shrimp trawl, New England largemesh haddock separator trawl, New England hagfish pots, New England crab pots, and Mid-Atlantic longline (Table 7, Appendix H). The third alternative would eliminate the shortfall by sequentially eliminating coverage in fleets that had the highest ratio of minimum pilot coverage to days absent from port based on FVTR reports in the previous year. This alternative would eliminate coverage from fleets with low numbers of days absent from port, therefore preserve coverage for the most active fishing modes. In 2012, the five fleets with the highest ratio were New England small-mesh gillnets, Mid-Atlantic large-mesh Ruhle trawl, New England small-mesh Ruhle trawl, Mid-Atlantic hagfish pots, and Mid-Atlantic large-mesh haddock separator trawl (Table 8, Appendix H). These alternatives represent a different form of prioritization that would only apply under extreme funding limitations. Which specific fleets might ultimately be impacted by these alternatives would depend on fleet activity in the preceding years, and the severity of the funding shortfall. As with the other prioritization alternatives, any potential impact would be a result of the total available funding and not the process used to prioritize it.

The environmental implications of changes in observer coverage levels across the fishing modes that may be linked to differences in how observer effort is allocated is negligible. Some fishing vessels could alter their behavior in the presence of a fishery observer (e.g., to avoid a bycatch "hot spot" when an observer is present), however, as described in chapter 5 and Appendix A, evidence of such an "observer effect" is minimal for Greater Atlantic Region fisheries.

### 7.2.6.1 Effects on Biological Resources

Due to the nature of the alternatives under consideration for this item, which are limited to a decision regarding the appropriate process to follow in order to prioritize
available funding for the purpose of allocating observer coverage levels, there are no direct or indirect effects on any biological resources (fishery resources, protected resources, or other non-fishery resources) anticipated for any of the alternatives.

### 7.2.6.2 Effects on the Physical Environment

Due to the nature of the alternatives under consideration for this item, which are limited to decisions regarding the appropriate process to follow in order to prioritize available funding for the purpose of allocating observer coverage levels, there are no direct or indirect effects on the physical environment (including EFH) anticipated for either of the alternatives.

### 7.2.6.3 Socio-Economic Effects

Due to the nature of the alternatives under consideration for this item, which are limited to a decision regarding the appropriate process to follow in order to prioritize available funding for the purpose of allocating observer coverage levels, there are no direct or indirect socio-economic effects on fishing vessels, fleets, or ports anticipated for either of the alternatives.

### 7.2.7 Environmental Consequences of Item 7: Industry-Funded Observer Programs

This item includes three alternatives addressing whether the SBRM Omnibus Amendment should establish and authorize observer service provider approval and certification procedures and requirements, and/or add provisions allowing industryfunded observer programs and observer set-aside programs as measures that can be implemented through framework adjustments. The status quo alternative would result in no change to the regulations on observer service provider approval and certifications that currently apply to the sea scallop fishery. The other alternatives would not actually implement any industry-funded observer programs or observer set-aside programs, but would create the mechanisms needed to more quickly and easily develop and implement such provisions in any of the Councils’ FMPs.

### 7.2.7.1 Effects on Biological Resources

Due to the nature of the alternatives under consideration for this item, which are limited to decisions regarding creating the mechanisms needed to develop and implement industry-funded observer programs rather than actually implementing any such programs, there are no direct or indirect effects on any biological resources (fishery resources, protected resources, or other non-fishery resources) anticipated for any of the alternatives. Any impacts that may be associated with actually implementing an industry-funded observer program and/or an observer set-aside program through a framework adjustment to an FMP would be fully analyzed in the documents supporting the action.

### 7.2.7.2 Effects on the Physical Environment (Habitat)

Due to the nature of the alternatives under consideration for this item, which are limited to decisions regarding creating the mechanisms needed to develop and implement industry-funded observer programs rather than actually implementing any such programs, there are no direct or indirect effects on any physical environment (including EFH) anticipated for any of the alternatives. Any impacts that may be associated with actually implementing an industry-funded observer program and/or an observer set-aside program through a framework adjustment to an FMP would be fully analyzed in the documents supporting the action.

### 7.2.7.3 Socio-Economic Effects

Due to the nature of the alternatives under consideration for this item, which are limited to decisions regarding creating the mechanisms needed to develop and implement industry-funded observer programs rather than actually implementing any such programs, there are no direct or indirect socio-economic effects on fishing vessels, fleets, or ports anticipated for any of the alternatives. Any impacts that may be associated with actually implementing an industry-funded observer program and/or an observer set-aside program through a framework adjustment to an FMP would be fully analyzed in the documents supporting the action.

### 7.3 Cumulative Effects Analysis

According to CEQ NEPA regulations, cumulative effects are effects that result from the incremental impacts of a proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of which agency (Federal or nonfederal) or person undertakes such actions. Cumulative effects can result from individually minor but collectively significant actions that take place over a period of time.

In general, a cumulative effects assessment should address:

- The area in which the effects of the proposed action will occur;
- the impacts that are expected in that area from the proposed action;
- other past, present, and reasonably foreseeable actions that have or are expected to have impacts in the area;
- the impacts or expected impacts from these other actions; and
- the overall impact that can be expected if the individual impacts are allowed to accumulate.


### 7.3.1 The Temporal and Geographical Scope of the Action

The temporal scope of past and present actions for the physical environment (habitat), biological resources, and socio-economic cumulative effects assessment, is
primarily focused on actions that have occurred after implementation of the FMPs amended by this action, as detailed in Section 2 (starting in 1977 for Atlantic surfclam and ocean quahog). The temporal range considered for protected resources begins in the 1990's when NMFS started generating stock assessments for marine mammals and developed recovery plans for sea turtles that inhabit waters of the U.S. EEZ. The temporal scope for future actions extends about 20 years (2035) into the future.

The geographic scope considered for analysis of impacts to the physical environment/habitat/EFH and biological resources is the Western Atlantic Ocean to the limit of the U.S. EEZ, from the U.S./Canadian maritime boundary through North Carolina. The geographic scope for the assessment of socio-economic effects is defined as those U.S. fishing communities directly involved in the harvest or processing of the managed resources, which were found to occur in the coastal states from Maine through North Carolina.

### 7.3.2 Past, Present and Future Foreseeable Actions

This section describes past, present, and future foreseeable actions that have effects on the valued ecosystem components (VECs) evaluated in this amendment.

### 7.3.2.1 Fishery management actions

Federal FMPs are developed to optimize yield in U.S. fisheries and to comply with the Magnuson-Stevens Act as reauthorized through 2007. The legislation promotes long-term positive impacts on the environment in the context of fisheries activities, stipulating that management plans must comply with a set of National Standards that collectively serve to optimize the conditions of the human environment. Specific goals of fishery management plans include improving or maintaining the stock structure and abundance of target species, improving economic and social outcomes, and minimizing incidental impacts, for example relative to protected resources and other non-target species. 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, although these actions are often associated with offsetting impacts. For example, constraining fishing effort frequently results in negative short-term socioeconomic impacts for fishery participants in order to bring about long-term sustainability of a given resource.

This section describes past, present, and future foreseeable FMP actions (Table 74). Future actions for all FMPs may include additional ecosystem considerations, either within the current FMP structure or as part of an overarching ecosystem plan. The New England and Mid-Atlantic Councils and the Atlantic States Marine Fisheries Commission do not currently have ecosystem plans in place, but all three groups are working on expanding their efforts in this sphere and future management actions will be developed in the context of ongoing environmental change.

In some cases, as was done with this amendment, FMP actions are developed in an omnibus fashion to update many plans at once. These amendments are considered
amendments to the individual fishery management plans, and the actions associated with these amendments are described in the table below as needed, by FMP. Examples of this include the 1999 New England Council EFH amendment, which designated EFH across all species managed by the Council at that time. Another example is the recent MidAtlantic Council ACL/AM omnibus amendment, which implemented annual catch limits and accountability measures. The New England Council took a plan-specific approach to implementing ACLs and AMs. Conversely, while New England is taking an omnibus approach to EFH updates, the Mid-Atlantic has been updating their EFH provisions plan by plan. In general, the designation of EFH is expected to have indirect, positive impacts on managed resources by guiding the development of conservation-oriented fishery management measures, and through conservation measures recommended for non-fishing projects via the EFH consultation process. Annual catch limits and accountability measures are also expected to have generally positive impacts of managed resources because these measures are designed to limit catches to biologically sustainable levels and to provide both proactive and reactive measures to ensure that these catch limits are not exceeded. Eliminating overfishing and reducing the number of overfished stocks is expected to generate long run benefits to the human community. Future foreseeable omnibus amendments include:

## Omnibus Essential Fish Habitat Amendment 2

This amendment is currently under development by the New England Council and will update EFH designations for all fishery species managed by the Council. In addition, this action considers the designation of new Habitat Areas of Particular Concern and minimizing the adverse effects of fishing to the extent practicable by considering changes and additions to the areas currently closed to fishing for protection of habitat and control of groundfish mortality.

## The Industry-Funded Monitoring Omnibus Amendment

This amendment is currently under development as a joint action of the New England and Mid-Atlantic Councils in coordination with NMFS. Through that action, the Councils are considering measures that would allow the Councils to implement future industry-funded monitoring coverage in some FMPs above the levels required by the SBRM, and specific coverage levels for the Atlantic mackerel and Atlantic herring fisheries to address management priorities in those fisheries.

| Fishery <br> Management <br> Plan | Past actions | Present actions | Future foreseeable actions |
| :--- | :--- | :--- | :--- |
| Northeast <br> Multispecies <br> FMP | FMP completed in 1986 by <br> NEFMC to reduce fishing <br> mortality and promote <br> rebuilding. Past measures <br> included input controls such as <br> days-at-sea, mesh size, trip, <br> and fish size, and permit limits, <br> and seasonal and year-round <br> management areas. EFH was <br> designated in 1999. | Current management <br> includes annual catch limits <br> by stock and accountability <br> measures for overages. Most <br> fishing conducted within the <br> sector system. Limits on <br> mesh-size, fish size, and <br> permits are still used, along <br> with area management. Trip <br> limits and days-at-sea are <br> infrequently relied upon. | Amendment 18: considering <br> capping accumulation limits, <br> changes to fleet structure. <br> Ongoing specifications actions <br> will allocate annual catch limits in <br> response to updated <br> assessment information. <br> Updates to spawning closures <br> on the multi-year Council priority <br> list. |
| Monkfish FMP | FMP completed in 1999 by | Current management | Amendment 6: considering |


| Fishery Management Plan | Past actions | Present actions | Future foreseeable actions |
| :---: | :---: | :---: | :---: |
|  | NEFMC and MAFMC to address concerns about small fish in landings, gear conflicts, and expanding directed fishery. Measures included permit and day-at-sea limits, trip limits, minimum fish sizes, seasonal spawning restrictions, and gear restrictions, as well as EFH designations. A subsequent action included designation of EFH management areas closed to monkfishing in Lydonia and Oceanographer canyons. | includes annual catch limits by stock and accountability measures for overages. In addition to original FMP measures, current management includes various exemption areas for trawls and gillnets where vessels can use large mesh and are not required to use a Multispecies day-at-sea. Management is closely tied to Northeast Multispecies FMP. Habitat closure areas in two canyons. | modifications to days-at-sea program and catch shares. <br> Ongoing specifications actions will allocate annual catch limits in response to updated assessment information. |
| Skate Complex FMP | FMP completed in 2003 by NEFMC to protect overfished skates and collect data about the fishery to improve management. Measures included federal permits, reporting requirements, possession limits for wing fishery, and prohibitions on landings of depleted species, as well as EFH designations. | Current management includes annual catch limits and accountability measures for overages. Possession limits now include both wing and bait fisheries. | Ongoing specifications actions will allocate annual catch limits in response to updated assessment information. |
| Atlantic Sea Scallop FMP | FMP completed in 1982 by NEFMC to rebuild stock and reduce interannual fluctuations in abundance. Measures included limits on permits, days-at-sea, crew size, gear restrictions, and meat count restrictions. EFH was designated in 1999 and Amendment 10 (implemented 2004) designated EFH closures, which were updated via Amendment 15 (implemented 2011) updated these areas to be consistent with those in Multispecies Amendment 13 | Current management includes annual catch limits and accountability measures for overages. Rotational closure/access area system combined with open area days-at-sea. Seasonal closures and groundfish subACLs to limit fish bycatch, gear restrictions to limit turtle bycatch. No longer have meat count restrictions; 4 inch ring and rotational management used to optimize yield per recruit. Habitat closure areas. | Ongoing specifications actions will allocate annual catch limits in response to updated assessment information. Considering adjustments to Northern Gulf of Maine and LAGC management programs. Future adjustments may be made to rotational management program if additional resource is made available to fishery through lifting of habitat closures. |
| Atlantic Herring FMP | FMP completed in 1999 by NEFMC. Area-based quota/TAC system. EFH was also designated in 1999. | Current management includes annual catch limits and accountability measures for overages. Enhanced monitoring in groundfish management areas. | Ongoing specifications actions will allocate annual catch limits in response to updated assessment information. Actions under development will implement reporting and slippage provisions as well as monitoring adjustments. Coordination with MAFMC and ASFMC on river herring/shad monitoring/bycatch. |
| Deep-Sea Red Crab FMP | FMP completed in 2003 by NEFMC to address overfishing and the potential for overcapitalization. Measures included permit limits, trips limits, annual TACs, days-atsea, and limits on gear and processing at sea, as well as the EFH designations. | Current management includes annual catch limits and accountability measures for overages. | Ongoing specifications actions will allocate annual catch limits in response to updated assessment information. |
| Surfclam and Ocean Quahog FMP | FMP completed in 1977 by MAFMC. Initial approaches included limited entry, quarterly quotas, and fishing time | Fishery is currently managed as an ITQ system, with annual catch limits capping total catch and accountability | Ongoing specifications actions will allocate annual catch limits in response to updated assessment information. |


| Fishery Management Plan | Past actions | Present actions | Future foreseeable actions |
| :---: | :---: | :---: | :---: |
|  | restrictions. ITQ system established in 1990. | measures for overages. Fishing is subject to food safety/PSP closures. During 2013 a large PSP closure exemption area was opened to clam dredging on Georges Bank. |  |
| Atlantic Bluefish FMP | FMP completed in 1990 to control fishing effort. | Current management includes annual catch limits and accountability measures for overages. Quotas for recreational vs. commercial fisheries. | Ongoing specifications actions will allocate annual catch limits in response to updated assessment information. |
| Atlantic <br> Mackerel, Squid, and Butterfish FMP | Original FMPs in 1978. Consolidated into a single plan in 1983 by MAFMC. | Current management includes annual catch limits and accountability measures for overages. A plan amendment currently in development is considering deep-sea coral management areas in various slope and canyon environments within the mid-Atlantic region. | Ongoing specifications actions will allocate annual catch limits in response to updated assessment information. |
| Spiny Dogfish FMP | Joint MAFMC-NEFMC FMP implemented in 2000. | Current management includes annual catch limits and accountability measures for overages. Catches controlled by quotas and trip limits. | Ongoing specifications actions will allocate annual catch limits in response to updated assessment information. |
| Summer Flounder, Scup, and Black Sea Bass FMP | Merged into the summer flounder FMP in 1996. | Current management includes annual catch limits and accountability measures for overages. Catch and landings limits are the primary management tool; allocations between recreational and commercial fisheries. Also minimum fish sizes, bag Gear restricted areas to protect scup and black sea bass habitats. | Ongoing specifications actions will allocate annual catch limits in response to updated assessment information. |
| Tilefish FMP | Golden tilefish in the MidAtlantic are managed by MAFMC (FMP in 2001). Total allowable landings, rebuilding plan, limited entry, and tiered commercial quota system. | Current management includes annual catch limits and accountability measures for overages. Commercial fishery under ITQ management, with catch limit in incidental fishery. Gear restricted areas to protect sensitive tilefish habitats in the heads of canyons. | Ongoing specifications actions will allocate annual catch limits in response to updated assessment information. |
| Northern Shrimp FMP | ASMFC plan implemented 1986. Management measures included minimum mesh size, seasonal closures, possession limits, and reporting requirements. | Assessments and specifications process ongoing, although currently the fishery is closed given the status of the stock. | Ongoing specifications actions will allocate annual catch limits in response to updated assessment information. |
| American Lobster FMP | ASFMC plan in state waters, federally managed in Federal waters consistent with ASMFC approach. Area-based management system with trap limits, minimum-maximum size limits, and protections for eggbearing females. | Area-based management system with trap limits, minimum-maximum size limits, and protections for egg-bearing females. Focus on fishing mortality reduction in Southern New England. | Ongoing specifications actions will allocate annual catch limits in response to updated assessment information. |

Table 74. Past, present, and future foreseeable actions within the fishery management plans in operation in the Greater Atlantic Region.

### 7.3.2.2 Protected Resources Management

Protected resource management focuses on evaluation of stock status, identification of fisheries and other activities that interact with protected resources, and development of measures to minimize interactions and the negative impacts associated with interactions that do occur. Management may also include designation of critical habitats. Table 75 presents the past, present, and future foreseeable actions within the management plans for protected resources in the Greater Atlantic Region.

| Plan | Past actions | Present actions | Future foreseeable actions |
| :---: | :---: | :---: | :---: |
| Harbor Porpoise Take Reduction Plan | Spatial and seasonal gear restrictions to minimize interaction, injuries, and mortalities between fishing gear and harbor porpoises, including requirements for pingers | Modifications to plan (effective September 30, 2013) eliminate consequence closure areas. | Continue previous actions |
| Atlantic Large Whale Take Reduction Plan | Spatial and seasonal gear restrictions to minimize interaction, injuries, and mortalities between vertical lines and large whale species | Changes to plan were published June 2014 (79 FR 36586) | Continue previous actions |
| Ship strike reduction programs | Reporting systems and speed restrictions to minimize ship strike events; education/outreach activities | Ongoing development of temporary speed restricted areas as needed | Continued updates to measures to reduce ship strikes as technology improves |
| Sea turtle regulations | Annual fisheries observer coverage requirements for certain fisheries; requirements on handling and resuscitation. Biological opinions have led to gear requirements in sea scallop fishery, summer flounder fishery, NC/VA large mesh gillnet fishery, and VA pound net fishery. | Continue previous actions | Continue previous actions |
| Shortnose <br> Sturgeon <br> Recovery <br> Program | Fishing for, catching or keeping shortnose sturgeon illegal; federal agencies that conduct, fund or authorize activities that may adversely affect shortnose sturgeon must consult with NOAA; periodic status reviews; development and implementation of recovery plan (1998) | Continue previous actions | Continue previous actions |
| Atlantic Sturgeon Recovery Program | Fishing for, catching or keeping Atlantic sturgeon illegal; various restrictions by state | Continue previous actions | Continue previous actions |
| Atlantic Salmon Recovery Program and General Conservation Plan | Species listings by distinct population segment; designation of critical habitats | General Conservation Plan to promote fish passage and dam removals | Continue previous actions |
| Proactive Conservation Program for Species of Concern and Candidate Species | Grants to fund research activities, monitoring of status of species of concern/candidate species. | Continue previous actions | Continue previous actions |
| Stranding and disentanglement | Network of organizations that rescue and rehabilitate stranded | Continue previous actions | Continue previous actions |


| Plan | Past actions | Present actions | Future foreseeable actions |
| :--- | :--- | :--- | :--- |
| program | mammals and turtles to reduce <br> mortalities associated with <br> stranding |  |  |

Table 75. Past, present, and future foreseeable actions within the protected resources management plans in operation in the Greater Atlantic Region

### 7.3.2.3 Other uses of the marine environment

Non-fishing activities combine with fishery management efforts to affect the VECs considered in this action. Wherever these activities co-occur, they are likely to work additively or synergistically to decrease the quality of the physical and biological environment, and, as such, may indirectly constrain the sustainability of the managed resources, protected resources, and human communities associated with fishing. Table 76 describes the non-fishing activities that affect estuarine/nearshore environments and offshore environments.

| Activity | Past actions | Present actions | Future foreseeable actions |
| :---: | :---: | :---: | :---: |
| Liquefied natural gas facilities | Three New England import facilities, one land-based just north of Boston, MA, and two offshore of Cape Ann, MA. See www.northeastgas.org/about I ng.php. | Existing facilities are not especially active and imports of LNG have been down in New England. See www.northeastgas.org/about I ng.php. | The U.S. Department of Energy regulates import and export of natural gas and would approve new import facilities or import to export facility conversions. Given excess capacity at existing New England import terminals, new terminal construction does not appear likely, at least in the short term. |
| Offshore renewable wind energy | None - emerging use offshore the New England and MidAtlantic states | Leases have been sold in the Rhode Island/Massachusetts Wind Energy Area (July 2013), the Virginia Wind Energy Area (September 2013), for the Cape Wind project in Nantucket Sound (October 2010), the Bluewater Wind project off Delaware (November 2012), and the Deepwater Wind and Fishermen's Energy of New Jersey off New Jersey in October and November 2010. None of these wind energy areas overlap the area management alternatives directly, although they do encompass habitats for some of the managed species and protected resources identified above, as well as fishing grounds. | Environmental assessment and eventually development activities in current leases; leasing activities in additional wind energy areas, followed by assessment and perhaps development of wind energy installations. |
| Petroleum exploration | Seismic testing, drilling sediment cores and test wells. Leases sold and test wells drilled in late 1970s and early 1980s; given findings, no additional test well activity after that (see www.boem.gov/OCS-Report-MMS-2000-031/) for more information. | Bureau of Ocean Energy Management (BOEM) oversees these activities; currently we are within the 2012-2017 planning period. Currently there are no lease sales proposed in the Atlantic. | BOEM is currently developing the 2017-2022 Oil and Gas Leasing Program (see www.boem.gov/Five-Year-Program-2017-2022I) and a public request for information was published early summer 2014. It is not yet clear whether the 2017-2022 program will |


| Activity | Past actions | Present actions | Future foreseeable actions |
| :---: | :---: | :---: | :---: |
|  |  |  | include potential leasing and exploration in the Atlantic. |
| Wave and tidal energy | Regulations for the Outer Continental Shelf Renewable Energy Program published in 2009; these include offshore wind energy as well as wave and current (i.e. hydrokinetic) energy projects. BOEM oversees development of these types of projects. | Information about current projects can be found here: en.openei.org/wiki/Marine and Hydrokinetic Technology Dat abase. Various projects in Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut are in the siting/planning, site development, and device testing phases. There are no deployed projects in the New England region. | Future projects could be developed pursuant to the 2009 regulations. |
| Aquaculture | Existing facilities in New England are in currently in state waters only. There are facilities oriented towards commercial production as well as restoration aquaculture (e.g. oyster reefs, hatcheries). | Currently there are facilities in all coastal New England states, with the largest number of operations in Maine. NH, MA, RI, and CT focus mainly on shellfish, although NH has a steelhead trout facility. Maine raises a diversity of finfish and shellfish species including Atlantic salmon. Salmon is the dominant finfish aquaculture species in New England. Algae and seaweeds are also currently grown. | Expansion of aquaculture appears likely and could include offshore waters in the future. Many factors influence the rate of growth in this sector such as permitting concerns, availability of suitable sites, and regulatory stability. The National Sustainable Offshore Aquaculture Act of 2011 establishes a permitting and programmatic review system for offshore aquaculture sites, although the extensive regulatory requirements of the law could discourage entry into the system. |
| Offshore dredging and disposal: activities include mineral mining and vessel disposal |  | BOEM oversees offshore mineral extraction and has signed agreements with various states to evaluate sand resources for coastal resilience and restoration. <br> The Environmental Protection Agency approves requests for vessel disposal offshore; two vessels have been disposed of in the past few years in the western Gulf of Maine. | BOEM/state collaborative surveys to identify geologic resources suitable for mining, while mapping habitat and cultural resources. <br> Continued disposal of vessels at sea through EPA process (see <br> www.epa.gov/region2/water/oc eans/wrecks.htm) |

Table 76. Past, present, and future foreseeable non-fishing activities within the Greater Atlantic Region

### 7.3.3 Baseline status of Valued Ecosystem Components

This section summarizes the current status of all VECs, based on past and present actions but not including the proposed action.

All VECs are influenced to some degree by changes in global climate. These climate shifts may alter the pattern and strength of ocean currents; change the rate of freshwater inflows; influence water temperature, acidity, and salinity; etc. These changes affect the physical environment directly, which in turn may shape the suitability of local habitats for non-target biological features, managed fish and shellfish species, and protected resources. Changes in the abundance and distribution of these biological resources affect the communities that prosecute fisheries for these resources. For
example, if the target species important to a particular port community declines in abundance or its distribution shifts north or south due to environmental factors, there may be negative economic impacts locally, although there could be positive impacts due to increases in abundance of other species. It is impossible to pinpoint the degree to which these types of environmental changes are influencing the baseline status of the VECs analyzed in this action, but certainly regional-scale changes in climate combine with fishing and non-fishing human activities to shape the baseline status.

### 7.3.3.1 Managed Species

The managed species VEC includes the following fishery resources. Chapter 2 and Chapter 3 describes in detail the biology, status, and distribution of these resources, as well as the fisheries which prosecute them. The focus here is the status (overfished/overfishing occurring) of the various species, including the status by stock if the species is not managed as a single unit. Although technically a managed species, information about Atlantic salmon is located in the protected resources section, because the fishery management plan prohibits possession of Atlantic salmon and there is no commercial fishery for the stock.

In summary, the majority of stocks that overlap the Greater Atlantic Region are not overfished with overfishing not occurring (Table 77). A small number of stocks are at low abundance, but with low fishing mortality, or at high abundance, but with high fishing mortality. Cod, some flounders, and thorny skates are overfished with overfishing occurring. In general, past fishery management actions have contributed positively to stock status, but additional action will be necessary to rebuild all stocks in the region. With the exception of thorny skate, all stocks in the overfished/overfishing category are large-mesh groundfish managed under the Northeast Multispecies FMP.

| Northeast multispecies FMP - large mesh species |  |
| :--- | :--- |
| Species | Status and trends |
| Acadian redfish | Not overfished, overfishing not occurring. Biomass and recruitment are increasing. |
| American plaice | Not overfished, overfishing not occurring. Biomass is increasing but recent recruitment has <br> been low. |
| Atlantic cod | Gulf of Maine and Georges Bank stocks: Overfished, overfishing occurring. Recent biomass <br> and recruitment estimates are low. |
| Atlantic halibut | Overfished, less than 10\% of target. Overfishing is not occurring, and fishing mortality rates <br> are very low. |
| Atlantic wolffish | Overfished, but overfishing not occurring. Recent recruitment slightly below average, biomass <br> very low. |
| Haddock | Gulf of Maine: not overfished, but overfishing is occurring. Declining biomass and high fishing <br> mortality rate. Georges Bank: not overfished, overfishing not occurring. Record high <br> recruitment in 2010. |
| Ocean pout | Overfished, but overfishing is not currently occurring. <br> PollockNot overfished, overfishing not occurring. Recently below average recruitment but above <br> average biomass estimates. |
| White hake | Not overfished, overfishing not occurring. Recent recruitment and biomass slightly below <br> average. |
| Windowpane flounder | Northern stock: overfished, and overfishing is occurring; but fishing mortality down and <br> biomass up between last two assessments. Southern stock: not overfished, overfishing not <br> occurring; which represents a status change since the previous assessment. |

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| Winter flounder | Gulf of Maine: status unclear, but overfishing probably not occurring; spawning stock biomass increased between 2003-2009, but current recruitment is low. Georges Bank: not overfished with overfishing not occurring; increases in both biomass and recruitment and decreases in fishing mortality. Southern New England/Mid-Atlantic: overfished, but overfishing not occurring; recent low landings, recruitment, and spawning stock biomass. |
| :---: | :---: |
| Witch flounder | Overfished with overfishing occurring. High recent recruitment with slight increases in spawning stock biomass. |
| Yellowtail flounder | Cape Cod/Gulf of Maine: overfished with overfishing occurring. Little change in biomass, decreasing recruitment, but decrease in fishing mortality. Southern New England/Mid-Atlantic: overfishing not occurring; conflicting biomass estimates but likely not overfished. Georges Bank: overfished with overfishing occurring. Fishing mortality rates are increasing and biomass is decreasing. |
| Northeast multispecies FMP - small mesh species |  |
| Species | Status and trends |
| Red hake | Northern and southern stocks: Neither is overfished, and overfishing is not occurring, although the status of northern red hake may change when the stock assessment is updated in 2014. |
| Offshore hake | No status determination due to lack of data. |
| Silver hake | Northern and southern stocks: Neither is overfished, and overfishing is not occurring. |
| Monkfish FMP |  |
| Species | Status and trends |
| Monkfish | Northern and southern stocks: recent three assessments suggest they are not overfished with overfishing not occurring, but considerable uncertainty in the assessments. |
| Skates FMP |  |
| Species | Status and trends |
| Smooth skate | Not overfished, overfishing not occurring. |
| Thorny skate | Overfished with overfishing occurring; biomass appears to be declining. |
| Barndoor skate | Not overfished, overfishing not occurring. |
| Little skate | Not overfished, overfishing not occurring. |
| Winter skate | Not overfished, but overfishing is occurring. |
| Clearnose skate | Not overfished, overfishing not occurring. |
| Rosette skate | Not overfished, overfishing not occurring. |
| Atlantic sea scallop FMP |  |
| Species | Status and trends |
| Atlantic sea scallop | Not overfished, overfishing not occurring, but fishing mortality in 2009 was equal to the threshold value. |
| Atlantic herring FMP |  |
| Species | Status and trends |
| Atlantic herring | Not overfished, overfishing not occurring. |
| Deep-sea red crab FMP |  |
| Species | Status and trends |
| Deep-sea red crab | Unknown stock status; data poor stock. |
| Surfclam and ocean quahog FMP |  |
| Species | Status and trends |
| Surfclam | Not overfished, overfishing not occurring. |
| Ocean quahog | Not overfished, overfishing not occurring. |
| Bluefish FMP |  |
| Species | Status and trends |
| Atlantic bluefish | Not overfished, overfishing not occurring. |


| Atlantic mackerel, squid, and butterfish FMP |  |
| :---: | :---: |
| Species | Status and trends |
| Atlantic mackerel | Not overfished, overfishing not occurring; substantial uncertainty in assessment. |
| Butterfish | Status unknown. Overfishing not likely. |
| Shortfin squid | Status unknown, but recent catch indices and landings within typical ranges. |
| Longfin squid | Not overfished, overfishing determination not possible. |
| Spiny dogfish FMP |  |
| Species | Status and trends |
| Spiny dogfish | Not overfished, overfishing not occurring. Rebuilt biomass as of 2010. |
| Summer flounder, scup, and black sea bass FMP |  |
| Species | Status and trends |
| Summer flounder | Not overfished, overfishing not occurring. Rebuilt as of 2011, with recent fishing mortality values fluctuating near the reference point. |
| Scup | Not overfished, overfishing not occurring; biomass approximately double the reference point. |
| Black sea bass | Not overfished, overfishing not occurring. |
| Golden tilefish FMP |  |
| Species | Status and trends |
| Golden tilefish | Not overfished, overfishing not occurring. Rebuilt as of 2012. |
| Northern shrimp FMP |  |
| Species | Status and trends |
| Northern shrimp | Collapsed; biomass has declined since 2007, and recruitment indices are poor. |
| American lobster FMP |  |
| Species | Status and trends |
| American lobster | Gulf of Maine, Georges Bank, and Southern New England stocks: none are experiencing overfishing, but the Southern New England stock is overfished. |

Table 77. Baseline status of managed species in the Greater Atlantic Region.

### 7.3.3.2 Protected resources

Various protected resources overlap the Greater Atlantic Region. The distribution and status of these species is described in detail in 7.1.2.2. In general, the various large whales and sea turtles that overlap the region are considered endangered under the Endangered Species Act. Some fish stocks including shortnose sturgeon, Atlantic sturgeon, and Atlantic salmon are also listed as endangered. Various small whale, dolphin, and pinniped species are protected by the Marine Mammal Protection Act.

In general, the status of protected resources is on a positive trajectory, with some exceptions (Table 78). Nest count data for turtles suggest improvements in the status of these species since 2004. Large whale assessments indicate general increases in the population sizes for these species, with slight increases in abundance for the most vulnerable of these animals, the North Atlantic Right Whale. Small cetacean and pinniped populations appear to generally be fairly stable or increasing in their abundance. The Atlantic sturgeon was only recently listed under the Endangered Species Act and assessments of the status of various distinct population segments are ongoing. The trend
in abundance of Atlantic salmon in the Gulf of Maine DPS has been low and either stable or declining over the past several decades.

| Sea Turtles |  |  |
| :---: | :---: | :---: |
| Species | Status | Potentially affected by this action |
| Leatherback sea turtle | Endangered | Yes; seasonal occurrence in SNE/MAB. |
| Kemp's ridley sea turtle | Endangered | Yes; seasonal occurrence in SNE/MAB. |
| Green sea turtle | Endangered ${ }^{\text {c }}$ | Yes; seasonal occurrence in SNE/MAB. |
| Loggerhead sea turtle, Northwest Atlantic DPS | Threatened | Yes; seasonal occurrence in SNE/MAB. |
| Hawksbill sea turtle | Endangered | No |
| Cetaceans |  |  |
| Species | Status | Potentially affected by this action |
| North Atlantic right whale | Endangered | Yes |
| Humpback whale | Endangered | Yes |
| Fin whale | Endangered | Yes |
| Sei whale | Endangered | Yes |
| Blue whale | Endangered | No |
| Sperm whale | Endangered | No |
| Minke whale | Protected | Yes |
| Long-finned pilot whale | Protected | Yes |
| Short-finned pilot whale | Protected | Yes |
| Risso's dolphin | Protected | Yes; but mostly along shelf edge and slope, uncommon bycatch species |
| Atlantic white-sided dolphin | Protected | Yes |
| Common dolphin | Protected | Yes |
| Spotted dolphin | Protected | Yes; but uncommon bycatch species |
| Bottlenose dolphin ${ }^{\text {a }}$ | Protected | Yes; but uncommon bycatch species |
| Harbor porpoise | Protected | Yes |
| Pinnipeds |  |  |
| Species | Status | Potentially affected by this action |
| Harbor seal | Protected | Yes; most common seal in area |
| Gray seal | Protected | Yes; second most common seal in area |
| Harp seal | Protected | Yes; but less common |
| Hooded seal | Protected | Yes; but less common |
| Fish |  |  |
| Species | Status | Potentially affected by this action |
| Shortnose sturgeon | Endangered | No |
| Atlantic salmon | Endangered | No |
| Atlantic sturgeon |  |  |
| Gulf of Maine DPS | Threatened | Yes |
| New York Bight DPS, Chesapeake Bay DPS, Carolina DPS \& South Atlantic DPS | Endangered | Yes |
| Cusk | Candidate | No |
| Dusky shark | Candidate | No |

## Table 78. Baseline status of protected resource species in the Greater Atlantic Region.

${ }^{\text {a }}$ Bottlenose dolphin (Tursiops truncatus), Western North Atlantic coastal stock is listed as depleted.
${ }^{c}$ 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.

### 7.3.3.3 Physical Environment and EFH

The physical environment, including EFH, relevant to this action includes nearshore and offshore marine habitats in the Gulf of Maine, on Georges Bank, in the Mid-Atlantic Bight, and along the continental slope. Fishery management actions have likely had a positive cumulative impact on the status of the physical and biological
environment. Fishery management plans are required to evaluate and minimize to the extent practicable adverse effects of fishing on essential fish habitats, and these actions are assumed to have made a positive contribution to habitat condition since the habitat requirements were added to the Magnuson-Stevens Act in 1996. The overall amount of fishing activity also contributes to the condition of the physical and biological environment. In this region, bottom otter trawls are the primary source of fishery impacts on benthic habitats, and the use of this gear has been on the decline overall, due to declining activity in the large-mesh groundfish fishery. This trend likely contributes positively to the condition of the physical and biological environment.

Protected resource management actions that focus on reducing mortality rates of marine mammals, fish, and turtles may have indirect impacts on the condition of the physical and biological environment. Increases in abundance of protected resources due to conservation measures will influence marine food webs generally, which could ultimately affect the distribution and abundance of benthic fishes and non-target species of fishes and invertebrates that comprise the biological environment.

Other human uses of the marine environment are generally likely to have negative impacts on the physical and biological environment. However, these activities and their associated impacts tend to be concentrated near shore, and through the essential fish habitat consultation provisions of the Magnuson Stevens Act, the NMFS is provided the opportunity to request that measures be taken to mitigate negative impacts.

### 7.3.3.4 Human communities and the fishery

The various fisheries that are likely to be affected are described in Chapter 2. A summary is provided in Table 79 below. These include fisheries for large and small mesh Northeast multispecies, monkfish, skates, Atlantic sea scallops, Atlantic herring, deep-sea red crab, surfclams/ocean quahogs, bluefish, mackerel/squid/butterfish, dogfish, summer flounder/scup/black sea bass, tilefish, shrimp, and lobster. Recent fishery management plan actions should be consulted for detailed assessments of fishery status and communities affected. The status of these fisheries is mixed, with most fisheries relatively stable and others on the decline. Declining fishery conditions may be linked to poor stock conditions; this is the case with the Northeast Multispecies large-mesh fishery (some, but not all stocks at low abundance) and the northern shrimp fishery. In the monkfish fishery, landings have been on a downward trend, but monkfish catch limits do not appear to be the limiting factor. A number of other fisheries have stable landings that are below allocations (see below). Depending on the status of their dominant fisheries, the associated communities may be on a positive, stable, or negative trajectory. Fishery management actions and stock status are assumed to be the major contributors to fishery status and associated community impacts, with protected resources management and nonfishing uses of the marine environment contributing incidentally to fishery and community baseline status. Some protected resource conservation measures negatively impact fishing operations, restricting the use of particular gear types during specific seasons and in specific areas. In some cases these regulations restrict use of a gear entirely, but in other instances there are gear modifications required only, such as vessel
speed restrictions, pinger requirements for gillnets, or use of turtle excluder dredges in the scallop fishery.

| Fishery | Status and trends <br> Northeast <br> multispecies <br> large mesh <br> fishery |
| :--- | :--- |
| Murphy et al. 2014 provides a summary of the economic performance of the Northeast multispecies <br> fishery through the end of fishing year 2012 (April 2013). For all vessels with a valid limited access <br> multispecies permit, gross nominal revenue from groundfish totaled nearly \$70 million dollars, with <br> 99\% coming from sector vessels and 1\% from the common pool. This total is lower than that for each <br> of the 2009-2011 fishing years. Over this same period, average groundfish price per pound has <br> increased, although this increase did not compensate for the decrease in landings, and non-groundfish <br> revenues were not sufficient to make up the difference and overall revenues decreased among <br> groundfish vessels. The number of active vessels has declined annually since 2009 to 764 in FY 2012. <br> The number of trips and days absent decreased from FY 2011 to FY 2012. |  |
| Northeast | The small mesh/whiting specifications will be updated this year (2014). A detailed update of the fishery <br> multispecies <br> trends was prepared for Amendment 19 to the Northeast Multispecies FMP (2012). Between 2002 and <br> small-mesh <br> 2010, silver hake landings fluctuated between 5,000-8,000 mt, with landings around 8,000 mt (\$11 <br> million revenue) in 2010. About 25\% of 2010 landings were from the northern area and the remaining <br> landings were from the southern area. Offshore hake landings are very minor. Red hake are less |
| commercially important, with between 400-900 mt landings over the same time period, and generally |  |
| under \$500,000 in revenue annually. |  |

\(\left.\left.$$
\begin{array}{|l|l|}\hline \text { Fishery } & \text { Status and trends } \\
\hline \begin{array}{l}\text { Deep-sea red } \\
\text { crab }\end{array} & \begin{array}{l}\text { The current status of the red crab fishery is summarized in the specifications package submitted in } \\
\text { 2014. 2010-2012 landings were lower than the TAL, and appeared to be consistent with average } \\
\text { landings since 2002. Landings were grouped by three fishing regions based on VTR-reported } \\
\text { statistical area fished, and landings by region indicated that the fishery has been operating nearly } \\
\text { equally in all regions in recent years. LPUE appeared stable between 2010 and 2012 and showed an } \\
\text { increasing trend since 2007. }\end{array} \\
\hline \begin{array}{ll}\text { Surfclam and } \\
\text { ocean quahog }\end{array} & \begin{array}{l}\text { The Mid-Atlantic Fishery Management Council surfclam and ocean quahog AP information documents } \\
\text { (2013) summarize the current status of the clam fisheries. The number of vessels fishing for surfclams } \\
\text { has been fairly stable over the last 15 years, with a ten year high of 42 vessels in 2012. Prices for }\end{array} \\
\text { surfclams increased slightly in 2012, and the ex-vessel value of the federal surfclam harvest was }\end{array}
$$\right\} \begin{array}{l}approximately \$28.4 million. Further expansion of the fishery on Georges Bank is likely in the near <br>
term. The number of vessels targeting quahogs both in the mid-Atlantic/southern New England and off <br>

the Maine coast has declined somewhat in recent years. In 2012, prices declined very slightly from\end{array}\right\}\)| 2011, but overall ex-vessel value of non-Maine landings increased about 10\% to \$22.9 million in 2012. |
| :--- |
| The Maine fishery ex-vessel value was reported at \$1.75 million in 2012 according to data from |
| dealers, a 23\% decrease from 2011. |

## Table 79. Baseline status of fisheries in the Greater Atlantic Region.

### 7.3.4 Cumulative Effects of the Alternatives

As established above, the actions being considered in this amendment focus solely on the administrative processes through which data and information on bycatch occurring in Greater Atlantic Region fisheries are collected, analyzed, and reported to fishery scientists and managers. This amendment does not address bycatch reduction or other issues related to the management measures utilized in Greater Atlantic Region fisheries. Although aspects of the proposed SBRM have been implemented previously and utilized in many ways in recent years, the Court ruling that both Amendment 10 to the Sea Scallop FMP and Amendment 13 to the Northeast Multispecies FMP failed to fulfill the Magnuson-Stevens Act requirement to establish an SBRM is evidence that the 2007 SBRM Amendment was unique in the Greater Atlantic Region as the first action to propose the establishment of a comprehensive SBRM for the region. This action proposes many of the same provisions as the 2007 SBRM Amendment, while addressing the deficiencies identified by the Court. As such, this action is similarly unique in the Greater Atlantic Region.

In many ways, this action simply formalizes the status quo mechanisms used in the Greater Atlantic Region to collect information and data on fisheries bycatch and to analyze bycatch data in order to effectively determine appropriate observer coverage levels and allocate observer effort across the many Greater Atlantic Region fisheries. This action would not result in any changes to fishing operations in areas covered by the subject FMPs. For these components of the SBRM, there are no incremental impacts to any fishing areas, including EFH or living marine resources associated with the proposed action, relative to the no action baseline. The SBRM elements proposed in this amendment that diverge from the status quo-implementation of an importance filter to establish and allocated target observer coverage levels, establishment of an SBRM performance standard, the requirement to conduct periodic evaluations and prepare a periodic SBRM report, the prioritization process, and the framework adjustment provisions-are purely administrative features intended to improve the effectiveness and the transparency of the SBRM. None of these additional components are associated with impacts to any fishing areas, including EFH or living marine resources within the Greater Atlantic Region that could be distinguished from the no action baseline.

The preferred alternative for Bycatch Reporting and Monitoring Mechanism has minor costs associated with equipment upkeep, transmission costs and costs associated with hosting an observer. Therefore this action is considered to have minor negative impacts on the socio-economic environment.

### 7.3.5 Cumulative Effects Summary

Given the largely administrative nature of this action, the preferred alternatives are not expected to impact the baseline of cumulative effects. For managed species, the impacts will remain non-significant, with some stocks experiencing minor to moderate negative impacts but overall condition of all stocks improving. For protected resources
and physical habitat/EFH, this action will have no impact and the cumulative impacts will remain moderately positive. While this action is expected to have minor, negative socioeconomic impacts, this is not expected to substantially impact the mixed, non-significant cumulative impacts present at baseline.

# Relationship to Applicable Laws and Directives 

### 8.1 Administrative Procedure Act (APA)

Section 553 of the APA 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 Councils are not requesting any abridgement of the rulemaking process for this action.

### 8.2 Coastal Zone Management Act (CZMA)

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. However, because this action deals solely with the procedural and administrative mechanisms by which data and information on bycatch in Greater Atlantic Region fisheries are collected and reported, the preferred alternatives associated with this action do not directly affect the coastal zone of any state. In addition, pursuant to the CZMA regulations at 15 CFR 930.33(a)(2) and 930.35, a negative determination is not required, and coordination with the state coastal zone management agencies under section 307 of the CZMA is not necessary.

### 8.3 Endangered Species Act (ESA)

Section 7 of the ESA 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 impacts of the proposed alternatives on protected species are considered in chapter 7 , section 7.2 , and, based on the procedural nature of the action, the Councils have determined preliminarily that there would be no direct or indirect impacts on protected resources, including endangered or threatened species or their habitat.

### 8.4 E.O. 12866

A Regulatory Impact Review (RIR) is required by NMFS for all regulatory actions that either implement a new FMP or significantly amend an existing FMP. An RIR is required by NMFS for all regulatory actions that are part of the "public interest." The RIR is a required component of the process of preparing and reviewing FMPs or amendments and provides a comprehensive review of the economic impacts associated with proposed regulatory actions. The RIR addresses many concerns posed by the regulatory philosophy and principles of E.O. 12866. The RIR serves as the basis for assessing whether or not any proposed regulation is a "significant regulatory action" under criteria specified by E.O. 12866.

The RIR must provide the following information: (1) A comprehensive review of the level and incidence of economic impacts associated with a proposed regulatory action or actions; (2) a review of the problems and policy objectives prompting the regulatory proposals; and (3) an evaluation of the major alternatives that could be used to meet these objectives. In addition, an RIR must ensure that the regulatory agency systematically and comprehensively consider all available alternatives such that the public welfare can be enhanced in the most efficient and cost effective manner.

Under the Regulatory Flexibility Act (RFA) of 1980, as amended by Public Law 104-121, new FMPs or amendments also require an assessment of whether or not proposed regulations would have a significant economic impact on a substantial number of small business entities. The primary purposes of the RFA are to relieve small businesses, small organizations, and small Government agencies from burdensome regulations and record-keeping requirements, to the extent possible.

This section of the SBRM Omnibus Amendment provides an assessment and discussion of the potential economic impacts, as required of an RIR and the RFA, of various proposed actions consistent with the purpose of this action.

### 8.4.1 Statement of the Problem and Need for Action

The legal mandates addressed by this amendment are described in section 1.2. The specific issues driving the development of this amendment are described in sections 1.3 and 1.5. It is intended that the programs, procedures, and reporting requirements implemented through this amendment would ensure that the timeliness, accuracy, and precision of information collected on discards occurring in Greater Atlantic Region fisheries remains sufficient to support all relevant stock assessments and management decisions.

### 8.4.2 Management Objectives

The rationale for the Councils' proposed actions is found in section 6.10. The purpose and need for this amendment is found in section 1.4.

### 8.4.3 Description of the Affected Entities

As noted in earlier sections (see section 7.1 and 7.2), this amendment is wholly concerned with the procedures and mechanisms by which data and information on the types and rates of bycatch are obtained and utilized by scientists and fishery managers. Thus, the scope of the impacts associated with this amendment is atypical for an FMP amendment. Most FMP amendments focus on changes to fishing regulations in order to effect a direct change in either fishing effort or fishing practices, and these regulatory changes generally result in direct effect on fishing vessel operations (by modifying where, when, and/or how fishing may take place). These types of changes to fishing vessel operations almost always have socio-economic impacts on the participants of the subject fisheries.

However, as the focus of this amendment is on the methodology by which bycatch information is obtained, analyzed, and utilized, the impacts of the proposed actions are wholly administrative in nature. Therefore, although this amendment addresses all fisheries operating in the Greater Atlantic Region under a Council FMP, which encompasses Federal fishing vessel permit holders across 22 different permit categories (see Table 73), the actual economic impacts associated with this amendment are considered to be negligible. A further discussion of the vessels, ports, and communities subject to the FMPs amended through this action is provided in section 7.1.3, along with the general information provided in chapters 2 and 3. Specific information about the potential for economic impacts to result from this amendment, and the affected entities is provided in sections 7.2.1.3 and 7.2.2.3.

### 8.4.4 Description of the Alternatives

A complete description of the alternatives considered during the development of this amendment can be found in chapter 6.

### 8.4.5 Expected Economic Effects of the Alternatives

A complete evaluation of the expected economic effects of the various alternatives is presented throughout section 7.2. As noted in section 7.2, this action may increase spending by the Federal Government to pay for increased levels of observer coverage and to pay for additional statistical analyses and reports to be prepared for use by fishery managers. Using 2004 as the case study, there were 8,429 observer sea days utilized in 2004. Under the SBRM proposed in this amendment, 9,874 observer sea days would be required based on 2004 data. This represents an increase of 1,445 observer sea days. Given a per day total cost of $\$ 1,150$ to pay the observer and cover the cost of all associated overhead for the contractor and the Government, that equates to an increase of $\$ 1,661,750$ from the 2004 spending level.

### 8.4.6 Determination of Significance under E.O. 12866

E.O. 12866 requires that the Office of Management and Budget review proposed regulatory programs that are considered to be significant. A "significant regulatory action" is one that is likely to: (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, 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 this Executive Order.

A regulatory program is "economically significant" if it is likely to result in the effects described above. The RIR is designed to provide information to determine whether the proposed regulation is likely to be "economically significant."

NMFS has determined that, given the information presented above, there would be net benefits derived from the implementation of the proposed SBRM Omnibus Amendment. Because none of the factors defining "significant regulatory action" are triggered by this proposed action, the action has been determined to be not significant for the purposes of E.O. 12866.

## $8.5 \quad$ E.O. 13132

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 under consideration in the SBRM Omnibus Amendment. 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 Councils (all affected states are represented as voting members of at least one Regional Fishery Management Council). Thus far, no comments were received from any state officials relative to any federalism implications that may be associated with this action.

### 8.6 Information Quality Act

Pursuant to NOAA guidelines implementing section 515 of Public Law 106-554 (the Information 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.

## Utility

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 proposed action, 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 their 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 Councils to this point are the result of a multi-stage public process. Thus, the information contained in this document has been improved based on comments from the public, the fishing industry, members of the Councils, and NMFS.

This document is available in several formats, including printed publication and online through the Councils' and NMFS's web pages.

Integrity
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 NMFS 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.

## Objectivity

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 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 NEFSC. Landing and revenue information is based on information collected through the FVTR and seafood dealer purchase report databases. Information on catch composition is based on reports collected by the NMFS 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 SBRM Fishery Management Action Team. A formal peer review of the primary analytical components of the document was conducted by members of the Councils’ Science and Statistical Committees.

The analyses conducted in support of the proposed action were conducted using information from the most recent complete calendar years, through 2012 or 2013, depending on the database. Some analysis in Chapter 5 illustrates the design of the

SBRM and the process used to estimate discards. This illustrative analysis was initially conducted in 2007, and uses data from 2004. As an illustration of a process, the validity of the analysis is not dependent on using data from a specific year. Therefore, repeating this analysis with data from a different fishing year would not provide any additional insight or value, and the original analysis has been retained. The data used in the analyses provide the best available information on catch and landings by participants in Greater Atlantic Region fisheries subject to the amended FMPs, bycatch rates in these fisheries, and recent coverage rates by the fishery observer program. 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 fisheries of the Greater Atlantic Region.

The policy choices are clearly articulated, in chapter 6 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 chapters 5, 6, and 7, and Appendix A, 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 Councils, the NEFSC, the GARFO, and NMFS 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 would be conducted by staff at NMFS Headquarters, the Department of Commerce, and the U.S. Office of Management and Budget.

A draft of the 2007 SBRM Omnibus Amendment document was made available to the public for review in November and December of 2006, during which time two public hearings were held on the draft amendment. Based on the comments received during this process, several changes were made to the draft amendment that were incorporated in the final document. This SBRM Omnibus Amendment builds on the work of the 2007amendment and therefore reflects the public input on that document. A draft of this SBRM Omnibus Amendment was made available for public review and comment in November and December of 2013. There will be an additional opportunity for the public to review this document during the Magnuson-Stevens Act-mandated 60day review period for the approval of the amendment.

### 8.7 Magnuson-Stevens Act

The preferred alternatives identified in this amendment do not propose to modify any of the management measures previously implemented under any of the FMPs to be amended through this action which were found to be fully in compliance with all national standards of the Magnuson-Stevens Act. The actions currently proposed to be implemented through this amendment are wholly administrative in nature and are focused solely on the procedures and mechanisms by which data and information on the types and rates of bycatch occurring in Greater Atlantic Region fisheries are obtained and utilized by scientists and fishery managers. All the actions identified in the preferred alternatives are intended to address the requirement in § 303(a)(11) of the Magnuson-Stevens Act to "establish a standardized bycatch reporting methodology to assess the amount and type of bycatch occurring in a fishery" to ensure that all Greater Atlantic Region FMPs are fully in compliance with this required provision. This action does not address any other required provision under the Magnuson-Stevens Act, and does not directly address any of the national standards. Due to the nature of the measures in the proposed action, there would be no direct impacts on any habitat or EFH; therefore, an EFH consultation is not required.

### 8.8 Marine Mammal Protection Act (MMPA)

The impacts of the preferred alternatives on protected species are considered in chapter 7 , section 7.1, and, based on the procedural nature of the action, the Councils have concluded preliminarily that there would be no direct or indirect impacts on marine mammals, that the preferred alternatives appear consistent with the provisions of the MMPA, and that the preferred alternatives would not alter existing measures to protect the species likely to inhabit the management units of the subject fisheries.

### 8.9 National Environmental Policy Act (NEPA)

### 8.9.1 Environmental Assessment

An assessment of the expected impacts of the preferred alternatives, and other alternatives considered as part of this amendment, is presented in chapter 7. This environmental assessment was prepared according to the provisions of NOAA Administrative Order 216-6.

### 8.9.1.1 Need for the Action

The purpose and need for this action are described in section 1.4 of this document. Other sections in chapter 1 describe the specific problem to be addressed (section 1.3) and the issued to be resolved (section 1.5).

### 8.9.1.2 Management Alternatives

The alternatives to the proposed action are identified and described in chapter 6 of this document.

### 8.9.1.3 Environmental Impacts of the Proposed Action and Alternatives

A description of the affected environment (section 7.1), along with a description of the environmental impacts of the proposed action and the alternatives (sections 7.2 and 7.3) are provided in chapter 7.

### 8.9.1.4 Agencies and Persons Consulted

The development of this amendment was a joint effort between the Mid-Atlantic and New England Fishery Management Councils and NOAA's National Marine Fisheries Service. No other Federal agencies participated in the development of this action. For a list of persons that contributed to or were consulted during the development of this amendment, see chapter 10 .

### 8.9.2 Finding of No Significant Impact for the SBRM Omnibus Amendment

NOAA Administrative Order 216-6 (NAO 216-6) (May 20, 1999) contains criteria for determining the significance of the impacts of a proposed action. In addition, the Council on Environmental Quality regulations at 40 C.F.R. 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." Each criterion listed below is relevant in making a finding of no significant impact and has been considered individually, as well as in combination with the others. The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria.

### 8.9.2.1 Criteria to Determine Significance of Action

8.9.2.1.1 Can the proposed action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?

Response: The measures proposed in the SBRM Omnibus Amendment are not expected to jeopardize the sustainability of any target species that may be affected by the action. As described in chapters 1 (Introduction and Background) and 6 (Proposed Action and Other Alternatives Considered), the focus of this amendment is on the methodology by which bycatch information is obtained, analyzed, and utilized. The measures would not impose or result in any changes to fishing operations, fishing behavior, fishing gears used, or areas fished. As such, the impacts of the preferred alternatives, described and analyzed in chapter 7 (Environmental Consequences), on any species that may be affected by the measures are wholly administrative in nature; there are no expected direct or indirect physical or biological impacts associated with the preferred alternatives.
8.9.2.1.2 Can the proposed action reasonably be expected to jeopardize the sustainability of any non-target species?


#### Abstract

Response: The measures proposed in the SBRM Omnibus Amendment are not expected to jeopardize the sustainability of any non-target species that may be affected by the action. As described in chapters 1 (Introduction and Background) and 6 (Proposed Action and Other Alternatives Considered), the focus of this amendment is on the methodology by which bycatch information is obtained, analyzed, and utilized. The measures would not impose or result in any changes to fishing operations, fishing behavior, fishing gears used, or areas fished. As such, the impacts of the preferred alternatives, described and analyzed in chapter 7 (Environmental Consequences), on any species that may be affected by the measures are wholly administrative in nature; there are no expected direct or indirect physical or biological impacts associated with the preferred alternatives.


### 8.9.2.1.3 Can the proposed action 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 unique characteristics of the geographic area impacted by the SBRM Omnibus Amendment include the presence of Essential Fish Habitat (EFH) and an abundance of life forms of commercial and non-commercial value. The value of this area was described in the amendment (see section 7.1.1), and an analysis of the action on ocean and coastal habitats and EFH was conducted. The measures proposed in the SBRM Omnibus Amendment are not expected to result in any direct physical or biological impacts to the affected environment and therefore would not cause substantial damage to ocean and coastal habitats or EFH. As described in chapters 1 (Introduction and Background) and 6 (Proposed Action and Other Alternatives Considered), the focus of this amendment is on the methodology by which bycatch information is obtained, analyzed, and utilized. As such, the impacts of the preferred alternatives, described and analyzed in chapter 7 (Environmental Consequences), are entirely administrative in nature with no associated direct impacts on the environment. Because this action would not result in direct adverse impacts to ocean and coastal habitats or EFH, an EFH consultation under the Magnuson-Stevens Act would neither be required nor conducted.
8.9.2.1.4 Can the proposed action be reasonably expected to have a substantial adverse impact on public health or safety?

Response: The preferred alternatives described in chapter 6 (Proposed Action and Other Alternatives Considered) would not impose or result in any changes to fishing operations, fishing behavior, fishing gears used, or areas fished. The measures are entirely administrative in nature. Therefore, implementation of the SBRM Omnibus Amendment would not have a direct impact on the public health or safety of either people directly involved in the fishing industry or the public at large.
8.9.2.1.5 Can the proposed action reasonably be expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species?

Response: The measures proposed in the SBRM Omnibus Amendment are not expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species. As described in chapters 1 (Introduction and Background) and 6 (Proposed Action and Other Alternatives Considered), this amendment is solely concerned with establishing the methodology to be used to obtain, analyze, and report information regarding discards occurring in Greater Atlantic Region fisheries. The measures would not impose or result in any changes to fishing operations, fishing behavior, fishing gears used, or areas fished. As such, the impacts of the preferred alternatives, described and analyzed in chapter 7 (Environmental Consequences), are wholly administrative in nature; there are no expected direct or indirect adverse impacts on any endangered or threatened species, or their critical habitat, associated with the preferred alternatives.
8.9.2.1.6 Can the proposed action 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 described in chapter 6 and analyzed in chapter 7 would not impose or result in any changes in fishing operations or behavior, fishing gears used, or areas fished. The impacts of establishing the methodology to be used to obtain, analyze, and report information regarding discards occurring in Greater Atlantic Region fisheries are administrative. Because the impacts of the SBRM would be procedural, with no direct or indirect impacts to the marine environment, there are no expected impacts to biodiversity or ecosystem function in the affected area.

### 8.9.2.1.7 Are significant social or economic impacts interrelated with natural or physical environmental effects?

Response: The preferred alternatives would continue the status quo program for bycatch reporting and monitoring for Federally-managed species managed by the New England and Mid-Atlantic Fishery Management Councils. There are no economic or social impacts associated with this alternative that could be distinguished from taking no action. This is not to say that there are no costs associated with the current information collection program, but rather that for purposes of analyzing the implications of this action, there would be no incremental changes to the costs currently imposed or any social or economic impacts interrelated with any natural or physical environmental effects.

### 8.9.2.1.8 $\quad$ Are the effects on the quality of the human environment likely to be highly controversial?

Response: The impacts on the quality of the human environment of the SBRM are not expected to be highly controversial. The SBRM Omnibus Amendment endeavors to establish a rigorous methodology to ensure that the discard data obtained by NMFS is of the highest quality possible, with high levels of precision and accuracy to meet the needs of the scientists and managers that utilize the data. A group of external peer reviewers concluded that the technical components of the SBRM do "a commendable job of formulating a comprehensive approach to the problem of assessing bycatch rates in multiple fisheries." The overall consensus of the reviewers is that the document "provides a rigorous objective framework for addressing the problem of bycatch monitoring." The effects of these methodologies, including data collection, analysis and reporting to fisheries scientists and managers, on the human environment are described in chapter 7 and are found to be minimal, temporary, and/or indistinguishable from baseline conditions.
8.9.2.1.9 Can the proposed action 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: The SBRM Omnibus Amendment would not adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places, nor is it expected to cause loss or destruction to significant scientific, cultural, or historical resources, because none of these features are present in the affected area. The SBRM Omnibus Amendment is specific only to Federally-managed fisheries that operate in the Exclusive Economic Zone (EEZ), as described in chapters 1, 2, and 7, and the unique areas described herein do not occur in the action area.
8.9.2.1.10 Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

Response: Implementation of the SBRM Omnibus Amendment is not expected to result in highly uncertain effects on the human environment or involve unique or unknown risks. The preferred data collection, analytic methodologies, and reporting alternatives presented in the document (chapter 6) were developed using the best available science and are consistent with currently employed tools and practices. The analyses provided in the document clearly demonstrate that none of the elements of the SBRM would result in direct or indirect impacts to the environment (chapter 7) that are distinguishable from current (baseline) conditions. Furthermore, the SBRM Omnibus Amendment endeavors to establish a rigorous methodology to ensure that the discard data obtained by NMFS are of the highest quality possible, with high levels of precision and accuracy to meet the needs of the scientists and managers that utilize the data. A group of external peer reviewers concluded that the technical components of the SBRM do "a commendable job of formulating a comprehensive approach to the problem of assessing bycatch rates in multiple fisheries." The overall consensus of the
reviewers is that the document "provides a rigorous objective framework for addressing the problem of bycatch monitoring."

### 8.9.2.1.11 Is the proposed action related to other actions with individually

 insignificant, but cumulatively significant impacts?Response: As described in chapter 7 of the document, the actions being considered as part of the SBRM solely address the administrative processes through which data and information on bycatch occurring in Greater Atlantic Region fisheries are collected, analyzed, and reported to fishery scientists and managers. The SBRM Omnibus Amendment does not address bycatch reduction or other issues related to the management measures utilized in Greater Atlantic Region fisheries. Although elements of the SBRM have been implemented previously and utilized in many ways in recent years, the Court ruling that both Amendment 10 to the Sea Scallop FMP and Amendment 13 to the Northeast Multispecies FMP failed to fulfill the Magnuson-Stevens Act requirement to establish an SBRM (described in chapter 1) is evidence that the 2007 SBRM Omnibus Amendment was unique in the Greater Atlantic Region as the first action to propose the establishment of a comprehensive SBRM for the region. In the time since the 2007 SBRM Omnibus Amendment was vacated by the Court ruling in Oceana v. Locke, the Greater Atlantic Region has been without a formal SBRM. This SBRM Omnibus Amendment proposes to once again establish a comprehensive SBRM for the region.

Overall, the SBRM Omnibus Amendment simply formalizes the status quo mechanisms used in the Greater Atlantic Region to collect information and data on fisheries bycatch and to analyze bycatch data in order to effectively determine appropriate observer coverage levels and allocate observer effort across the many Greater Atlantic Region fisheries. For these components of the SBRM, there are no incremental impacts to any fishing areas or living marine resources associated with the proposed action relative to the no action baseline. The SBRM elements proposed in the amendment that diverge from the status quo- creation of a prioritization process that determines available funding for SBRM and adjusts coverage levels within available funding, the requirement to conduct periodic evaluations and prepare a periodic SBRM report, establishment of provisions for industry funded observer programs, and adopting provisions for modifying the SBRM through framework adjustments or annual specifications-are purely administrative features intended to improve the effectiveness and the transparency of the SBRM. These additional components are not associated with impacts to any fishing areas or living marine resources within the Greater Atlantic Region that could be distinguished from the no action baseline (chapter 7). Therefore, given the limited and procedural nature of this action and the preferred alternatives, the SBRM Omnibus Amendment is not related to any other actions with individually insignificant but cumulatively significant impacts.
8.9.2.1.12 Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the

National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?

Response: There is no evidence that the implementation of the SBRM Omnibus Amendment will adversely affect entities listed in or eligible for listing in the National Register of Historic Places or will cause loss or destruction of significant scientific, cultural, or historic resources. Compliance with the preferred measures will not result in the permanent loss or destruction of resources.

### 8.9.2.1.13 Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?

Response: The implementation of the SBRM Omnibus Amendment would not result in any actions that would be expected to result in the introduction or spread of a nonindigenous species. The measures included in the SBRM Omnibus Amendment are administrative in nature (chapter 7).

### 8.9.2.1.14 Is the proposed action likely to establish a precedent for future actions

 with significant effects or represents a decision in principle about a future consideration?Response: The implementation of the SBRM Omnibus Amendment does not establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration. The data collection, data analysis, and reporting tools being implemented are required in order for the agency to meet objectives under the Magnuson-Stevens Act and three Court Orders (described in chapter 1). The measures included in the SBRM Omnibus Amendment were designed and chosen to achieve specific objectives given local conditions and issues, and are therefore not expected to establish a precedent for future actions. In the future, NMFS would similarly evaluate bycatch related data reporting, collection and analysis needs in order to respond to specific issues, such as changes to environmental, regulatory, economic, and/or fishing industry conditions. Therefore, SBRM requirements for each FMP and/or administrative region would be evaluated separately based upon its own unique factual situation. Furthermore, while data collected under the SBRM may influence fisheries management decisions throughout the region for years to come, each of those future management decisions would be the subject of its own environmental review under NEPA. As such, this action would not establish a precedent for any forthcoming decision or analysis.
8.9.2.1.15 Can the proposed action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?

Response: There is no evidence that implementation of the SBRM Omnibus Amendment would result in a violation of a Federal, state, or local law for environmental protection. In fact, the SBRM Omnibus Amendment is expected
to support Federal laws because it was developed to address the requirements of the Magnuson-Stevens Act to include, in all FMPs, an SBRM (chapter 1). Furthermore, and analysis of the relationship of the SBRM with applicable Federal laws and Executive Orders was conducted (chapter 8) and it was determined that the measures included in the SBRM Omnibus Amendment are consistent with all applicable Federal laws and Executive Orders.

### 8.9.2.1.16 Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

Response: In part, the SBRM Omnibus Amendment simply formalizes the status quo mechanisms used in the Greater Atlantic Region to collect information and data on fisheries bycatch and to analyze bycatch data in order to effectively determine appropriate observer coverage levels and allocate observer effort across the many Greater Atlantic Region fisheries (chapter 6). For these components of the SBRM, there are no incremental impacts to any fishing areas or living marine resources associated with the proposed action relative to the no action baseline. The SBRM elements proposed in the amendment that diverge from the status quo- creation of a prioritization process that determines available funding for SBRM and adjusts coverage levels within available funding, the requirement to conduct periodic evaluations and prepare a periodic SBRM report, establishment of provisions for industry funded observer programs, and adopting provisions for modifying the SBRM through framework adjustments or annual specificationsare purely administrative features intended to improve the effectiveness and the transparency of the SBRM. These additional components are not associated with impacts to any target or non-target species within the Greater Atlantic Region that could be distinguished from the no action baseline (chapter 7). Therefore, given the limited and administrative nature of this action and the preferred alternatives, the SBRM Omnibus Amendment may not reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species.

### 8.9.2.2 Determination

In view of the information presented in this document and the analysis contained in the supporting Environmental Assessment prepared for the SBRM Omnibus Amendment, it is hereby determined that the SBRM Omnibus Amendment 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 necessary.


### 8.10 Paperwork Reduction Act (PRA)

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 preferred alternatives currently associated with this action do not propose to modify any existing collections, or to add any new collections; therefore, no review under the PRA is necessary.

### 8.11 Regulatory Flexibility Act (RFA)

The objective of the RFA is to require consideration of the capacity of those affected by regulations to bear the direct and indirect costs of regulation. If an action would have a significant impact on a substantial number of small entities, an Initial Regulatory Flexibility Analysis must be prepared to identify the need for action, alternatives, potential costs and benefits of the action, the distribution of these impacts, and a determination of net benefits. The RFA requires the Federal rulemaker to examine the impacts of proposed and existing rules on small businesses, small organizations, and small Governmental jurisdictions.

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 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 populations of fewer than 50,000 .

If an action is determined to affect a substantial number of small entities, the analysis must include:

1. A description and estimate of the number of small entities and total number of entities in a particular affected sector, and the total number of small entities affected; and
2. Analysis of the economic impact on small entities, including the direct and indirect compliance costs of completing paperwork or recordkeeping requirements, effect on the competitive position of small entities, effect on the small entity's cash flow and liquidity, and ability of small entities to remain in the market.

If it is clear that an action would not have a significant economic impact on a substantial number of small entities, the RFA allows Federal agencies to certify the proposed action to that effect to the SBA. The decision on whether or not to certify is generally made after the final decision on the preferred alternatives for the action and may be documented at either the proposed rule or the final rule stage.

Based on the information and analyses provided in earlier sections of this amendment, it is clear that this action would not have a significant economic impact on a substantial number of small entities, and that certification under the RFA is warranted. The remainder of this section establishes the factual basis for this determination, as recommended by the Office of Advocacy at the SBA.

### 8.11.1 Basis and Purpose of the Action

The legal basis for this amendment can be found in section 303(a)(11) of the Magnuson-Stevens Act, which requires that each FMP "establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery." This is described further in section 1.2. The action is needed to ensure that all FMPs of the Greater Atlantic Region, developed under the jurisdiction of the New England and MidAtlantic Councils, comply with the SBRM requirements of the Magnuson-Stevens Act. The purpose of the action is to: (1) Explain the methods and processes by which bycatch is currently monitored and assessed for Greater Atlantic Region fisheries; (2) determine whether these methods and processes need to be modified and/or supplemented; (3) establish standards of precision for bycatch estimation for all Greater Atlantic Region fisheries; and, thereby, (4) document the SBRMs established for all fisheries managed through the FMPs of the Greater Atlantic Region. The purpose, need, and objectives of the SBRM Omnibus Amendment are described further in section 1.4.

### 8.11.2 Description and Estimate of the Number of Small Entities to Which the Action Applies

The implementation of this action will formally establish, as the SBRM, the methods and procedures by which data and information on discards occurring in Greater Atlantic Region fisheries are obtained, processed, and utilized. Because the primary mechanisms used to collect data and information on discards are the at-sea observers and the FVTRs, the small entities to which the SBRM applies include all federally permitted fishing vessels operating in the Greater Atlantic Region subject to one or more of the
affected FMPs (see Table 1). Table 73 identifies the number of fishing vessels holding each category of Federal commercial fishing permit in the Greater Atlantic Region. Because of the transitory nature of open access permits, and due to the overlap associated with vessels holding multiple permits, it is difficult to determine the exact number of affected entities. As described in section 7.1, there are approximately 2,100 fishing vessels that hold at least one limited access permit (excluding the permits for American lobster, which are not subject to this amendment), and approximately 1,900 fishing vessels that hold at least one open access permit but no limited access permits. This indicates an approximate total of 4,000 fishing vessels subject to the provisions of the FMPs addressed by this amendment and, therefore, subject to the provisions of the SBRM.

Some of the vessels with Federal fishing permits may be considered to be part of the same firm, because they may have the same owners. Firms are classified as finfish, shellfish, or for-hire based on the activity from which they derive the most revenue. Permitted vessels were grouped together according to common owners. The resulting groupings were then treated as fishing businesses for purposes of identifying small and large firms. Based on these criteria there are 948 finfish firms, 2741 shellfish firms, and 454 for-hire firms in the Greater Atlantic Region. Of those firms, 20 shellfish firms are considered large entities. All other firms meet the criteria for small entities.

### 8.11.3 Economic Impacts on Small Entities

The economic impacts associated with each alternative considered in the development of this amendment are evaluated throughout section 7.2. For the purposes of the RFA certification review, the following addresses the economic impacts associated with each element of the proposed action.

### 8.11.3.1 Bycatch Reporting and Monitoring Mechanisms

This element of the proposed action focuses on the specific mechanisms by which data and information on discards are obtained. The proposed action is to maintain the status quo for all fisheries subject to the SBRM Omnibus Amendment, including FVTRs, at-sea observers, MRIP, VMS, and industry-based surveys, among others. Because the proposed action is to maintain the status quo, with no change, there are no marginal changes to the economic impacts on small entities associated with this element. A nonpreferred alternative to implement electronic video monitoring in one or more fisheries would have resulted in potentially significant economic costs to the participants of the affected fisheries; however, this alternative was not selected (see section 7.2.1.3.2).

### 8.11.3.2 Analytical Techniques and Allocation of Observers

This element of the proposed action establishes the procedures used to analyze data on discards occurring in Greater Atlantic Region fisheries and to determine the appropriate allocation of at-sea observers on fishing vessels in order to obtain sufficiently accurate and precise discard data. The proposed action is to expand upon and refine the current methodology to encompass 56 distinct fishing modes across 15 species and
species groups. While this element of the proposed action has implications for the quality of the discard data obtained for all Greater Atlantic Region fisheries, this action is wholly centered on the analytical tools and methodologies used to determine appropriate levels and allocations of at-sea observers. There are no direct or indirect costs to fishing vessel permit holders associated with this element.

The only way for this element of the proposed action to have an economic impact on fishing vessel permit holders is if the participants of the fishery pay for the at-sea observers. In this case, an observer allocation methodology that resulted in increased levels of observer coverage could be said to impose additional costs to those participants. However, in the Greater Atlantic Region, the at-sea fisheries observer program operates entirely through a contract service funded by NMFS, with the single exception of the sea scallop industry-funded observer program. As described in section 7.2.2.3, the Sea Scallop FMP includes provisions to compensate scallop vessels required to carry and pay for an observer through either an increased trip limit, extra trips to an access area, or extra DAS. The intent of the compensation program is to offset the costs of carrying an observer such that the realized cost to the vessel is zero. Thus, within the bounds of the compensation program, an increase in the observer coverage level would not have an economic impact on the affected entities, as any increase in initial costs (paying for the observer) would be offset by the compensation.

This amendment proposes no additional industry-funded observer programs, although it does create a framework adjustment process should either Council wish to establish one in the future. However, any economic impacts associated with such a program would be identified and analyzed in the future management action that establishes the program.

### 8.11.3.3 SBRM Performance Standard

This element of the proposed action establishes that the intent of the previous element is to allocate an appropriate level of at-sea observers to each of the 56 subject fishing modes such that the data on discards occurring in each fishing mode achieve a CV of no more than 30 percent for each relevant bycatch species or species group. Under the proposed action, a CV of 30 percent becomes the performance standard against which the effectiveness of the SBRM may be judged. It also serves as the basis for determining the appropriate levels and allocation of at-sea observers across all 56 fishing modes.

Similar to the previous element, while this element of the proposed action has implications for the quality of the discard data obtained for all Greater Atlantic Region fisheries, this action is solely concerned with the performance standard used as the basis to determine appropriate levels and allocations of at-sea observers. There are no direct or indirect costs to fishing vessel permit holders associated with this element.

The only way that this element could be associated with costs to fishing vessels would be through the level of the CV selected as the performance standard. That is, a CV higher than 30 percent (e.g., 40 percent) would likely require lower levels of observer coverage in some fisheries to meet the performance standard, while a lower CV (e.g., 20
percent) may require higher levels of coverage in some fisheries. However, as noted for the previous element, all at-sea observers are paid for by NMFS with the exception of the sea scallop fishery. Thus, with the exception of the sea scallop fishery, which has an established compensation program to offset the costs of observers to vessels, all the costs of increased levels of observer coverage are borne by NMFS, not by the fishery participants.

### 8.11.3.4 $\underline{\text { SBRM Review/Reporting Process }}$

This element of the proposed action establishes a formal review and reporting process for the SBRM. There are two components to this element of the amendment: The first would establish an annual report, to be prepared by the NEFSC, for the Councils that presents information on discards occurring in the managed fisheries, as documented by at-sea fisheries observers; and the second would establish a more comprehensive periodic report that presents information on and evaluates the effectiveness of the SBRM at achieving the performance standard (see section 6.4 for more detail on what would be included in these reports).

Although this element is considered a critical component of the SBRM, the impacts associated with this action are incurred solely by NMFS and the Councils, who must prepare the reports. The action proposed for this element has no potential direct or indirect economic impact on regulated entities.

### 8.11.3.5 Framework Adjustment Provisions

This element of the proposed action provides the Councils with a mechanism to more efficiently modify certain aspects of the SBRM as conditions in the fisheries or management needs evolve. Framework adjustments and annual specifications enable the Councils to develop fishery management actions through a process that is more timely and streamlined than the process to develop and submit a full FMP amendment. The impacts associated with this action are incurred solely by NMFS and the Councils, who must prepare, review, and implement the fishery management actions developed under the abbreviated procedures. The action proposed for this element has no potential direct or indirect economic impact on regulated entities.

### 8.11.3.6 Prioritization Process

This element of the proposed action establishes the steps to be followed by NMFS to redistribute at-sea observer coverage levels and allocations determined through the analytical components of the SBRM in response to a funding limitation. The preferred alternatives would establish a formulaic process for determining whether there is a funding shortfall, and then, if necessary, adjust at-sea observer coverage levels within available funding. The impacts associated with this action are incurred solely by NMFS, who must determine funding available for SBRM, and then implement the formulaic process for prioritizing observer days if necessary. . The action proposed for this element has no potential direct or indirect economic impact on regulated entities.

### 8.11.3.7 Industry-Funded Observer Programs

This element of the proposed action establishes and authorizes observer service provider approval and certification procedures and requirements, and adds provisions allowing industry-funded observer programs and observer set-aside programs as measures that can be implemented through framework adjustments. The proposed action would not actually implement any industry-funded observer programs or observer setaside programs, but would create the mechanisms needed to more quickly and easily develop and implement such provisions in any of the Councils' FMPs. Although there may be economic impacts to fishing vessel permit holders associated with any future industry-funded observer programs, any such impacts that may be associated with actually implementing an industry-funded observer program and/or an observer set-aside program through a framework adjustment to an FMP would be fully analyzed in the documents supporting the action.

### 8.11.4 Criteria Used to Evaluate the Action

### 8.11.4.1 Significant Economic Impacts

The RFA requires Federal agencies to consider two criteria to determine the significance of regulatory impacts: Disproportionality and profitability. If either criterion is met for a substantial number of small entities, then the action should not be certified.

### 8.11.4.1.1 Disproportionality

As noted above, none of the elements of this proposed action are associated with economic impacts on small entities. Therefore, no small entities are disproportionately affected (put at a disadvantage) relative to large entities, and the disproportionality criterion is not met.

### 8.11.4.1.2 Profitability

As noted above, none of the elements of this proposed action are associated with economic impacts on small entities. Therefore, no reductions in profit are expected for any small entities, and the profitability criterion is not met.

### 8.11.4.2 Substantial Number of Small Entities

Indirectly, the methodologies established by this action apply generally across all federally managed fisheries operating in the Greater Atlantic Region under the subject FMPs. However, although a substantial number of entities are involved in these fisheries, none of these entities are expected to incur any economic impacts as a result of this action.

### 8.11.5 Description of, and Explanation of, the Basis for All Assumptions Used

Because the actions proposed in this amendment all are focused on the administrative aspects of the methodology used to obtain and analyze data and information on discards occurring in Greater Atlantic Region fisheries, there are no direct or indirect economic impacts associated with this amendment. No assumptions are necessary to conduct the analyses in support of this conclusion.

## List of Public Meetings

List of public meetings at which the development of the 2007 SBRM Omnibus Amendment or this SBRM Omnibus Amendment were discussed:

## Joint SBRM Oversight Committee Meetings

1. April 3, 2006 - Mystic, CT
2. May 2, 2006 - Virginia Beach, VA
3. June 12, 2006 - Newport, RI
4. September 6, 2006 - Warwick, RI
5. September 25, 2006 - Peabody, MA
6. April 9, 2007 - Mystic, CT

Science and Statistical Committee Meeting

1. August 22, 2006 - Warwick, RI

## Mid-Atlantic Fishery Management Council Meetings

1. January 17, 2006 - Annapolis, MD
2. May 4, 2006 - Virginia Beach, VA
3. August 3, 2006 - Philadelphia, PA
4. October 12, 2006 - Kitty Hawk, NC
5. February 15, 2007 - Claymont, DE
6. June 14, 2007 - Hampton, VA
7. April 11, 2012 - Duck, NC
8. June 14, 2012 - New York, NY
9. October 17, 2012 - Long Branch, NJ
10. April 10, 2013 - Raleigh, NC
11. June 13, 2013 - Eatontown, NJ
12. April 10, 2014 - Montauk, NY

New England Fishery Management Council Meetings

1. January 31, 2006 - Portland, ME
2. April 4, 2006 - Mystic, CT
3. June 13, 2006 - Newport, RI
4. September 27, 2006 - Peabody, MA
5. February 7, 2007 - Portsmouth, NH
6. April 10, 2007 - Mystic, CT
7. June 21, 2007 - Portland, ME
8. April 24, 2012 - Mystic, CT
9. June 19, 2012 - Portland, ME
10. September 27, 2012 - Plymouth, MA
11. April 25, 2013 - Mystic, CT
12. June 20, 2013 - Portland, ME
13. April 23, 2014 - Mystic, CT

New England Fishery Management Council Ad-Hoc SBRM Committee Meeting

1. January 16, 2014 - Portsmouth, NH

Public Hearings on the Draft 2007 Amendment

1. November 14, 2006 - Gloucester, MA
2. December 13, 2006 - New York, NY

Public Comment Periods on the Draft Amendment Document

1. September 27 - October 27, 2013
2. November 19 - December 19, 2013

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## Glossary of Terms

Accuracy. The closeness of a measured or estimated value (e.g., population parameter) to its true value. Accuracy should not be confused with precision, which relates to the variability of the measured or estimated value (i.e., the closeness of repeated measurements of the same quantity).

Allocation. The practice of apportioning resources among various entities. Under the SBRM, allocation often regards the assignment of observer effort across the various sampling strata; i.e., geographical region (by port of departure), fishing modes (gear type and mesh size), access area, and trip category.

Bias. A systematic difference between the expected value of a statistical estimate and the quantity it estimates. Absent bias, precision will lead to accuracy; thus, bias and accuracy are used interchangeably, but bias is generally associated with the design of sampling program. Eliminating potential sources of bias improves the accuracy of the results.

Biomass (B). (1) The total weight of a group (or stock) of living organisms (e.g., fish, plankton) or of some defined fraction of it (e.g., spawners) in an area, at a particular time. (2) Measure of the quantity, usually by weight in pounds or metric tons $(2,205 \mathrm{lb}$ or 1 metric ton), of a stock at a given time.

Bycatch. According to the Magnuson-Stevens Act, bycatch includes all fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards. Fish released alive under a recreational catch and release fishery management program are not considered bycatch. The words bycatch and discard are used interchangeably in SBRM documents.

Catch. (1) To undertake any activity that results in taking fish out of its environment dead or alive. To bring fish on board a vessel dead or alive. (2) The total number (or weight) of fish caught by fishing operations, including retained catch (landings) and discarded catch (bycatch). (3) The component of fish encountering fishing gear that is retained by the gear.

Coefficient of variation (CV). A standard measure of precision, calculated as the ratio of the square root of the variance of the bycatch estimate (i.e., the standard error) to the bycatch estimate itself. The higher the CV, the larger the standard error is relative to the estimate. A lower CV reflects a smaller standard error relative to the estimate. A 0percent CV means there is no variance in the sampling distribution. Alternatively, CVs of 100 percent or higher indicate that there is considerable variance in the estimate.

Discard. To release or return fish to the sea, dead or alive, whether or not such fish are brought fully on board a fishing vessel. Fish (or parts of fish) can be discarded for a variety of reasons such as having physical damage, being a non-target species for the trip, and compliance with management regulations such as minimum size limits or quotas.

The terms discard and bycatch are used interchangeably in SBRM documents.
Effort. The amount of time and fishing power used to harvest fish; includes gear size, boat size, and horsepower.

Environmental assessment (EA). As part of the National Environmental Policy Act (NEPA) process, an EA is a concise public document that provides evidence and analysis for determining whether to prepare an environmental impact statement (EIS) or a finding of no significant impact (FONSI).

Finding of no significant impact (FONSI). As part of the National Environment Policy Act (NEPA) process, a FONSI is a document that explains why an action that is not otherwise excluded from the NEPA process, and for which an environmental impact statement (EIS) will not be prepared, will not have a significant effect on the human environment.

Fish. Means finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds.

Fishing mode. A way of grouping fishing activities according to the fishing gears used, port of departure, mesh size, and, in some cases, regulatory fishing program, rather than by FMP or species of fish landed. There are 56 fishing modes defined in the Greater Atlantic Region for the purpose of the SBRM Omnibus Amendment.

Fishing vessel trip report (FVTR) or Logbook. A detailed, usually official, record of a vessel's fishing activity registered systematically onboard the fishing vessel, usually including information on catch and its species composition, the corresponding fishing effort, and location. Some form of trip report must be completed and submitted by every holder of a Federal fishing permit in the Greater Atlantic Region, except those who hold a Federal permit only for lobster.

Marine Recreational Fisheries Statistical Survey (MRFSS). An annual national survey conducted by NMFS, in cooperation with the coastal states, to estimate the number, catch, and effort of recreational fishermen. MRFSS was phased out and replaced by MRIP in 2011.

Marine Recreational Information Program (MRIP). An annual national survey conducted by NMFS, in cooperation with the coastal states, along with the supporting statistical methods, that are used to estimate the number, catch, and effort of recreational fishermen.

National Standard 9. A provision in the Magnuson-Stevens Act that requires that "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." NMFS has defined the term "to the extent practicable" to include a consideration of the effects of reducing bycatch and bycatch mortality on the overall benefit to the Nation.

Observer. At-sea fishery observers are generally biologists trained to collect information on board fishing vessels. They may be deployed for various reasons including monitoring interactions with protected species, measuring catch composition and disposition (including discards), validating or adjusting self-reported data, tracking inseason quotas (including bycatch quotas), or a variety of other reasons. The regional observer program is administered by the Northeast Fisheries Science Center.

Precision. The degree of agreement of repeated measurements of the same quantity or object.

Sampling design. The sampling design of a scientific survey refers to the statistical techniques and methods adopted for selecting a sample and obtaining estimates of the survey variables from the selected sample.

Standardized bycatch reporting methodology (SBRM). The combination of sampling design, data collection procedures, and analyses used to estimate bycatch in fisheries. An SBRM is required to be implemented for each fishery under section 303(a)(11) of the Magnuson-Stevens Act.

Stock assessment. The process of collecting and analyzing biological and statistical information to determine the changes in the abundance of fishery stocks in response to fishing, and, to the extent possible, to predict future trends of stock abundance. Stock assessments are based on resource surveys; knowledge of the habitat requirements, life history, and behavior of the species; the use of environmental indices to determine impacts on stocks; and catch statistics. Stock assessments are used as a basis to assess and specify the present and probable future condition of a fishery.

Stock Assessment and Fishery Evaluation (SAFE) report. A report that provides a summary of the most recent biological condition of a stock of fish and the economic and social condition of the recreational fishermen, commercial fishermen, and seafood processors who use the fish. The report provides information to the fishery management councils for determining harvest levels.

Total allowable catch (TAC). The annual recommended or specified regulated catch for a species or species group. The regional fishery management council sets the TAC from the range of acceptable biological catch (ABC).

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## APPENDI CES

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## Appendix A

NEFSC Bycatch Estimation Methodology: Allocation, Precision, and Accuracy

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# NEFSC Bycatch Estimation Methodology: Allocation, Precision, and Accuracy 

by

Paul J. Rago, Susan E. Wigley, and Michael J. Fogarty

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# NEFSC Bycatch Estimation Methodology: Allocation, Precision, and Accuracy 

by

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U.S. DEPARTMENT OF COMMERCE

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National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

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This document's publication history is as follows: manuscript submitted for review -- July 28, 2005; manuscript accepted through technical review -- July 28, 2005; manuscript accepted through policy review -- August 2, 2005; and final copy submitted for publication -- August 11, 2005. This document may be cited as:

Rago, P.J.; Wigley, S.E.; Fogarty, M.J. 2005. NEFSC bycatch estimation methodology: allocation, precision, and accuracy. U.S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 05-09; 44 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.

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## Executive Summary

This report describes the standardized methodology used to estimate bycatch rates of finfish by commercial fisheries in the Northeast. In this report, bycatch is defined as the observed discarded catch, summed over from eleven different groundfish species. Estimates of unobserved discards are not considered. All retained catches are included whether or not the catches were incidental to the target species. Emphasis is placed on the methods used to define the sampling frame (i.e., the population of commercial fishing trips to be sampled), appropriate stratification, and efficient allocation of sampling effort to these strata. Efficient allocation of sampling effort within a stratified survey design improves the precision of the estimate of overall discard rates. Accuracy of sample estimates is evaluated by comparing various performance measures (e.g., landings, trip duration) between vessels with and without observers present. Although formal statistical distinctions between accuracy and bias of estimators and estimates can be made, in this report we use the terms interchangeably and less formally. A biased estimator is inaccurate; an accurate estimator is unbiased.

This report focuses on bycatch estimates based on discard to kept ratios. Use of this ratio is appropriate for trawl, gillnet and longline fisheries in the Northeast US. A formal assessment of bycatch estimates based on the ratio of discards to fishing effort is not considered in this report. Estimators based on ratios of total discard to fishing effort are more appropriate for fisheries that do not target groundfish, such as the sea scallop and herring fisheries. Evaluations of groundfish bycatch in these fisheries are being conducted by technical committees for their respective fishery management plans.

The Northeast Fisheries Science Center allocates observer sea days to monitor bycatch in commercial fisheries along the Northeast coast. These fisheries are diverse and therefore it is necessary to stratify commercial trips into fleet sectors (strata) with similar characteristics. Data from Northeast Fisheries Observer Program and the Fishing Vessel Trip Report are used together to define the size of the sample and the size of the strata, respectively. We define a total of 227 fisheries for 2005 observer coverage, consisting of three major gear types, four mesh sizes, two levels of trip durations, six port areas, and four seasonal quarters. The total fishing effort for April 2003 to March 2004 in the defined strata comprises 43,703 trips. Our examination of efficacy of observer coverage included results from 1,103 trips and 2,704 sea days. Every effort has been made to make the sampling program synoptic (i.e., cover all the major fisheries that discard commercially important species) and robust to sources of uncertainty. In particular, we utilize discard information at the trip level as opposed to the tow level. Sampling selection relies on observable properties of the strata, rather than desired outcomes (e.g., a targeted "cod" trip). Trips within strata are also assigned a probability of obtaining useful information relative to the species group of interest. The "usefulness" of a trip is conditional on the likelihood that a trip will catch one or more of the species within a predefined group of species.

Our analysis of sea-day allocations and use of optimization methods to improve allocations rest on two primary assumptions. First, the extant data are sufficient to obtain consistent estimates of the underlying variance of the discard ratio per stratum. Consistency is ensured if the samples are representative. Second, the relative size of the strata, i.e., the total number of trips, remains
constant from year to year. This is a more tenuous assumption, as the balance of fishing effort can change in response to changes in resource abundance or regulations. Both of these assumptions are inherent in the use of retrospective data to improve a future sampling program.

The observer sea-day allocation model developed here represents an extension of Neyman optimal allocation (Cochran 1977). Observer trips are allocated to strata as a function of their contribution to the total variance, the expected number of observer days per trip, and the probability that a trip will provide information on one or more of the species groups of interest. The essential features of the sampling design and allocation process are summarized below.

- Strata are defined on the basis of observable properties of the fleet sector
- The sample unit within a stratum is a trip
- The primary response variables are total discards and kept weights of groups of species. Eleven groundfish species constitute one group, monkfish another group, and summer flounder-scup-sea bass, a third group
- The probability of obtaining information on one or more of the species groups from a future trip in a stratum is estimated from analysis of observer data
- An estimate of the probability of not obtaining any information about one of the three species groups is incorporated to allow appropriate increases in sample sizes commensurate with this risk
- Expected average trip durations are defined for each stratum
- Total observer days at sea serve as a constraint on the allocation process
- Additional constraints can be imposed on the minimum and maximum numbers of samples per stratum
- Unsampled strata use imputed (or borrowed) values from adjacent strata to ensure that some information is used for sample selection
- Imputation also identifies gaps in coverage and allows for updates of the population frame as new data are acquired
- Discard ratios and standard errors incorporate the approximate covariance of the ratio
- The precision of the overall discard/kept ratio is the primary performance measure in the allocation process.
- Total variance can be minimized subject to a total observer day constraint, or the number of observer days can be minimized subject to a desired level of precision

Results from the optimization model are used as a tool to improve observer coverage. Some post-processing of the optimized sea days is needed to fine-tune coverage across fleet sectors. Where feasible, the fine-tuning of sea-day allocation capitalizes on the multi-purpose attributes of observer coverage oriented toward assessment of non-finfish species (e.g., acquire data in the sea scallop fishery from trips designed to evaluate turtle bycatch rates.)

Presently the model is based on aggregate Discard/Kept (D/K) ratios. These ratios are relevant to most fisheries but, of course, the Discard/Effort (D/E) ratio is important in others. D/E ratio data have been prepared but not yet implemented in the model. D/E ratios are relevant for fisheries such as sea scallops, northern shrimp, and herring. It should be noted that one of the primary difficulties of implementing the $\mathrm{D} / \mathrm{E}$ methodology is the selection of an appropriate unit of effort.

The "trip" level of effort may be the most useful but additional work will be necessary before extending the methodology to optimally allocate observer coverage to these fisheries.

The optimization methodology addresses the precision of the overall $\mathrm{D} / \mathrm{K}$ ratio in the context of multiple objectives and limited resources. The issue of accuracy/bias is addressed by comparing various properties of vessels with and without observers onboard. Bias -- the systematic difference between the estimated and true value -- is addressed by first ensuring that the vessel trips are representative, and that a variety of quality assurance/control procedures are employed to accurately monitor vessel performance. Refusals to take an observer and other forms of nonresponse by industry are possible sources of bias. These sources are addressed via increased use of Enforcement personnel. For these concerns, the NEFSC observer program is consistent with the recommendations of the NMFS National Working Group on Bycatch (NMFS 2004).

Babcock et al. (2003) assert that increases in sampling effort are sufficient to reduce bias. If the presence of observers onboard alters the vessels fishing patterns, then it can be argued that all observed trips yield potentially biased results. If the unobserved vessel fishes with different methods in different areas and so forth, then the increases in sample size can only reduce but not eliminate the scope for bias. A variety of statistical techniques for inferring bias can be applied, but a review of the literature suggests that these techniques have been only moderately successful. Independent measures of vessel behavior may be possible from Vessel Monitoring System data, but such analyses can only detect gross changes from observed trips. Where possible, verification by independent data sources is encouraged, but one should be careful to avoid the problems of incorrectly assuming that a particular methodology is completely unbiased.

Several tests were conducted to address the potential sources of bias by comparing measures of performance for vessels with and without observers present. Bias can arise if the vessels with observers on board consistently catch more or less than other vessels, if the average trip durations change, or if vessels fish in different areas. Each of these hypotheses was tested by comparing observable properties in strata having vessels with and without observers. Average catches (pounds landed) for observed and total trips compare favorably, following an expected linear relationship. The expected difference of the stratum specific means and standard deviations for both kept weight of groundfish and total trip duration was near zero. The frequency distribution of these differences provided no evidence of systematic bias. The mean difference between average catch rates of 238 pounds was not significantly different from zero ( $\mathrm{p}=0.59, \mathrm{df}=84$ ). A paired t -test of the stratum specific standard deviations of pounds kept suggested no significant difference from zero ( $\mathrm{p}=0.08$ ). A similar analysis of average trip duration revealed a strong correlation between observed and unobserved trips (Figure 7) and a suggestion that the observed trips were about a half-day longer when the observer was on board ( $p=0.01$ ). A paired t-test of the difference in stratum specific standard deviations of trip length was not significantly different from zero $(p=0.60)$ (Figure 8B). Some skewing of the differences in mean trip durations was observed, with observed trips being slightly longer.

Two measures of spatial coherence suggest that the spatial distribution of fishing effort for trips having observers closely matches the spatial distribution of all trips. The null hypothesis of
observer proportions equal to the VTR proportions was rejected ( $\mathrm{P}<0.05$ ) in 20 of 65 comparisons. Of these 20 cases, 10 involved ports in Southern New England and the MidAtlantic region where landings of New England groundfish are expected to be low. Of the remaining ten cases, five involved the large and extra-large gill net fisheries that mainly target monkfish. Thus, the null hypothesis of equivalent spatial distribution of sampling was rejected in only 5 of 50 fleet sectors, a rejection rate only slightly higher than due to chance alone.

A paper by Murawski et al. (2005 in press) presents information on the spatial distribution of otter trawl fishing effort for vessels with Vessel Monitoring Systems (VMS) with the distribution of tows on observed trips. Qualitatively, the spatial distributions match very well with high concentrations of effort near the boundaries of the existing closed areas on Georges Bank and within the Gulf of Maine. Moreover, the effort concentration profiles deduced from VMS data coincided almost exactly with the profiles derived from observed trips. Overall, these comparisons suggest strong coherency between the two independent measures of fishing locations.

An assessment of the sources of uncertainty in the design and data collected in the Northeast Fisheries Observer program indicates that the level of precision in the discard ratios ( $\mathrm{d} / \mathrm{k}$ ) for the New England Groundfish fisheries as a whole is high and there is little evidence of bias. However, at finer temporal and spatial scales, precision of the discard ratios will generally be lower than the aggregate. Precision of the discards estimates will also be lower for individual species, age groups and size classes.

## Introduction

Estimation of bycatch in any commercial fishery is a difficult task. At the level of an individual trip, bycatch occurs sporadically over wide geographical ranges. Proper quantification typically requires presence of trained observers. The commercial marine fisheries of the Northeastern US comprise many vessels of widely different sizes, targeting multiple species in a variety of habitats. Overlaying the complexity of the fleet and target species is a complex regulatory environment that constrains fleet behaviors. Since many stocks are in rebuilding phases, the effects of restrictions on landings per trip, and therefore revenue per trip, are difficult to predict. The Northeast Fisheries Observer Program (NEFOP) addresses this complexity by first ensuring that the data obtained from any trip are of the highest quality. This is achieved through a rigorous training program, standardized on-board data collection protocols, and thorough auditing of data. To allow for extrapolation from the sample data to the fleet as a whole, these procedures must be embedded in a statistical sampling design. This report provides a summary of the issues relevant to the design and analysis of the observer sampling program particularly with respect to the allocation of observer days to achieve desired levels of precision.

The NEFOP program incorporates the following important features:

1. Definition of a sampling frame across all relevant fisheries
2. Identification of strata based on observable properties
3. Development of rules for imputing variance estimates in unsampled strata (i.e., "borrowing" estimates from appropriate strata)
4. Use of a trip as the sample unit (rather than individual tow)
5. Definition of discards by species groups, corresponding to the major finfish species within the Northeast US.
6. Use of discard to kept ratios ( $\mathrm{d} / \mathrm{k}$ ) for species groups as the primary response variable.
7. Estimation of approximate variances for $\mathrm{d} / \mathrm{k}$ for groups of species, rather than individual species
8. Allocation of sampling effort based on reduction in total variance of the $\mathrm{d} / \mathrm{k}$ estimate, subject to total cost constraints.
9. Allowance for observer coverage in remaining fisheries not included in the sampling frame, owing to other priorities (e.g., protected species concerns).
10. Where feasible, capitalize on the multi-purpose attributes of observer coverage oriented toward assessment of non-finfish species (e.g., acquire data in sea scallop fishery from trips designed to evaluate turtle bycatch rates.)

In this report we describe the foundations of our standardized approach for bycatch reporting methodologies and the primary sources of uncertainty.

## Background

The Northeast Fisheries Science Center (NEFSC) routinely allocates observer coverage to monitor bycatch (fish, invertebrates, and protected species) in the commercial fisheries in the Mid-Atlantic and New England regions. The observer coverage is administered in units of 'sea
days'. Based on the daily cost of an observer at sea, the available funds determine the number of potential sea days. However, for the New England groundfish fishery, the number of sea days is presently mandated to be $5 \%$ coverage of the fishery. The projected fishing activity (in days) for the year is estimated by the available days-at-sea allowed under the Northeast Multispecies Fishery Management Plan. Thus, in a given year, the NEFSC has a mixture of mandated sea days and non-mandated sea days to monitor bycatch in the Northeast region (North Carolina to Maine) for various fisheries.

Allocation of sea days is guided by an optimization algorithm that is based on generalization of the well-known Neyman allocation principle in survey sampling. Precision of the overall estimate of the discard ratio is improved by allocating samples to strata with the greatest contribution to the total variance, subject to an overall constraint on available resources. In this application, "resources" refers to the total number of observer days available. Improvement of the allocation process requires an evaluation of the current sampling design and precision of estimators. The ability to improve the design is contingent on the reliability of the stratumspecific variances and the persistence of these estimates in the future (or at least the next sampling period).

The optimization algorithm can be used to (1) minimize the variance of the discard estimate subject to a given number of sea days, or (2) minimize the number of sea days subject to a desired level of precision. Results from the optimization model are used as a tool to improve the coverage. However, the model does not incorporate information regarding sampling for protected species, nor does it include information for fisheries where the discard ratio may be more appropriately measured by a discard to effort ratio (d/e). Thus the model predictions are conditioned to exploit the multipurpose utility of the protected species sampling, and coverage in important fisheries (like sea scallops) is ensured by reserving some additional days to "level out" sampling that may be required for either protected species or closed area trips.

This report will describe: 1) the fishery identification and data sources used; 2) imputation rules for unobserved fisheries; 3) sampling theory and optimization methods; 4) application of the model to observer coverage; and 5) address accuracy issues discussed by Babcock et al. (2003)

## Definition of Strata -- Fishery Identification

Diverse commercial fisheries are prosecuted off the Northeastern coast of the USA. These fisheries vary in size (number of trips) and have varying bycatch rates. To monitor these fisheries with at-sea observers, it is necessary to stratify the trips into fleet sectors with similar characteristics. For this report, fleet sectors are defined as strata within a survey design.

Commercial fishing trips are partitioned into fleet sectors using five classification variables: calendar quarter, gear type, mesh size, geographical region, and trip length. These classification variables are selected because they are generally known before a trip occurs. Using these criteria it is possible to generate a list of candidate vessels for each stratum, which simultaneously enables a random selection process and reduces the number of repeat trips on vessels. This is a
critical aspect for both strata definition and sample selection. One cannot base a sampling design on the outcome of a sample observation. In this exercise, it is not possible to select a sampling design that specifically improves the precision of cod discards, since that objective is dependent on the realization of the actual sample. However, it is possible to select samples that will improve the probability of obtaining improved discard estimates by estimating the expected proportion of trips that catch species groups of interest.

Calendar quarter was considered the most feasible temporal unit to capture seasonal variations in fishing activity and bycatch rates over the full range of fisheries. Although some management regulations operate at a finer scale (e.g. weekly), quarterly data can be further subdivided if finer resolution is needed. Otter trawl, gillnet and longline gear were defined as the three major gear types for finfish. Otter trawl and gillnet trips were classified into four mesh size groups: Small (less than 3.99 inch mesh); Medium (between 3.99 and 5.49 inch mesh); Large (between 5.5 and 7.99 inch mesh) and XLarge (8.0 inch mesh or greater). Additionally, trips are classified into six geographical regions based upon the port of departure: ports located within Maine and New Hampshire (ME_NH); Massachusetts (N_MA, excluding Bristol county); Connecticut, RI, and Bristol county, MA (SNE); New Jersey - New York (NJ/NY); Maryland and Delaware (MD/DE); Virginia and North Carolina (VA/NC). Trip length serves as a surrogate for spatial resolution (inshore vs. offshore). Otter trawl trips are further classified into two trip length categories: day trips and multi-day trips. Longline and gillnet gears are not partitioned by trip length.

Due to the mixture of species caught during a trip, it is not sufficient to classify trips with regard to target species because discard of target and non-target species may occur. To account for target and non-target discard, trips in each fleet sector are classified into one or more of three species groups: New England groundfish (NEGF); summer flounder, scup and black sea bass (FSB); and monkfish (MONK). There is often overlap between trips which catch NEGF, FSB and MONK. The estimated number of trips and sea days needed to cover these fleet sectors may be overestimated when the trips are assumed to be independent, therefore the overlapping nature of the fishing fleets are taken into account. Sampling fractions, and how the overlap is accounted for, are described in a later section.

Eleven species constitute the New England groundfish species group: cod, haddock, yellowtail flounder, American plaice, witch flounder, winter flounder, redfish, pollock, white hake, windowpane, and halibut. If a trip catches (retains or discards) at least 1 of the 11 large-mesh regulated species, the trip is categorized as NEGF trip and the hail weights of the 11 species are summed to form an aggregate species total for NEGF. Similarly, if a trip catches (retains or discards) either summer flounder, black sea bass or scup, the trip is categorized as a FSB trip and the hail weights of these species are summed to form an aggregate species total for FSB. If a trip catches (retains or discards) monkfish, then the trip is categorized as a MONK trip. A trip may be categorized to one or more of the three species groups.

## Data Sources

Trip characteristics are recorded in both the NEFOP and Fishing Vessel Trip Reports (VTR) data sets. Together, these databases are used to define the size of the sample and the size of the strata, respectively. Data from each source are retrieved and prepared separately before the two sets are combined (Figure 1).

## Fishing Vessel Trip Report Data

Beginning in June 1994, the Northeast Region’s data collection system was changed from a voluntary to a mandatory reporting system for USA fishermen and dealers who catch and buy/sell groundfish species regulated by the Northeast Multi-species Fishery Management Plan. The mandatory reporting system consists of two components: 1) dealer reporting and 2) vessel trip reporting. Each component contains information needed for fishery management and stock assessment analyses: the dealer reports contain total landings by market category, while the vessel trip reports contain information on area fished, kept and discarded portions of the catch, and fishing effort. The VTR data has been routinely used in management analyses and peer reviewed stock assessments. Details on example applications of the VTR to stock assessments may be found in a large number of reports of the Stock Assessment Review Committee (SARC). Reports prepared since 2000 may be found at http://www.nefsc.noaa.gov/nefsc/saw/. Earlier reports are available by contacting saw_reports@noaa.gov.

In this report, the VTR data are used to: 1) define the sampling frame of the commercial fishing trips, and 2) evaluate the accuracy of the observer data with respect to area fished, kept pounds, and trip length. The VTR data are the only synoptic data source for vessel activity, area fished and fishing effort for commercial fisheries. The Vessel Monitoring System data and the Days-At-Sea data systems cover only portions of the fisheries and therefore are limited in use.

The VTR data can be used as a basis for defining the sampling frame, because all federally permitted vessels are required to file a VTR for each fishing trip (see NMFS-NERO http://www.nero.noaa.gov/ro/fso/vtr inst.pdf ). These self-reported data constitute the basis of the fishing activity of the commercial fleets. The VTR trip data are collapsed into fleet sectors and species groups as defined above. For each species group within a fleet sector, the number of trips that caught the species group, the average number of days absent, and the weight of the species in the species group are calculated.

The limitations of self-reported catch data are well known (e.g., Walsh et al. 2002, NMFS 2004). Limitations of the initial data VTR data sets were described by the SARC in 1996 (NMFS 1996). Since then, many of these limitations have been addressed. In particular, subsequent peerreviews through numerous SARCs and a review by the National Research Council (1998) have identified the strengths, weaknesses, and appropriate uses of the VTR data from the Northeast.

The validity of VTR data as a basis for a sampling frame is supported by comparisons with total landings data from dealer records. All dealers which buy and sell groundfish regulated by federal

FMPs are required to report $100 \%$ of the landings. These data are generally thought to constitute a near census of landings of groundfish. The NRC (1998) noted that misreporting of landings is "usually a significant issue only when fisheries are managed by setting a total allowable catch." On this basis, the magnitude of misreporting by dealers would be low as Northeast groundfish stocks have been managed primarily through effort controls. A comparison of total groundfish landings from VTR and Dealer records for calendar year 2003 reveals close agreement between the two sources:

| Species | VTR Landings <br> $(\mathrm{mt})$ | Dealer <br> Landings (mt) | Difference <br> $(\mathrm{mt})$ | Pecent <br> Difference |
| :--- | :--- | :--- | :--- | :--- |
| Cod | 8240 | 8692 | 452 | $5.2 \%$ |
| Winter flounder | 5321 | 5714 | 393 | $6.9 \%$ |
| Witch flounder | 2971 | 3108 | 137 | $4.4 \%$ |
| Yellowtail flounder | 5208 | 5530 | 322 | $5.8 \%$ |
| American Plaice | 2204 | 2415 | 211 | $8.7 \%$ |
| Windowpane flounder | 102 | 60 | -42 | $-70 \%$ |
| Haddock | 5778 | 5874 | 96 | $1.6 \%$ |
| White Hake | 2268 | 3305 | 1037 | $31.4 \%$ |
| Halibut | 11 | 13 | 2 | $15.4 \%$ |
| Redfish | 338 | 360 | 22 | $6.1 \%$ |
| Pollock | 3839 | 4188 | 349 | $8.3 \%$ |
| Total | 36281 | 39258 | 2977 | $7.6 \%$ |

For the three major species, cod, haddock and yellowtail flounder, the percentage differences range from $1.6 \%$ to $5.8 \%$. Only windowpane flounder, white hake and halibut exhibit large percentage differences. Total landings of windowpane flounder and halibut represent small fractions of the total ( $0.3 \%$ of VTR and $0.2 \%$ Dealer) landings and these percentage differences are considered negligible. Large percentage differences for white hake may be attributable to confusion between white hake and red hake. White hake can be difficult to distinguish from red hake (sp) and may be identified simply as "hake" by both dealers and fishermen. The overall difference of $7.6 \%$ is dominated by large differences in the landings of white hake. Excluding white hake from the comparison reduces the overall percentage difference to $5.4 \%$.

Other measures to ensure the validity of the VTR database include routine auditing procedures, standardized data entry protocols and compliance reviews (pers. comm. Greg Power, Chief, Fisheries Information Section, Northeast Regional Office, NMFS).

## Northeast Fisheries Observer Program Data

The NEFOP employs trained, sea-going observers to collect catch data by species and disposition (retained and discarded). Biological samples, gear characteristics data, and economic information are also collected. For the optimization data set, only observed hauls from trips classified as 'standard sea sampling trips' are used. Observed trips that were aborted or which
used a 'limited' fish sampling protocol (no discard data collected) are excluded. Hail weight can be reported in round or dressed weights; if kept hail weights are reported as 'dressed', then the hail weight is converted to round (live) weight using Commercial Fisheries Database System (CFDBS) conversion factors for the species. All discard hail weights are assumed to be round (live) weight.

The NEFOP data are collapsed into strata as defined above. For each stratum, the number of observed trips that caught one or more of the three species groups is calculated. For each fleet sector and species group, the number of observed trips, number of observed hauls, average trip length (in days), kept weight of all species in the species group, discarded weight of all species in species group, and the number of observed days are calculated. A discard ratio and the variance of the ratio are calculated for each stratum (fleet sector and species group).

## Optimization Data Set

The VTR and NEFOP data sets are concatenated by fleet sector and species group. A list of variables and their definitions are presented in Table 1. Not all VTR fleet activity may have NEFOP coverage (Table 2). When fleet sectors do not have observer coverage, imputed values are used (Table 3). The imputed values are derived from NEFOP data from similar fleet sectors, thus providing an estimate for the non-observed fleets. Details of the imputation process are provided in the following section.

The optimization tool is flexible and allows the user to select the entire input data set, or a subset. To allocate sea days for an entire year, four calendar quarters of data are used. Using the most recent available data, given the time needed for data entry and auditing, the year consists of calendar quarter 3 and 4 from year -1 and calendar quarter 1 and 2 from the current year.

The three gear types (otter trawl, gillnet, and longline) used in the optimization data set are gear types for which fishing regulations allow finfish to be retained, thus a discard to kept ratio estimator ( $\mathrm{d} / \mathrm{k}$ ) is used. Fisheries using other gear types where regulations may prohibit groundfish possession are excluded from the current optimization process because a $\mathrm{d} / \mathrm{k}$ ratio is not appropriate for these cases.

## Imputation rules for unobserved fisheries

Not all of the fishery strata had observed trips between April 2003 and March 2004. To account for the expected variance of the estimates in the missing cells, it was necessary to develop a standardized procedure to handle both missing and minimal levels (e.g., a single trip) of observer coverage. This procedure is referred to hereafter as 'imputation' and the estimates derived by the imputation are referred to 'imputed values'. Imputed values are derived by sequentially relaxing the fleet sector classification. The fleet sectors for each species group (NEGF, FSB, and MONK) are imputed separately. The imputed values fill in missing values for the unobserved strata. Fishery strata are defined with respect to rigid definitions of categorical variables such as region
or quarter. A stratum with missing data must be filled with data from similar strata. To identify suitable candidate strata as "donor" or "parent" cells, it is necessary to "relax" the definitions of the strata. For example, if no trips occur in the Jan.-Mar. quarter, one might relax the definition to include data from the Jan-Jun. half year. The objective process of relaxing strata definitions to impute data is described below.

A fleet sector was not imputed if:

1) VTR number of trips $=0$ (no imputation needed when there is no fleet activity for the species group);
2) VTR number of trips $>0$ and standard error was not missing (no imputation needed when there is fleet activity for the species group and there is a standard error of the observer d/k ratio); and
3) VTR number of trips $>0$ and total observed kept pounds $=0$ (no imputation needed when there is fleet activity for the species group and the standard error cannot be calculated); otherwise, the fleet sector was imputed.

The imputation uses three increasing levels of aggregated NEFOP data (using the same data and calculation methods as the original calculations of observed $\mathrm{d} / \mathrm{k}$ ratio and associated statistics). Three of the five stratification factors are relaxed (region, mesh size and calendar quarter). Gear type and trip length are used, but their stratification is not relaxed. Trip length is not relaxed because the average trip length is used to determine the number of sea days needed to obtain the desired precision level. Gear type is not relaxed because of fundamental differences in catches (retained and discarded) occur using these gear types.

Level 1: Calendar quarter is relaxed to half year and the six geographic regions are relaxed to two regions (NE region = ME/NH, N_MA, SNE; MA region = NY/NJ, DE/MD, NC/VA); gear, mesh size and trip length categories are maintained.

Level 2: Calendar quarter is relaxed to an entire year, the six geographic regions are relaxed to two regions (as in Level 1), and the four mesh groups are relaxed to two mesh groups (SMALL = small and medium mesh groups; LARGE = none, large, and Xlarge mesh groups); gear and trip length categories are maintained.

Level 3: Calendar quarter is relaxed to an entire year (as in Level 2), the six regions are relaxed to one region (all six regions combined), and the four mesh groups are relaxed into one mesh group. This level served as a 'catch-all' for all remaining fleets sectors that required imputation.

The VTR-NEFOP data set is merged with Level 1 NEFOP data; if a fleet sector needs imputed values, based on the criteria list above, then the imputed values from the observed trips in Level 1 are transferred to the corresponding VTR-NEFOP fleet sector and species group only if the trips in the Level 1 data set are greater than 1. Data from Level 2 and Level 3 are subsequently merged with the VTR-NEFOP. When imputed values are used in the VTR-NEFOP data set,
the fleet sector and species group is 'flagged' with the imputation level used. All fleet sectors that need imputation obtain values at one of the three levels.

Below is a summary of the number of fleet sectors, by imputation level and species group used in the 2005 sea day allocation.

|  | Species group |  |  |
| :--- | :--- | :--- | :--- |
| Imputation Level | NEGF | FSB | MONK |
| Level 0 (no imputation) | 150 | 116 | 111 |
| Level 1 | 30 | 51 | 44 |
| Level 2 | 27 | 41 | 35 |
| Level 3 | 20 | 19 | 37 |
| Total | 227 | 227 | 227 |

To include all fisheries using otter trawl, gillnet and longline gear in the optimization, approximately $33 \%$ to $50 \%$ of the mean discard rates and variances are imputed or 'borrowed'.

When a fleet sector and species group is imputed, five variables (number of observed trips, observed $\mathrm{d} / \mathrm{k}$ ratio, total observed kept pounds, standard error of the $\mathrm{d} / \mathrm{k}$ ratio, and number of observed days) are estimated with imputed values. Because the aggregated NEFOP data at each level have more observations than the original VTR-NEFOP fleet sector, the imputed values need to be rescaled before they are used. Except for the imputed d/k ratio, the imputed values for the number of observed trips, the total observed kept pounds, the standard error and the number of observed days are re-scaled using a sampling fraction represented by the ratio of the total NEFOP trips for that level, fleet sector and species group to the total VTR trips for that level, fleet sector and species group. Equations used to re-scale imputed values within stratum h are:

$$
\begin{aligned}
& \mathrm{T}_{\mathrm{vtr}}=\text { total VTR trips of } \text { Level }_{\mathrm{i}} \\
& \mathrm{~T}_{\text {obs }}=\text { total NEFOP trips for } \text { Level }_{\mathrm{i}} \\
& \mathrm{~T}_{\text {imp,h }}=\left(\mathrm{T}_{\mathrm{obs}} / \mathrm{T}_{\mathrm{vtr}}\right) * \text { Trips }_{\mathrm{vtr}, \mathrm{~h}} ; \\
& \text { Kept }{ }_{i m p}=\left(\mathrm{T}_{\mathrm{imp}, \mathrm{~h}} / \mathrm{T}_{\mathrm{obs}}\right) * \text { NEFOP kept pounds sum in } \text { Level }_{\mathrm{i}} \\
& \mathrm{SE}_{\text {imp }}=\left(\mathrm{T}_{\text {obs }} / \mathrm{T}_{\mathrm{imp,h}}\right)^{1 / 2} * \text { NEFOP standard error in } \text { Level }_{\mathrm{i}} \\
& \text { Days }_{\text {imp }}=\left(\mathrm{T}_{\mathrm{imp}, \mathrm{~h}} / \mathrm{T}_{\text {obs }}\right) * \text { total number of NEFOP days in } \text { Level }_{\mathrm{i}} \\
& \mathrm{~T}_{\mathrm{imp}, \mathrm{~h}} \text { is rounded to a whole number, if } \mathrm{T}_{\mathrm{imp,h}}<1 \text {, then } \mathrm{T}_{\mathrm{imp,h}}=1 \text {; }
\end{aligned}
$$

where Level $_{i}$ denotes Imputation Level 1, Level 2 or Level 3.

## Sampling Theory and Optimization Methods

Fishing trips are considered the primary sample unit in estimating $\mathrm{d} / \mathrm{k}$ ratios. Fishing trips generally catch multiple species, some of which are not landed owing to various regulations or market conditions. We defined three major groups of species: (1) New England groundfish, (2) summer flounder, scup and sea bass, and (3) monkfish. Fishing trips in a given stratum may catch species from one or more of these groups. The degree of overlap among species groups has important implications for the efficacy of sampling within strata, i.e., the number of samples necessary to achieve a desired level of precision. Because some fraction of trips provide information on more than one species group, estimates of sample size based on the assumption of independence, will overestimate the number of required trips. Developing estimators that explicitly account for the magnitude of overlap can circumvent this potential inefficiency. There are two ways to approach this estimation. One is based on the pattern of overall trips from the vessel trip reports. The second is based on the pattern in observer sampled trips. In theory, if the observed trips are a representative sample, the proportions in the vessel trip reports and observer trips should be the same. In practice, the proportions in the observed trips will deviate from those in the VTRs due to sampling variability and other factors. The selection of observed trips reflects a practical mix of vessel availability, knowledge of vessel operations, familiarity, and safety considerations. These are, of course, important factors for program management, but it must be recognized that these factors introduce bias into estimates.

Both approaches follow the algorithm described below. Let $\mathrm{I}_{\mathrm{hij}}$ be an indicator variable denoting the presence or absence of species group $j$ within trip $i$ in stratum $h$. Then $\mathrm{I}_{\mathrm{hij}}=1$ if species group j is present, else 0 . A design matrix can be used to describe each unique trip within a stratum. The design matrix appends to each trip record a set of indicator variables that identify the presence/absence of species groups caught. The following table illustrates a hypothetical case with 7 trips in stratum h .

## Example 1

|  | $\begin{aligned} & \mathrm{I}_{\mathrm{h} \_1} 1 \\ & \mathrm{j}=1 \end{aligned}$ | $\begin{aligned} & \mathrm{I}_{\mathrm{h} \_2} \\ & \mathrm{j}=2 \end{aligned}$ | $\begin{aligned} & \mathrm{I}_{\mathrm{h} \_3} \\ & \mathrm{j}=3 \end{aligned}$ |
| :---: | :---: | :---: | :---: |
| Trip ID | NEGF | Monk | FSB |
| 1 | 1 | 0 | 0 |
| 2 | 1 | 1 | 0 |
| 3 | 1 | 1 | 1 |
| 4 | 1 | 0 | 1 |
| 5 | 0 | 1 | 1 |
| 6 | 0 | 1 | 0 |
| 7 | 0 | 0 | 1 |
| Sum | 4 | 4 | 4 |
| $\mathrm{n}_{\mathrm{h}}=7$ | $\mathrm{n}_{\mathrm{h} 1}$ | $\mathrm{n}_{\mathrm{h} 2}$ | $\mathrm{n}_{\mathrm{h} 3}$ |

In this simple example, four of the seven trips caught New England groundfish, four trips caught monkfish, and four caught summer flounder, scup or sea bass. If all of these trips (or trip types) are equally likely, then the probability of obtaining a sample that yields information on NEGF is $4 / 7$ and so forth. The probability of obtaining information on species $j$ is the sum of the species
group specific trips within the stratum (i.e., $\mathrm{n}_{\mathrm{hj}}$ ) divided by the total number of unique trips within the stratum $\left(n_{h}\right)$. Note that

$$
n_{h} \neq \sum_{j=1}^{3} n_{h j}
$$

owing to the overlap in coverage for some trips. The probability that a random trip provides information on species group j is defined as

$$
\begin{equation*}
\hat{p}_{h j}=\frac{n_{h j}}{n_{h}} \tag{1}
\end{equation*}
$$

For each stratum, the probabilities can be computed that a random sample will contain information about species group $j$. The basis for the probability estimator can either be the observed set of trips within a stratum or the total set of trips represented in the VTRs. Applying the same set of indicator variables to the VTR data, one can obtain the population estimates of these quantities as

$$
\begin{equation*}
\hat{P}_{h j}=\frac{N_{h j}}{N_{h}} \tag{2}
\end{equation*}
$$

Eq. 1 establishes the basis for a random sample from the set of observed trips. Eq. 2 establishes the same basis from the VTR. On first principles, Eq. 2 is a better estimator if a representative sample can be taken in a stratum. Eq. 1 is more appropriate if the set of observed trips within a stratum is representative of those trips available for observation.

Using Eq. 1 or 2, it is now possible to examine the effects of altered sample sizes. Let $\mathrm{n}_{\mathrm{h}}$ represent the new total number of trips to be taken in stratum $h$. For the purpose of evaluating the expected change in variance in the component species groups, the n'hj for each species group need to be redefined. This is accomplished using the equation

$$
\begin{equation*}
n_{h j}^{\prime}=\hat{p}_{h j} n_{h}^{\prime} \tag{3}
\end{equation*}
$$

if Eq. 1 is used , or

$$
\begin{equation*}
n_{h j}^{\prime}=\hat{P}_{h j} n_{h}^{\prime} \tag{4}
\end{equation*}
$$

if Eq. 2 (based on VTR) is used to estimate the expected probabilities that a trip in stratum h will capture fish from species group j.

Another worked example will reinforce the basic concept of the expected proportions of samples likely to sample species group j. Consider a stratum with 10 observed trips with Eq. 1 used to estimate p’ ${ }^{\mathrm{hj}}$.

## Example 2

|  | $\mathrm{I}_{\mathrm{h} \_1}$ <br> $\mathrm{j}=1$ | $\mathrm{I}_{\mathrm{h}-2}$ <br> $\mathrm{j}=2$ | $\mathrm{I}_{\mathrm{h} \_}$3 <br> $\mathrm{j}=3$ |
| :---: | :--- | :--- | :--- |
| Trip ID | NEGF | Monk | FSB |
| 1 | 1 | 1 | 0 |
| 2 | 1 | 0 | 0 |
| 3 | 1 | 0 | 1 |
| 4 | 1 | 1 | 0 |
| 5 | 1 | 1 | 1 |
| 6 | 0 | 0 | 1 |
| 7 | 0 | 0 | 1 |
| 8 | 1 | 0 | 1 |
| 9 | 0 | 1 | 0 |
| 10 | 0 | 1 | 0 |
| Sum | 7 | 4 | 5 |
| $\mathrm{n}_{\mathrm{h}}=10$ | $\mathrm{n}_{\mathrm{h} 1}$ | $\mathrm{n}_{\mathrm{h} 2}$ | $\mathrm{n}_{\mathrm{h} 3}$ |
| $\mathrm{P}_{\mathrm{hj}}$ | $7 / 10$ | $4 / 10$ | $5 / 10$ |

If the $n_{h}$ were increased to $n^{\prime}{ }_{h}=30$ then the revised estimates of $n^{\prime}{ }_{h j}$ would be

$$
\begin{aligned}
& \hat{n}_{h 1}^{\prime}=\left(\frac{7}{10}\right) 30=21 \\
& \hat{n}_{h 2}^{\prime}=\left(\frac{4}{10}\right) 30=12 \\
& \hat{n}_{h 1}^{\prime}=\left(\frac{5}{10}\right) 30=15
\end{aligned}
$$

Thus, adding 20 trips to stratum h would translate into an expected increase of 14 trips for NEGF (i.e., 21-7), 8 trips for monkfish (i.e., 12-8) and 10 trips for FSB (i.e., 15-5). The increase in the total number of trips for a stratum differs with respect to the pattern of information in the sample. The allowance for non-integer numbers of trips is considered to have a negligible effect. In practice, the actual implementation of a sampling strategy would be based on rounding to the nearest integer, and subject to a lower bound constraint, say $\mathrm{n}_{\mathrm{hj}}=2$.

Example 2 could be repeated for estimates derived from the VTR data. For such an example, the universe of trips would be much larger.

## Measures of Overlap

Venn diagrams of the number of trips in the VTR and NEFOP depict the degree of overlap between the three species groups in the two data sets. In the April 2003-March 2004 VTR
database, half of the trips ( 22,274 trips out of 43,703 trips) are unique to the species groups (Figure 2), while in the NEFOP database, a third of the trips (286 trips out of 1,103 trips) are unique to the species groups (Figure 3). The sampling fractions (NEFOP trips divided by VTR trips) are given in Figure 4. The numbers of trips (and days) in the Venn diagrams are based on whole trips, and therefore slight differences occur in the number of trips between the Venn diagram and $\mathrm{d} / \mathrm{k}$ ratio analyses (e.g. there are trips in $\mathrm{d} / \mathrm{k}$ ratio analysis which used two different mesh sizes during a trip).

## Observers Days at Sea Constraints

While trips constitute the sampling unit, the total number of sampling units is constrained by the total number of days available during any interval. To consider this component of the sampling design, it is necessary to consider the average trip duration in stratum $h$. Let $t_{h i}$ be the trip duration (days) for the i-th trip in stratum $h$. The total number of observed trips in stratum $h$ is $n_{h}$ and the total number of observed days is $\Sigma \mathrm{t}_{\mathrm{hi}}$ The average trip duration is estimated as

$$
\begin{equation*}
\bar{t}_{h}=\frac{\sum_{i=1}^{n_{h}} t_{h i}}{n_{h}} \tag{5}
\end{equation*}
$$

The actual number of future observer days that will be required under some new sampling intensity ( $n$ ' ${ }_{h}$ ) is proportional to $n^{\prime}{ }_{h} / n_{h}$. Eq. 5 can also be defined in terms of the durations of the trips in the VTR database. The expected total number of days allocated to stratum h is defined as

$$
\begin{equation*}
T_{h}=\bar{t}_{h} n_{h}=\sum_{i=1}^{n_{h}} t_{h i} \tag{6}
\end{equation*}
$$

regardless of whether observer or VTR data are used. The average trip duration in stratum h is not influenced by the number of trips allocated, as long as the trips selected are representative of the basis used to define the species composition of the trips. Recall that either the observer database or the VTR database can be used. Thus the total number of observer days allocated to stratum h under some new allocation is

$$
\begin{equation*}
T_{h}^{\prime}=\bar{t}_{h} n_{h}^{\prime} \tag{7}
\end{equation*}
$$

The grand total number of days at sea that would be allocated given some new set $\{n$ ' $\}$ \} would be

$$
\begin{equation*}
T^{\prime}=\sum_{h=1}^{H} \bar{t}_{h} n_{h}^{\prime} \tag{8}
\end{equation*}
$$

Some key points in this derivation are:

- It is not possible to derive any real-world sampling program without considering the key uncertainties related to the probability that the trip will be "successful" and that the cost of sea days may vary.
- The number of successful trips, relative to the objective of reducing the variance of the estimate, is a random variable, based on a probability estimate. The expected number of actual trips may not actually result in information necessary to improve the precision of the estimate.
- The "cost" per trip is expressed as the expected duration. Actual duration may also vary within strata, although the stratification is designed reduce the variation in this component.

Optimization is a technique for maximizing (or minimizing) some quantity of interest subject to one or more constraints. Constraints are the key concept. In this application, we consider upper and lower bounds on the size of the sample within a strata, a total constraint on the number of available days, and a constraints related to acceptable levels of precision. For problems that do not explicitly consider dynamic (i.e., time dependent) processes, a variety of optimization methods can be used including linear and nonlinear programming. For this project, the optimization program, Premium Solver Platform (Version 5.5) developed by Frontline Systems, Inc. (2003) was used.

To address the optimization problem, the overall variance of the discard to kept ratio must first be estimated. The discard ratio for species group $j$ in stratum $h$ is the sum of discard weight over all trips divided by sum of kept weights over all trips:

$$
\begin{equation*}
\hat{R}_{j h}=\frac{\sum_{i=1}^{n_{h}} d_{i j h}}{\sum_{i=1}^{n_{h}} k_{i j h}} \tag{9}
\end{equation*}
$$

where $\mathrm{d}_{\mathrm{ijh}}$ is the discards for species group j within trip i in stratum h and $\mathrm{k}_{\mathrm{ijh}}$ is the kept portion of the catch. $\mathrm{R}_{\mathrm{jh}}$ is the discard rate for species group j in stratum h . The stratum weighted discard to kept ratio for species group $j$ is obtained by weighted sum of discard ratios over all strata:

$$
\begin{equation*}
\hat{R}_{j}=\sum_{h=1}^{H}\left(\frac{N_{h}}{\sum_{h=1}^{H} N_{h}}\right) \hat{R}_{j h} I_{h} \tag{10}
\end{equation*}
$$

The variable $\mathrm{I}_{\mathrm{h}}$ is a zero/one indicator of whether or not a stratum is included in the computation. The indicator variable can be considered as a composite measure of the suitability of stratum $h$ in the estimator. The indicator variable allows a stratum to be filtered on the basis of one or more metrics. A more complete description of the various types of filtering is described in the next section.

The approximate variance of the estimate of $\mathrm{R}_{\mathrm{jh}}$ is obtained from a first order Taylor series expansion about the mean:

$$
\begin{equation*}
V\left(\hat{R}_{j h}\right)=\frac{1}{\left(n_{j h}-1\right) n_{j h} \bar{k}_{j h}^{2}}\left[\left(\sum_{i=1}^{n_{j h}} d_{i j h}\right)^{2}+\hat{R}_{j h}^{2}\left(\sum_{i=1}^{n_{j h}} k_{i j h}\right)^{2}-2 \hat{R}_{j h}\left(\sum_{i=1}^{n_{j h}} d_{i j h}\right)\left(\sum_{i=1}^{n_{j h}} k_{i j h}\right)\right] \tag{11}
\end{equation*}
$$

where $d_{i j h}$ is the total discard weight of species group $j$ in trip i within stratum $h, \mathrm{k}_{\mathrm{ijh}}$ is the total kept weight of species group j in trip i within stratum $\mathrm{h}, \mathrm{nj}_{\mathrm{h}}$ is the sample size (number of trips) that caught species group $j$ in stratum $h$, and $k_{j h}$ bar is the mean kept landing of species group $j$ within stratum $h$. Note that in this formulation of the variance, the finite population correction factor (fpc), i.e., one minus the sampling fraction within the stratum, has been omitted. This has been done to improve readability. The fpc is included however, in Eq. 11 for the total variance of the $\mathrm{d} / \mathrm{k}$ ratio.

The variance of the $\mathrm{d} / \mathrm{k}$ ratio for species group j over the entire set of strata is estimated using standard sampling theory methodology for a stratified random design as

$$
\begin{equation*}
V\left(\hat{R}_{j}\right)=\sum_{h=1}^{H}\left(\frac{N_{h}-n_{j h}}{N_{h}}\right)\left(\frac{N_{h}}{\sum_{h=1}^{H} N_{h}}\right)^{2} V\left(\hat{R}_{j h}\right) I_{h} \tag{12}
\end{equation*}
$$

The overall coefficient of variation for the discard/kept ratio is defined as

$$
\begin{equation*}
C V_{j}=\frac{\sqrt{V\left(\hat{R}_{j}\right)}}{\hat{R}_{j}} \tag{13}
\end{equation*}
$$

It is now possible to define an overall estimate of the relative precision of the $\mathrm{d} / \mathrm{k}$ ratio across all species groups as

$$
\begin{equation*}
C V=\sum_{j=1}^{3} \lambda_{j} C V_{j} \tag{14}
\end{equation*}
$$

where $\lambda_{j}$ is an arbitrary weighting factor for species group $j$. In this formulation, the $\lambda_{j}$ can be used as binary factors $(0,1)$ to examine the allocations individually for species groups.

The optimization tool evaluates the potential improvements in the precision of the discard ratio through reallocation of the number of trips to individual strata. Equation 11 illustrates that the variance of the ratio decreases as the number of trips $\left(\mathrm{n}_{\mathrm{h}}\right)$ increases. Assuming that the data yield representative estimates of the stratum specific variances, then the reduction in total variance can be examined as a function of alternative allocation schemes for each stratum. If $\mathrm{n}^{*} \mathrm{~h}$ is defined as the optimal number of trips taken in stratum h , then the variance of the overall ratio is estimated as

$$
\begin{equation*}
V\left(\hat{R}_{j}^{*}\right)=\sum_{h=1}^{H}\left(\frac{N_{h}-n_{j h}}{N_{h}}\right)\left(\frac{N_{h}}{\sum_{h=1}^{H} N_{h}}\right)^{2}\left(\frac{n_{j h}}{n_{j h}^{*}}\right) V\left(\hat{R}_{j h}\right) I_{h} \tag{15}
\end{equation*}
$$

The optimization problem can now be posed as the minimization of the CV of the composite ratio estimate, subject to a total days at sea constraint $\left(\mathrm{T}_{\mathrm{C}}\right)$ and constraints on the number of trips per stratum.

$$
\begin{align*}
& \min \sum_{j=1}^{3} \lambda_{j} C V_{j} \\
& \text { subject to } \\
& 2 \leq n_{j h}^{*} \leq N_{h} \quad, \forall_{h}  \tag{16}\\
& T_{C}^{*} \geq \sum_{h=1}^{H} \bar{t}_{h} n_{h}^{*}
\end{align*}
$$

Alternatively, the optimization problem can be defined with the objective of minimizing the total number of days at sea, subject to an acceptable coefficient of variation ( $\mathrm{CV}_{\mathrm{CRII}}$ ). This version of the model can be written as:

$$
\begin{align*}
& \min \sum_{h=1}^{H} \bar{t}_{h} n_{h}^{*} \\
& \text { subject to } \\
& 2 \leq n_{j h}^{*} \leq N_{h} \quad, \forall_{h}  \tag{17}\\
& C V_{C R I T} \geq \sum_{j=1}^{3} \lambda_{j} C V_{j}
\end{align*}
$$

Another relevant consideration is that a trip may not yield information on any of the target species groups. In some strata, for example, a number of trips fail to capture groundfish, monkfish or the summer flounder, scup and sea bass mixture. To protect against this possibility, it is desirable to inflate the optimal number of trip estimates by the ratio of $\mathrm{N}_{\mathrm{h}}$ to $\mathrm{N}^{\prime}{ }_{h}$ where $\mathrm{N}_{\mathrm{h}}$ is the total number of trips in stratum h and $\mathrm{N}^{\prime}{ }_{\mathrm{h}}$ is the number of trips that obtained information on one or more of the species groups.

## Application of the Model

Using the optimization algorithm to minimize the variance of the discard estimates subject to a given number of sea days, the allocation of observer sea days for the Mid-Atlantic (M-A) and New England (NE) regions was optimized separately and the resulting allocated sea days combined. Separate analyses were conducted because of differential sea days constraints (mandated sea days for New England groundfish versus non-mandated sea days for the MidAtlantic region). Before the optimization began, a portion of the available sea days were set aside to cover fisheries which do not enter the optimization process (e.g. scallop dredge fishery). For these fisheries, sea days are allocated proportional to fishing effort (number of trips or number of days fished).

The Mid-Atlantic optimization used data from the SNE, NJ/NY, DE/MD and VA/NC regions with the species weighting coefficients set to 1 for both FSB and MONK and to 0 for NEGF. The NE optimization used data from the SNE, N_MA, and ME-NH regions, with the species weighting coefficients set to 1 for NEGF and to 0 for both FSB and MONK. Data from the SNE region were included in both optimizations due to the intersection of the NE and M-A regions. Stratum indexes were applied to reduce the data set to contain only the relevant fisheries.

Below is a summary of the indexes and thresholds used in the NE and M-A sea day optimizations.

NE region trip and landings setting and thresholds

| Switch | Setting | Threshold (fraction) | Description of Filters that Operate on Entire Strata |
| :---: | :---: | :---: | :---: |
| I(L_negf\%) | 1 | 0.0025 | Landings of NEGF<Threshold=>0, else 1 |
| I(L_fsb\%) | (All) | 0.0001 | Landings of FSB<Threshold $=>0$, else 1 |
| I(L_monk\%) | (All) | 0.0001 | Landings of Monk<Threshold=>0, else 1 |
| sum(İL_all\%)) | (All) | NA | If any of Landings indices for NEGF,FSB or Monk=1 then $=>1$, else 0 |
| I(Nh_negf\%) | 1 | 0.0001 | Trips of NEGF<Threshold=>0, else 1 |
| I(Nh_fsb\%) | (All) | 0.0001 | Trips of FSB $<$ Threshold $=>0$, else 1 |
| I(Nh_monk\%) | (All) | 0.0001 | Trips of Monk<Threshold=>0, else 1 |
| I(\%TotVTR_3sp) | 1 | 0.00005 | Filter on \% of total landings of 3 species groups |
| Filter on All Trips | 0 | NA | Excludes entire Strata if value=0 |

$\mathrm{M}-\mathrm{A}$ region trip and landings settings and thresholds

| Switch | Setting | Threshold (fraction) | Description of Filters that Operate on Entire Strata |
| :---: | :---: | :---: | :---: |
| I(L_negf\%) | (All) | 0.0025 | Landings of NEGF $<$ Threshold=>0, else 1 |
| I(L_fsb\%) | 1 | 0.0001 | Landings of FSB $<$ Threshold $=>0$, else 1 |
| I(L_monk\%) | 1 | 0.0001 | Landings of Monk<Threshold=>0, else 1 |
| sum(I(L_all\%)) | (All) | NA | If any of Landings indices for NEGF,FSB or Monk=1 then =>1, else 0 |
| I(Nh_negf\%) | (All) | 0.0001 | Trips of NEGF<Threshold=>0, else 1 |
| I(Nh_fsb\%) | 1 | 0.0001 | Trips of FSB<Threshold=>0, else 1 |
| I(Nh_monk\%) | 1 | 0.0001 | Trips of Monk<Threshold=>0, else 1 |
| I(\%TotVTR_3sp) | 1 | 0.00005 | Filter on \% of total landings of 3 species groups |
| Filter on All Trips | 0 | NA | Excludes entire Strata if value=0 |

NE and M-A regions $\mathrm{d} / \mathrm{k}$ ratio thresholds

|  | Threshold <br> (d/k ratio) | Description of Filters that Operate on Individual Cells <br> (Species within Strata) | Number of <br> Cells <br> Included | Number of <br> Cells <br> Excluded |
| :--- | :--- | :--- | :--- | :--- |
| Max d/k_NEGF | 1 | Maximum d/k ratio used for NEGF. Values>Threshold <br> excluded | 25 | 11 |
| Max d/k_FSB | 2 | Maximum d/k ratio used for FSB. Values>Threshold <br> excluded | 32 | 4 |
| Max d/k_Monk | 2 | Maximum d/k ratio used for Monkfish. Values>Threshold <br> excluded | 33 | 3 |

Some 'post-processing' of the allocation of optimized sea days was necessary. Even though one or more indicator variables (i.e., filters) were applied during optimization, it was necessary to fine-tune the sea day allocations by applying a minimum and maximum amount of coverage, and to maintain coverage of fishing activity throughout the year. The optimized sea days were multiplied by the average trip duration for each stratum to estimate the projected number of observed trips. If the projected number of observed trips was less than 3 trips per strata, then the sea days were redistributed to other strata representing more relevant fisheries. If the number of
potential observed trips in a stratum exceeded $15 \%$ of the VTR trips, then the sea days in that stratum were reduced to the number of sea days representing $15 \%$ (potential observer trips/VTR trips) coverage. The sea days from strata exceeding the $15 \%$ coverage cap were reassigned to other strata.

The number of unique vessels and the vessel selection protocols in a stratum limit the number of trips that can be observed in that stratum. The number of unique vessels varies among strata; in the 2005 sea day optimization, the number of unique vessels in a stratum ranged between 1 and 146 vessels, with $85 \%$ of the strata having 50 vessels or less. The vessel selection protocols state a vessel is not to be observed more than twice during a month. As an approximate guide for balancing between the potential number of observed trips and the number of unique vessels in a stratum, a $15 \%$ trip coverage cap was selected to prevent assigning more sea days to a stratum than the number of vessels could support. The 15\% cap prevented clustering of sampling effort, particularly in instances where the estimate of the variance of $\mathrm{d} / \mathrm{k}$ might be imprecise. In these instances, the optimization model will tend to allocate large number of trips to such strata to reduce the standard error of the estimate. When the analysis was restricted to the relevant strata for the New England groundfish fisheries, the 15\% cap was binding in only 4 of 33 strata for the observer coverage allocation scheme based on 2,708 observer days.

The diagnostics within the optimization tool were used to evaluate the imputation process. The optimization algorithm calculates the $\mathrm{d} / \mathrm{k}$ ratios and the variance estimates for 'all data' and for 'data without imputed values'. Generally, the $\mathrm{d} / \mathrm{k}$ ratios and variance estimates were similar between the 'all data' and 'data without imputed values' for each species groups. This indicates that the imputation generally provided consistent values across the three levels of aggregation.

## Precision, Bias and Sampling Intensity: A Rebuttal to E.A Babcock et al. (2003)

Understanding the sampling properties of estimates of bycatch derived from observer programs and other sources with respect to accuracy and bias is critical. This section reviews issues related to bycatch estimation in observer programs with an emphasis on potential biases that may exist. The NMFS national bycatch report (NMFS 2004) emphasizes that wherever possible, attempts to detect and guard against bias should be made in observer programs. The report strongly advocates the development of rigorous randomization procedures in sample selection to help ensure representative sampling. All can agree that with unlimited resources, the more observer coverage the better. The real issue however is how to allocate finite resources to meet multiple requirements for stock assessment and protected species evaluation. The cases that Babcock et al. (2003) point to as success stories typically have relative few boats involved compared to many other fisheries. These cases are not representative overall of the issues facing program managers.

Babcock et al. (2003) insufficiently distinguish between two very different types of bias. The first type arises when non-representative sampling occurs. The second type is related to the statistical properties of the consistency of the estimators. These two types of bias are very different and it is important to be clear which type of bias is under consideration. The second type of bias is typically reduced with sufficiently large sample size. However, this may not be
addressed by increases in sample size if fishermen refuse to take observers, if certain classes of boats cannot accommodate observers, etc. Babcock et al. (2003) take as an article of faith that increasing the number of trips will reduce bias. Some of the solutions identified by Babcock et al. (2003) for correcting bias (e.g. the use of bootstrap estimators) apply to correcting bias of the second type. However, no amount of bootstrapping will overcome non-representative sampling.

The mean square error (MSE) of an estimate is composed of two elements, the variance of the estimate and the square of the bias (defined as the difference between the mean of the sample and the true population value). The MSE therefore comprises two additive elements. Cochran (1977) notes that if bias is less than $10 \%$ of the standard deviation of the estimate, the effect of this bias on the accuracy of the estimate is negligible. As noted by Babcock et al. (2003), most work on the properties of estimates derived from observer programs have focused on the variance component, with far fewer studies examining bias. For reasons described in detail below, we believe that estimating the bias of the first type is more difficult than intimated by Babcock et al. (2003). It is nonetheless important to try to estimate this quantity. Focusing on the precision part of the MSE in certain analyses does not imply that bias is unimportant, or that it should be dismissed as insolvable as suggested by Babcock et al. (2003)

A critical element of the arguments developed by Babcock et al. (2003) appears to be that increasing the number of trips sampled will, by itself, reduce bias of the first type. This assertion, if true, is important. However, no corroborative evidence is provided. The argument is that fishermen will change behavior if they are subjected to a higher probability of being included in a sample, or of being sampled more frequently by observers. In essence, fishermen will be less likely to fish in a non-typical manner when an observer is on board if the probability of selection is higher. This may not be true if say a particular fishing trip has a $20 \%$ chance of being selected vs. a $10 \%$ chance and if the fishermen do not know in advance how many trips they may have to accommodate within a specified time period. In any event, we doubt that this can be calculated unless a model of human behavior is part of the estimation procedure.

Babcock et al. (2003) report that Sampson (2002) detected statistically significant differences between a multivariate indicator of landings composition by participants in the Enhanced Data Collection Project (EDCP) of the Oregon Department of Fish and Wildlife and the composition of landings by the entire groundfish trawl fleet. This analysis is used to indicate that biases exist in voluntary programs such as the EDCP and that it is possible to use similar approaches to identify bias in observer programs in general. What Babcock et al. do not report is that Sampson indicated that the multivariate analysis employed (Principal Components Analysis) was only "moderately successful" in capturing the properties of the data. The first three principal components accounted for 15.4, 12.0, and $8.0 \%$ of the variance `respectively for trips landing more than $10,000 \mathrm{lbs}$ in which hake comprised less than $50 \%$ of the total (designated "Big" trips by Sampson). For trips less than $10,000 \mathrm{lbs}$ in which hake comprised less than $50 \%$ of the total ("Small" trips), the first three principal components accounted for 13.7, 10.4, and 9.0\% of the variance. Sampson (2002) reported significant differences between the participants in the EDCP and the total fleet in the $1^{\text {st }}$ and $3^{\text {rd }}$ principal components for both Big and Small trips and concluded that the EDCP fleet may not be representative of the entire fleet. However, because the first three PCs captured only a moderate fraction of the variance, these analyses should be viewed with caution. It is worth noting that Sampson provided canonical variable plots of PCA 1
against PCA 2 (Figure 6a and 6b of his report) in which both the information from the EDCP and the whole fleet are superimposed and these show that the data from the EDCP do not appear to be markedly different from the total fleet. A truly important bias should show up clearly in these plots, which take into account more of the variance of the samples than the individual t-tests actually used in the report.

The general issue of testing for bias in observer data using landings data raises some important questions concerning the inferences that can be drawn. In particular, if no significant differences are detected between observer and landings data, this does not guarantee that there is no bias in the estimates of discards.

The other major source of information that could be used to test the representativeness of observer data is to test against self-reported estimates by fishermen. Sampson (2002) made such an analysis for the EDCP data and detected differences. In this case, it was inferred that the selfreported estimates were not accurate. In contrast, Liggens (1997) found no differences between observer data for catch and discards against fleet wide estimates. In general, self-reported estimates are rightly viewed with caution and this is the most commonly available type of discard information against which to compare observer data.

To deal with logistical constraints and their effect on observer programs, Babcock et al. (2003) cite the work of Cotter et al. (2002) using a probability proportional to size (PPS) sampling allocation procedure. However, Cotter et al. (2002) concluded that this approach did not markedly improve the performance of the estimators.

Babcock et al. (2003) refer to the method of collapsing strata as an ad hoc procedure when, in fact, it is a very well established method (see Cochran 1977). Bias can occur using this method if an investigator deliberately chooses similar strata to combine. However, methods in which objective rules for combining strata are employed are much less likely to cause bias.

Babcock et al. (2003) assert that Fogarty and Gabriel (2002) assumed that the sampling fraction did not matter. In fact, Fogarty and Gabriel (2002) noted that the sampling fraction does affect the precision of the estimate through the finite population correction factor. The effect indicated by Babcock et al. (2003) is a very well established property of the statistical estimators employed. Fogarty and Gabriel (2002) noted in their analysis that "Ignoring the finite population correction factor results in an overestimate of the standard error..." Fogarty and Gabriel (2002) did not include the FPC in their estimates so as to provide a conservative estimate of the variance (e.g. biased on the high side). This is very different than assuming that the sampling fraction does not matter.

Recommendations made by the NMFS National Working Group on Bycatch (NMFS 2004) largely address the issues of major concern - the importance of obtaining representative sampling, careful consideration of stratification, etc. We recommend that information from observer trips (catch, trip duration, number of hauls/tows, fishing location etc.) also be checked against independent sources of information to see if differences can be detected. The only solution that Babcock et al. (2003) provide when such a bias is detected is to increase the number of trips covered by observers. As noted above, this may or may not be effective. Other solutions
to the problem need to be explored, as well as increasing observer coverage when analyses indicate it is cost-effective to do so given finite resources and competing programmatic needs.

## An Evaluation of Bias in the Northeast Fisheries Observer (Sea Sampling) Program

Several tests were conducted to address the potential sources of bias. We compared several measures of performance for vessels with and without observers present. Bias can arise if the observed trips within a stratum are not representative of the other vessels within the stratum. Such bias could arise if the vessels with observers on board consistently catch more or less than other vessels, if the average trip durations change, or if vessels fish in different areas. Each of these hypotheses was tested by comparing observable properties in strata having data from vessels with and without observers.

All vessels are required to report the total trip landings, the number of days absent from port, and the primary statistical area fished. Average catches (pounds landed) for observed and total trips compare favorably (Figure 5), and follow an expected linear relationship. If the observed and unobserved trips within a stratum measure the same underlying process, one would expect no statistical difference in the average catches (and the standard deviations) between the VTR and observer data sets. An examination of the distribution of these differences (Figures 6A and 6B) indicates no evidence of systematic bias. The mean difference of 238 pounds in average catch rates between the two data sets is not significantly different from zero ( $\mathrm{p}=0.59, \mathrm{df}=84$ ). As well, a paired t -test of the stratum specific standard deviations of pounds kept showed no significant difference from zero ( $\mathrm{p}=0.08$ ). A strong correlation was detected in trip duration between observed and unobserved trips (Figure 7), with observed trips averaging about a half-day longer ( $\mathrm{p}=0.01$ ) (Figure 8A). However, the difference in stratum specific standard deviations of trip length was not significantly different from zero ( $p=0.60$ ) (Figure 8B). Some skewing of the differences in mean trip durations is evident, with observed trips being slightly longer.

Two measures of spatial coherence were also examined. Within stratum $\mathbf{h}$ the expected number of observer trips by statistical area $\mathbf{j}$ as the product of the proportion of VTR trips in Statistical Area $\mathbf{j}$ and stratum $\mathbf{h}\left(\mathbf{V}_{\mathbf{j h}}\right)$ and the number of observed trips in stratum $\mathbf{n}_{\mathbf{h}}$. Thus, $\mathbf{E}_{\mathbf{j h}}=\mathbf{V}_{\mathbf{j h}}$ * $\mathbf{n}_{\mathbf{h}}$. These expectations can then be compared to the actual frequencies $\left(\mathbf{O}_{\mathbf{j h}}\right)$ of observed trips by statistical area. Results of these analyses indicate that the spatial distribution of fishing effort for trips with observers on board closely matches the spatial distribution of trips for the stratum as a whole (Table 4). It was possible to compute chi-square statistics for 65 strata. The null hypothesis of observer proportions equal to VTR proportions was rejected ( $\mathrm{P}<0.05$ ) in 20 of the 65 comparisons. Of these 20 cases, 11 were from ports in Southern New England and MidAtlantic states. Of the remaining nine cases, five involved the large and extra-large gill net fisheries that land both groundfish and monkfish. Thus, the null hypothesis of equivalent spatial distribution of sampling was rejected in only 4 of 50 cases, a rejection rate only slightly higher than expected from chance alone.

As a final measure of the potential spatial bias, a paper by Murawski et al. (2005 in press) is instructive. In this paper, information is presented on the spatial distribution of otter trawl fishing effort for vessels with Vessel Monitoring Systems (VMS) and compared with the
distribution of fishing effort from observed trips (Figure 9). Qualitatively, the spatial distributions match very well with high concentrations of effort near the boundaries of existing closed areas on Georges Bank and within the Gulf of Maine. Moreover, the effort concentration profiles deduced from VMS data coincide almost exactly with the profiles derived from the observed trips. Overall, these comparisons suggest strong coherency between these two independent measures of fishing locations.

## Sources of Uncertainty

In the Northeast, every effort is made to ensure representative observer coverage. This is accomplished by stratifying the fleet into homogeneous spatial, temporal and gear groups and by randomly selecting vessels from these strata. Stratification and randomization of sampling units are basic principles of survey design (e. g. Cochran 1977; Thompson 2002) and have been used in previous studies of bycatch to improve both "knowledge of the fleet" (Cotter et al. 2002) and precision of estimates (Allen et al. 2002; Borges et al. 2004). VTR data are used to produce a list of fishing vessels, by quarter and fleet sector. The vessel list contains a randomly ordered list of all vessels that participated in each fleet sector. To obtain a representative sample of the fleet, the NEFOP Area Coordinators use this vessel list, in addition to their local knowledge of fleet activity, to identify vessels on which to place observers. Vessels are required to take an observer if requested to do so. The NEFOP has standard protocols regarding vessel selection. A vessel, using the same gear, is not observed more than twice in the same month - this prevents repeated observations from the same vessel. The NEFOP Area Coordinators have protocols for documenting refusals; a refusal occurs when a vessel owner/captain is asked to take an observer and the owner/captain declines - or agrees but does not follow through (i.e. the vessel leaves the dock without the observer on board). Refusals are forwarded to Law Enforcement. A vessel owner can be prosecuted for failing to take an observer.

An objective process is used for imputation of missing values in unsampled strata. The imputation methodology helps identify gaps in sampling strategy and is an important component for ongoing improvements of the survey design. Stratoudakis et al. (1999) employed a poststratification technique of "collapsing strata" as a way of dealing with unsampled strata. Our method of imputing means and variances for unsampled strata builds on this approach by utilizing information in comparable strata as a basis for initial sample allocation. Imputation represents a tradeoff between a realistic survey consistent with known fishing patterns and a less realistic pooled survey. Excessive imputation, however, can be indicative of an overly ambitious stratification approach; utilizing the observer data at an unrealistically fine temporal or spatial scale (say daily estimates in a small area) not only leads to an excessive extrapolation, but also violates the premise that observations in the current year are sufficient to predict patterns in the following year.

Persistence of annual patterns is critical to the estimation of an 'optimal' scheme. As regulations change and fishing patterns shift, using data based on fleet activity in the preceding year may be problematic. Using the current year's fishing activity pattern to predict future fishing patterns within strata cannot account for changes induced by variations in resource abundance, revenues, or management regimens. In a study of discards in the North Sea, Statoudakis et al. (1998)
reported immediate increases in discarding rates following increases in minimum size limits, but noted consistent patterns over time and among gears for higher value species such as cod and haddock. Without a predictive model of human behavior, it is not possible to anticipate fine-scale changes in fishing patterns. Rochet et al. (2002) were unable to find reliable predictor variables for prediction of bycatch but it should be noted that their study examined only 26 trips, about two orders of magnitude less than the number of trips considered in this report.

A related source of uncertainty is the ability to make inferences about specific species, stocks or age groups. Our evaluation of the Northeast Observer Program considers discard to kept ratios at the level of species groups. This approach is consistent with recent literature (Allen et al. 2001, Borges et al. 2004). An optimal strategy for New England Groundfish as a group however, will not necessarily be optimal for age 2 haddock on Georges Bank. The precision of discard information required at this level will typically exceed the nominal levels predicted as a result of optimal sampling. Figure 10 illustrates the relationship between the coefficient of variation for the overall New England groundfish discard ratio estimate as a function of total observer days allotted to this fishery. Assuming that 2,708 sea days can be allocated in an optimal manner in 2005, the predicted CV of the $\mathrm{d} / \mathrm{k}$ ratio is well below $4 \%$. The predicted CV drops to $2.5 \%$ at about 4,000 days and drops to about $1 \%$ at 20,000 days (about $50 \%$ coverage). The continuously decreasing slope of the relationship between CV and observer sea days reflects the reduced effectiveness of additional days as a way of improving overall precision.

Several important points are relevant to the interpretation of Figure 10. First, any non-optimal allocation of sampling effort will tend to increase the overall CV of the d/k ratio. Non-optimal allocations occur when the desired sampling plan cannot be followed, or when the pattern of landings among the strata in the current year differs from the pattern used as a basis for the optimal allocation scheme. Second, the CV of the overall $\mathrm{d} / \mathrm{k}$ ratio is smaller than the precision of the individual components. Thus, the CV of the $\mathrm{d} / \mathrm{k}$ ratio for a particular gear type or for a $\mathrm{d} / \mathrm{k}$ ratio based on a finer temporal or spatial scale will generally be greater than the composite estimate. This property is illustrated in Figures 11 and 12 for quarterly estimates in the New England groundfish otter trawl and gillnet fisheries, respectively. Note that the number of observed otter trawl trips would need to be tripled to reduce the CV of the $\mathrm{d} / \mathrm{k}$ ratio from $20 \%$ to $10 \%$.

The coefficient of variation (CV) of the $\mathrm{d} / \mathrm{k}$ ratios for New England groundfish are well below the $20 \%-30 \%$ CV range established by the Atlantic Coastal Cooperative Statistics Program (ACCSP) for high priority commercial fisheries (ACCSP 2001) and by NMFS's National Working Group on Bycatch (NWGB) (NMFS 2004). The NWGB recommends: "For fishery resources, excluding protected species, caught as bycatch in a fishery, the recommended precision goal is a $20-30 \%$ CV for estimates of total discards (aggregated over all species) for the fishery; or if total catch cannot be divided into discards and retained catch then the recommended goal for estimates of total catch is a CV of 20-30\% (NMFS 2004). Assuming that landings are known without error, the precision of estimated total discard for New England groundfish equals the precision of the $\mathrm{d} / \mathrm{k}$ ratio for this fishery.

A decrease in precision of the $\mathrm{d} / \mathrm{k}$ ratio is also expected for any single species analysis. For example, the CV of the $\mathrm{d} / \mathrm{k}$ ratio for haddock alone will probably be much greater than the CV of
the $\mathrm{d} / \mathrm{k}$ ratio for the overall groundfish complex. Once again, it is important to remember that the sampling program must be based on observable properties of the strata, not on the outcome of the experiment. Any efforts to improve the precision of the $\mathrm{d} / \mathrm{k}$ ratio for a single species will come at the expense of reduced precision for other species. Moreover, oversampling of a particular group of vessels may introduce undesirable properties (e.g., repeat trips on a single vessel) that can make the sampling less representative.

An exact definition of an acceptable level of bias and precision depends on the objectives of the analyses and the levels of acceptable risk to the fishery resource and the fishery. The acceptable level of risk must be defined externally by managers but should, at a minimum, consider the risk of stock collapse if management actions are compromised by imprecise information on discards. From the analyses presented in this report, it would appear that the level of precision is high for the groundfish resource as a whole and that there little evidence of bias in the discard rates.

Presently the optimization model uses aggregate $\mathrm{d} / \mathrm{k}$ ratios, which are appropriate for most fisheries; however, for other fisheries, $\mathrm{d} / \mathrm{e}$ ratios are more appropriate. The optimization algorithm can handle datasets containing either type of ratio, but not both in the same set (without external weighting). Input data sets with d/e ratios have been developed, but have not yet been incorporated into the overall process. A comparison of the precision of alternative estimators of discard ratios is the subject of ongoing research.

## Acknowledgments

We wish to thank Mark Terceiro, Katherine Sosebee, and Ralph Mayo for their insights and assistance in identifying the fishery strata, the bases for imputation, and the iterative process of refining the application. We also thank Fred Serchuk for his constructive comments and review.

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Table 1. The variables, their description, their associated species group, data source, and units of the input data set of the optimization algorithm.

| Variable Name | Definition | Species <br> Group | Data Source | Units |
| :---: | :---: | :---: | :---: | :---: |
| year | Year |  |  | categories |
| negear | gear type |  |  | categories |
| qtr | quarter of year |  |  | number |
| mesh | mesh size |  |  | categories |
| region | state grouping, port of departure |  |  | categories |
| trp | Trip Duration (days) |  |  | categories |
| alltrips | Total number of trips, all species | ALL | VTR | trip |
| allmnda | Ave number of days absent, all species | ALL | VTR | days |
| vcount | Total number of VTR trips for 3 sp . Groups | 3 Sp Grp | VTR | trip |
| ocount | Total number of observed trips that caught one or more of the 3 sp groups | 3 Sp Grp | VTR | trip |
| vnegfntrips | Number of VTR trips that caught NEGF | NEGF | VTR | trip |
| vgfda | Total VTR days absent for trips that caught Groundfish | NEGF | VTR | days |
| vgftotal | Total VTR pounds(all sp) landed for trips landing groundfish | NEGF | VTR | pounds |
| vgflb | VTR pounds landed-groundfish | NEGF | VTR | pounds |
| vgfmnda | VTR average days absent-groundfish | NEGF | VTR | days |
| onegf | Sum of the "0/1 flags" for observed trips that caught NEGF | NEGF | OBS | trip |
| ogfntrips | Number of observed trips that caught NEGF | NEGF | OBS | trip |
| ogfparent | Flag indicating if values of $\mathrm{d} / \mathrm{k}$ are observed (=1) or imputed (=0) | NEGF | OBS | flag |
| ogfnewcv | Desired CV closest to 0.30--intermediate value | NEGF | OBS | number |
| ogfnewntrips | Number of Observed trips necessary to achieve CV=ogfxnewcy | NEGF | OBS | trip |
| ogfxnewcv | Desired CV=0.30 --exact value | NEGF | OBS | number |
| ogfavgtriplen | Ave Trip Length in days for observed trips | NEGF | OBS | days |
| ogfntows | Number of observed Tows | NEGF | OBS | tows |
| ogfksums | Kept-observed | NEGF | OBS | pounds |
| ogfdsums | Discarded—observed | NEGF | OBS | pounds |
| ogfdkratio | d/k ratio | NEGF | OBS | number |
| ogfse | SE of d/k ratio | NEGF | OBS | number |
| ogfcv | CV of mean d/k ratio | NEGF | OBS | number |
| ogfseadays | Number of sea days needed to achieve CV=0.3 (=avg triplen x newntrips) | NEGF | OBS | days |
| Ogfndays | Number of observed days | NEGF | OBS | days |
| vfsbntrips | Number of VTR Trips that caught FSB | FSB | VTR | trip |
| vfsbda | Total VTR days absent for trips that caught FSB | FSB | VTR | days |
| vfsbtotal | Total VTR pounds (all sp) landed for trips landing FSB | FSB | VTR | pounds |
| vfsblb | VTR pounds landed-FSB | FSB | VTR | pounds |
| vfsbmnda | VTR average days absent-FSB | FSB | VTR | days |
| ofsb | Sum of the "0/1 flags" for observed trips that caught FSB | FSB | OBS | trip |
| ofsbntrips | Number of observed trips that caught FSB | FSB | OBS | trip |
| ofsbparent | Flag indicating if values of $\mathrm{d} / \mathrm{k}$ are observed (=1) or imputed (=0) | FSB | OBS | flag |
| ofsbnewcr | Desired CV closest to 0.30--intermediate value | FSB | OBS | number |
| ofsbnewntrips | Number of Observed trips necessary to achieve CV=ofsbxnewcy | FSB | OBS | trip |
| Ofsbxnewcv | Desired CV=0.30 --exact value | FSB | OBS | number |


| ofsbavgtriplen | Ave Trip Length in days for observed trips | FSB | OBS | days |
| :---: | :---: | :---: | :---: | :---: |
| ofsbntows | Number of observed Tows | FSB | OBS | Tows |
| ofsbksums | Kept—observed | FSB | OBS | pounds |
| ofsbdsums | Discarded—observed | FSB | OBS | pounds |
| ofsbdkratio | d/k ratio | FSB | OBS | number |
| ofsbse | SE of d/k ratio | FSB | OBS | number |
| ofsbcy | CV of mean d/k ratio | FSB | OBS | number |
| ofsbseadays | Number of sea days needed to achieve CV=0.3 (=avg triplen x newntrips) | FSB | OBS | days |
| ofsbndays | Number of observed days | FSB | OBS | days |
| vmonkntrips | Number of VTR Trips that caught Monk | Monk | VTR | trip |
| vmonkda | Total VTR days absent for trips that caught monk | Monk | VTR | days |
| vmonktotal | Total VTR pounds (all sp) landed for trips landing Monkfish | Monk | VTR | pounds |
| vmonklb | VTR pounds landed---Monk | Monk | VTR | pounds |
| vmonkmnda | VTR average days absent-Monk | Monk | VTR | days |
| Omonk | Sum of the "0/1 flags" for observed trips that caught Monkfish | Monk | OBS | trip |
| omkntrips | Number of observed trips that caught Monk | Monk | OBS | trip |
| omkparent | Flag indicating if values of $\mathrm{d} / \mathrm{k}$ are observed (=1) or imputed (=0) | Monk | OBS | flag |
| omknewcv | Desired CV closest to 0.30--intermediate value | Monk | OBS | number |
| omknewntrips | Number of Observed trips necessary to achieve CV=omkxnewcv | Monk | OBS | trip |
| omkxnewcv | Desired CV=0.30 --exact value | Monk | OBS | number |
| omkavgtriplen | Ave Trip Length in days for observed trips | Monk | OBS | days |
| omkntows | Number of observed Tows | Monk | OBS | Tows |
| omkksums | Kept—observed | Monk | OBS | pounds |
| omkdsums | Discarded—observed | Monk | OBS | pounds |
| omkdkratio | d/k ratio | Monk | OBS | number |
| omkse | SE of d/k ratio | Monk | OBS | number |
| omkcv | CV of mean d/k ratio | Monk | OBS | number |
| omkseadays | Number of sea days needed to achieve CV=0.3 (=avg triplen x newntrips) | Monk | OBS | days |
| omkndays | Number of observed days | Monk | OBS | days |
| onegfcpue | Observer Catch(kept) per unit effort (lbs/day ) for NEGF | NEGF | OBS | lbs/day |
| ofsbcpue | Observer Catch (kept) per unit effort (lbs/day ) for FSB | FSB | OBS | lbs/day |
| omkcpue | Observer Catch (kept) per unit effort (lbs/day ) for Monk | Monk | OBS | lbs/day |
| alltotal | Total number of pounds of all species landed in this cell | ALL | VTR | pounds |
| vnegfcpue | VTR Landings per unit effort (lbs/day ) for NEGF | NEGF | VTR | lbs/day |
| vfsbcpue | VTR Landings per unit effort (lbs/day ) for FSB | FSB | VTR | lbs/day |
| vmkcpue | VTR Landings per unit effort (lbs/day ) for Monk | Monk | VTR | lbs/day |
| L_negf\% | Fraction of NEGF landings in stratum h | NEGF | VTR | unitless |
| L_fsb\% | Fraction of FSB landings in stratum h | FSB | VTR | unitless |
| L_monk\% | Fraction of Monk landings in stratum h | Monk | VTR | unitless |
| Nh_negh\% | Fraction of NEGF trips in stratum h | NEGF | VTR | unitless |
| Nh_fsb\% | Fraction of FSB trips in stratum h | FSB | VTR | unitless |
| Nh_monk\% | Fraction of Monk trips in stratum h | Monk | VTR | unitless |
| I(L_negf\%) | Indicator $\{0,1\}$ for Fraction of NEGF landings in stratum h | NEGF | VTR | switch |
| I(L_fsb\%) | Indicator $\{0,1\}$ for Fraction of FSB landings in stratum h | FSB | VTR | switch |
| I(L_monk\%) | Indicator $\{0,1\}$ for Fraction of Monk landings in stratum h | Monk | VTR | switch |
| sum(I(L_all\%)) | Indicator $\{0,1\}$ for composite landings. $=0$ if all species specific indicators=0,else 1 | 3 Sp Grp | VTR | switch |
| I(Nh_negf\%) | Indicator $\{0,1\}$ for Fraction of NEGF trips in stratum h | NEGF | VTR | switch |
| I(Nh_fsb\%) | Indicator $\{0,1\}$ for Fraction of FSB trips in stratum h | FSB | VTR | switch |


| I(Nh_monk\%) | Indicator $\{0,1\}$ for Fraction of Monk trips in stratum h | Monk | VTR | switch |
| :---: | :---: | :---: | :---: | :---: |
| sum(I(Nh_all\%) | Indicator $\{0,1\}$ for composite TRIPS. $=0$ if all species specific indicators=0,else 1 | 3 Sp Grp | VTR | switch |
| I(onegfcpue) | Indicator $\{0,1\}$ for observer CPUE in stratum $h$ for NEGF. $1=>$ exceeds threshold, else 0 | NEGF | OBS | switch |
| I(ofsbcpue) | Indicator $\{0,1\}$ for observer CPUE in stratum $h$ for FSB. $1=>$ exceeds threshold, else 0 | FSB | OBS | switch |
| I(omkcpue) | Indicator $\{0,1\}$ for observer CPUE in stratum h for Monk. 1=> exceeds threshold, else 0 | Monk | OBS | switch |
| I(vnegfcpue) | Indicator $\{0,1\}$ for VTR CPUE in stratum $h$ for NEGF. 1=> exceeds threshold, else 0 | NEGF | VTR | switch |
| I(vfsbcpue) | Indicator $\{0,1\}$ for VTR CPUE in stratum $h$ for FSB. 1=> exceeds threshold, else 0 | FSB | VTR | switch |
| I(vmkcpue) | Indicator $\{0,1\}$ for VTR CPUE in stratum h for Monk. 1=> exceeds threshold, else 0 | Monk | VTR | switch |
| I(d/k_negf) | Indicator $\{0,1\}$ for Obsvr $\mathrm{d} / \mathrm{k}$ ratio in stratum h for NEGF. $1=>$ exceeds threshold,else 0 | NEGF | OBS | switch |
| $I\left(d / k \_f s b\right)$ | Indicator $\{0,1\}$ for Obsvr d/k in stratum h for FSB. 1=> exceeds threshold, else 0 | FSB | OBS | switch |
| I(d/k_monk) | Indicator $\{0,1\}$ for Obsvr $\mathrm{d} / \mathrm{k}$ in stratum h for Monk. 1=> exceeds threshold, else 0 | Monk | OBS | switch |
| Total VTR <br> 3spgroup | Sum of landings by strata for each species group | 3 Sp Grp | VTR | switch |
| \%Total VTR 3 group | Percent of landings of sum of 3 sp groups in strata | 3 Sp Grp | VTR | switch |
| I(\%TotVTR_3sp) | flag for total landings of 3 species groups | 3 Sp Grp | VTR | switch |
| ogfimp_level | Indicator $\{0,1,2,3\}$ of imputation level | NEGF | OBS | category |
| ofsbimp_level | Indicator $\{0,1,2,3\}$ of imputation level | FSB | OBS | category |
| omonkimp_level | Indicator $\{0,1,2,3\}$ of imputation level | Monk | OBS | category |

Table 2. Number of trips, by strata, in the Fishing Vessel Trip Reports (VTR) and Northeast Fisheries Observer Program (NEFOP) data sets used in the 2005 sea day optimization.


Table 3. Summary of fleet sectors (strata), by species group, that are imputed (1) and not imputed (0); blank cells indicate no fleet activity.

|  |  |  |  | QUARTER |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | 1 |  |  | 2 |  |  | 3 |  |  | 4 |  |  |
| Region | Gear | Mesh | Trip lengt\| | NEGF | FSB | MONK | NEGF | FSB | MONK | NEGF | FSB | MONK | NEGF | FSB | MONK |
| DE/MD | Otter Trawl | Large | $\begin{aligned} & \text { day } \\ & \text { multi-day } \end{aligned}$ | 0 | 1 | 1 | 0 0 | 1 | 1 | 0 0 | 1 | 1 | 0 0 | 1 | 1 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |
|  |  | Medium | $\begin{aligned} & \text { day } \\ & \text { multi-day } \end{aligned}$ | 0 | 0 | 1 | 0 | 1 | 1 |  |  |  | 0 0 | 1 | 0 |
|  |  | Small | $\begin{aligned} & \text { day } \\ & \text { multi-day } \end{aligned}$ | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
|  | Gillnet | Medium |  | 0 | 1 | 0 | 0 | 1 | 0 |  |  |  |  |  |  |
|  |  | Small |  | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |  |  |  |
|  |  | XLarge |  | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| ME_NH | Longline | None |  | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
|  | Otter Trawl | Large | $\begin{aligned} & \text { day } \\ & \text { multi-day } \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \\ & 0 \end{aligned}$ | 0 0 | $\begin{aligned} & 1 \\ & 1 \\ & 0 \end{aligned}$ | 0 0 | 1 | 0 0 | 0 0 | 1 | 0 0 | 1 0 | 1 1 | 1 0 |
|  |  | Medium | $\begin{array}{\|l\|} \hline \text { day } \\ \text { multi-day } \\ \hline \end{array}$ |  |  |  | 1 | 0 | 1 |  |  |  | 0 | 1 | 0 |
|  |  | Small | $\begin{array}{\|l\|} \hline \begin{array}{l} \text { day } \\ \text { multi-day } \end{array} \\ \hline \end{array}$ |  |  |  |  |  |  | 1 | 0 | 0 | 1 | 0 0 | 1 |
|  |  | XLarge | $\begin{array}{\|l\|} \hline \text { day } \\ \text { multi-day } \\ \hline \end{array}$ | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
|  | Gillnet | Large |  | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
|  |  | Medium |  |  |  |  |  |  |  |  |  |  | 1 | 0 | 1 |
|  |  | None |  |  |  |  | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |
|  |  | Small |  |  |  |  |  |  |  | 1 | 0 | 1 |  |  |  |
|  |  | XLarge |  | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| N_MA | Longline <br> Otter Trawl | None |  | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
|  |  | Large | $\begin{aligned} & \text { day } \\ & \text { multi-day } \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | 1 | 0 0 | 0 0 | 0 | 0 0 | 0 0 | 1 | 0 | 0 0 | 1 | 0 |
|  |  | Medium | $\begin{aligned} & \text { day } \\ & \text { multi-day } \end{aligned}$ |  |  |  | 1 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |
|  |  | Small | $\begin{array}{\|l\|} \hline \text { day } \\ \text { multi-day } \\ \hline \end{array}$ | $\begin{aligned} & 1 \\ & 0 \end{aligned}$ | 0 1 | 1 | 0 0 | 0 1 | 0 0 | 0 0 | 1 0 | 0 0 | 0 0 | 0 0 | 0 |
|  |  | XLarge | $\begin{array}{\|l\|} \hline \text { day } \\ \text { multi-day } \\ \hline \end{array}$ |  |  |  | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 |
|  | Gillnet | Large |  | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
|  |  | Medium |  | 1 | 0 | 0 |  |  |  |  |  |  | 1 | 0 | 1 |
|  |  | None |  | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
|  |  | Small |  | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |
|  |  | XLarge |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NC/VA | Otter Trawl | Large | $\begin{aligned} & \text { day } \\ & \text { multi-day } \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | 1 0 | 0 0 | 0 0 | 1 | 1 |  |  |  | 1 | 1 0 | 1 0 |
|  |  | Medium | $\begin{array}{\|l\|} \hline \begin{array}{l} \text { day } \\ \text { multi-day } \end{array} \\ \hline \end{array}$ | 0 0 | 1 | 0 | 0 0 | 1 | 0 1 |  |  |  | 0 | 0 | 1 |
|  |  | Small | multi-day | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 |
|  |  | XLarge | multi-day | 0 | 1 | 1 | 0 | 1 | 1 |  |  |  |  |  |  |
|  | Gillnet | Large |  | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
|  |  | Medium |  | 0 | 1 | 1 | 0 | 1 | 1 |  |  |  | 0 | 1 | 1 |
|  |  | Small |  | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
|  |  | XLarge |  | 0 | 1 | 1 | 0 | 1 | 1 |  |  |  | 0 | 1 | 1 |
| NJ/NY | Longline <br> Otter Trawl | None |  | 1 | 0 | 0 | 1 | 0 | 0 |  |  |  |  |  |  |
|  |  | Large | $\begin{array}{\|l\|} \hline \text { day } \\ \text { multi-day } \end{array}$ | 0 0 | 0 0 | 0 0 | 0 1 | 0 0 | 0 0 | 1 1 | 1 | 1 | 1 0 | 1 1 | 1 1 |
|  |  | Medium | $\begin{array}{\|l\|} \hline \text { day } \\ \text { multi-day } \\ \hline \end{array}$ | 1 | 1 0 | 0 | 0 0 | 0 | 0 | 0 1 | 0 0 | 0 | 0 | 0 0 | 0 |
|  |  | Small | $\begin{array}{\|l\|} \hline \text { day } \\ \text { multi-day } \\ \hline \end{array}$ | 1 0 | 1 | 1 | 0 0 | 0 | 0 | 1 | 1 | 1 | 1 1 | 1 0 | 1 |
|  |  | XLarge | $\begin{aligned} & \text { day } \\ & \text { multi-day } \end{aligned}$ | 0 | 1 | 1 | 1 0 | 1 | 1 | 0 0 | 1 | 1 | 0 0 | 1 | 1 0 |
|  | Gillnet | Large |  |  |  |  | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
|  |  | Medium |  |  |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
|  |  | None |  |  |  |  | 0 | 1 | 1 |  |  |  | 0 | 1 | 1 |
|  |  | Small |  | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
|  |  | XLarge |  | 0 | 1 | , | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| SNE | Otter Trawl | Large | $\begin{array}{\|l} \hline \text { day } \\ \text { multi-day } \end{array}$ | 0 0 | 0 0 | 0 | 0 0 | 0 | 0 | 1 0 | 0 0 | 1 | 0 0 | 0 0 | 0 |
|  |  | Medium | $\begin{array}{\|l\|} \hline \text { day } \\ \text { multi-day } \end{array}$ | 0 | 1 | 1 | 0 1 | 0 1 | 1 | 0 0 | 1 | 1 | 0 1 | 0 1 | 0 <br> 1 |
|  |  | Small | $\begin{aligned} & \text { day } \\ & \text { multi-day } \end{aligned}$ | $\begin{aligned} & 1 \\ & 0 \end{aligned}$ | 1 | 1 | 0 0 | 0 0 | 0 0 | 0 0 | 0 1 | 1 | 0 | 0 0 | 0 0 |
|  |  | XLarge | $\begin{array}{\|l\|} \hline \text { day } \\ \text { multi-day } \end{array}$ | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 1 | 1 |
|  | Gillnet | Large |  | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 |
|  |  | Medium |  |  |  |  |  |  |  | 0 | 1 | 0 |  |  |  |
|  |  | None |  | 1 | 0 | 1 | 0 | 0 | 1 |  |  |  | 0 | 1 | 0 |
|  |  | Small |  |  |  |  | 0 | 1 | 1 |  |  |  |  |  |  |
|  |  | XLarge |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 4. Summary of contingency table analyses of spatial distribution of VTR and observed trips. Expected value of observed trips is based on proportions of VTR trips by Statistical Area. Critical value of Chi-Square statistics is based on alpha level of 0.05 . Degrees of freedom are based on number of Statistical Areas reported in VTR database.

| Quarter | Gear | Mesh | Region | Trip Duration | Chi Sqr Test Statistic | df | Chi Sqr Crit Value | Signif <br> Level |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 3 | Gill Net | Large | ME_NH | all | 41.92 | 6 | 12.59 | 0.000 |
| 3 | Gill Net | XLarge | ME_NH | all | 32.19 | 4 | 9.49 | 0.000 |
| 3 | Gill Net | Large | N_MA | all | 36.92 | 11 | 19.68 | 0.000 |
| 3 | Gill Net | XLarge | NJ/NY | all | 20.30 | 5 | 11.07 | 0.001 |
| 4 | Gill Net | XLarge | N_MA | all | 16.89 | 4 | 9.49 | 0.002 |
| 4 | Gill Net | Large | ME_NH | all | 14.76 | 4 | 9.49 | 0.005 |
| 4 | Gill Net | XLarge | NJ/NY | all | 10.46 | 2 | 5.99 | 0.005 |
| 2 | Gill Net | XLarge | ME_NH | all | 12.06 | 7 | 14.07 | 0.098 |
| 2 | Gill Net | Large | NC/VA | all | 3.06 | 2 | 5.99 | 0.216 |
| 1 | Gill Net | XLarge | NC/VA | all | 2.15 | 2 | 5.99 | 0.341 |
| 1 | Gill Net | Large | SNE | all | 0.40 | 1 | 3.84 | 0.527 |
| 4 | Gill Net | Large | N_MA | all | 2.69 | 4 | 9.49 | 0.611 |
| 2 | Gill Net | Large | N_MA | all | 6.10 | 8 | 15.51 | 0.636 |
| 2 | Gill Net | XLarge | N_MA | all | 1.48 | 3 | 7.81 | 0.687 |
| 1 | Gill Net | XLarge | N_MA | all | 1.23 | 3 | 7.81 | 0.746 |
| 3 | Gill Net | XLarge | N_MA | all | 2.29 | 5 | 11.07 | 0.808 |
| 1 | Gill Net | Large | N_MA | all | 1.29 | 4 | 9.49 | 0.862 |
| 2 | Longline | None | ME_NH | all | 1.15 | 3 | 7.81 | 0.764 |
| 1 | Longline | None | N_MA | all | 1.63 | 7 | 14.07 | 0.977 |
| 2 | Trawl | Large | N_MA | 1day | 243.29 | 6 | 12.59 | 0.000 |
| 2 | Trawl | Medium | SNE | 2+day | 120.00 | 3 | 7.81 | 0.000 |
| 3 | Trawl | Large | NJ/NY | 1day | 80.97 | 13 | 22.36 | 0.000 |
| 2 | Trawl | Large | NJ/NY | 1day | 61.00 | 5 | 11.07 | 0.000 |
| 4 | Trawl | Large | ME NH | 2+day | 49.91 | 9 | 16.92 | 0.000 |
| 1 | Trawl | Small | NJ/NY | 1day | 32.36 | 3 | 7.81 | 0.000 |
| 4 | Trawl | Medium | NJ/NY | 2+day | 28.00 | 2 | 5.99 | 0.000 |
| 3 | Trawl | Large | N_MA | 1day | 37.19 | 9 | 16.92 | 0.000 |
| 4 | Trawl | Small | NJ/NY | 1day | 15.00 | 2 | 5.99 | 0.001 |
| 4 | Trawl | Small | N_MA | 2+day | 14.00 | 2 | 5.99 | 0.001 |
| 1 | Trawl | Large | NC/VA | 2+day | 29.65 | 13 | 22.36 | 0.005 |
| 2 | Trawl | Small | DE/MD | 1day | 8.67 | 3 | 7.81 | 0.034 |
| 1 | Trawl | Medium | SNE | 2+day | 4.00 | 1 | 3.84 | 0.046 |
| 2 | Trawl | Large | NC/VA | 2+day | 14.28 | 8 | 15.51 | 0.075 |
| 2 | Trawl | Large | N_MA | 2+day | 22.66 | 15 | 25.00 | 0.092 |
| 2 | Trawl | Small | NJ/NY | 1day | 13.22 | 8 | 15.51 | 0.105 |
| 2 | Trawl | Large | DE/MD | 2+day | 13.03 | 8 | 15.51 | 0.111 |
| 4 | Trawl | Large | SNE | 2+day | 2.00 | 1 | 3.84 | 0.157 |
| 3 | Trawl | Large | ME_NH | 1day | 14.30 | 10 | 18.31 | 0.160 |
| 4 | Trawl | Large | NC/VA | 2+day | 19.92 | 15 | 25.00 | 0.175 |
| 2 | Trawl | Small | NJ/NY | 2+day | 7.58 | 5 | 11.07 | 0.181 |
| 3 | Trawl | Small | NJ/NY | 1day | 1.00 | 1 | 3.84 | 0.317 |
| 1 | Trawl | Large | SNE | 2+day | 3.81 | 4 | 9.49 | 0.432 |
| 4 | Trawl | Small | N_MA | 1day | 0.60 | 1 | 3.84 | 0.439 |
| 2 | Trawl | Medium | N_MA | 1day | 0.50 | 1 | 3.84 | 0.480 |
| 4 | Trawl | Large | NC/VA | 1day | 7.45 | 8 | 15.51 | 0.489 |
| 2 | Trawl | Large | DE/MD | 1day | 0.41 | 1 | 3.84 | 0.520 |
| 4 | Trawl | Small | NJ/NY | 2+day | 8.01 | 9 | 16.92 | 0.533 |
| 4 | Trawl | Medium | NC/VA | 2+day | 0.33 | 1 | 3.84 | 0.564 |
| 2 | Trawl | Small | SNE | 1day | 1.00 | 2 | 5.99 | 0.607 |
| 4 | Trawl | Large | N_MA | 1day | 5.25 | 7 | 14.07 | 0.630 |
| 1 | Trawl | Small | N_MA | 2+day | 1.67 | 3 | 7.81 | 0.644 |
| 1 | Trawl | Large | NJ/NY | 1day | 3.08 | 5 | 11.07 | 0.687 |
| 4 | Trawl | Large | NJ/NY | 2+day | 0.71 | 2 | 5.99 | 0.700 |
| 1 | Trawl | Large | N_MA | 1day | 6.29 | 10 | 18.31 | 0.790 |
| 3 | Trawl | Large | ME_NH | 2+day | 3.02 | 6 | 12.59 | 0.807 |
| 4 | Trawl | Large | N_MA | 2+day | 5.87 | 10 | 18.31 | 0.826 |
| 1 | Trawl | Large | N_MA | 2+day | 1.08 | 4 | 9.49 | 0.897 |
| 1 | Trawl | Large | ME_NH | 1day | 3.40 | 8 | 15.51 | 0.907 |
| 3 | Trawl | Large | N_MA | 2+day | 2.06 | 6 | 12.59 | 0.914 |
| 1 | Trawl | Large | NJ/NY | 2+day | 2.00 | 6 | 12.59 | 0.920 |
| 4 | Trawl | Large | ME_NH | 1day | 0.39 | 3 | 7.81 | 0.943 |
| 2 | Trawl | Large | ME_NH | 2+day | 4.43 | 11 | 19.68 | 0.956 |
| 1 | Trawl | Large | ME_NH | 2+day | 0.85 | 6 | 12.59 | 0.991 |
| 3 | Trawl | Large | DE/MD | 1day | 0.81 | 6 | 12.59 | 0.992 |
| 2 | Trawl | Large | ME_NH | 1day | 1.67 | 9 | 16.92 | 0.996 |

## Overview of Optimization Process



Figure 1. An overview of the optimization process used to allocate sea days to fisheries in the Northeast region.

## Number of trips in 2003/2004 VTR data subsets for otter trawl, gillnet and longline trips

(43,703 trips)


FSB Set
19,872 trips

Total Unique Trips: 43,703
Total Trips with Overlap: 21,429
Sum of Trip Sets: 67,132

Figure 2. Number of trips in the 2003/2004 Vessel Trip Report (VTR), by data subsets (New England groundfish -NEGF; Monkfish - MONK; and summer flounder, scup and black sea bass - FSB) for otter trawl, gillnet and longline trips.

## Number of trips and sea days in the 2003/2004 Observer data subsets for otter trawl, gillnet and longline trips

(1,103 trips and 2,704 sea days)


## FSB Set

342 trips

> Total Unique Trips: 1,103
> Total Trips with Overlap: 817
> Sum of Trip Sets: 2,105

Figure 3. Number of trips and sea days in the 2003/2004 Northeast Fisheries Observer Program, by data subsets (New England groundfish - NEFG; Monkfish MONK; and summer flounder, scup and black sea bass - FSB) for otter trawl, gillnet and longline trips.

# Sampling Fraction: 2003/2004 Observer trips/VTR trips for otter trawl, gillnet and longline trips <br> ( 43,703 unique trips) 

NEGF Set
4.1\%
(944/23,263)


MONK Set
3.4\%
(819 / 23,997)

FSB Set
1.7\%
(342 / 19,872)

Total Unique Trips: 2.5\% (1,103/43,703)
Total Trips with Overlap: $3.8 \%(817 / 21,429)$
Sum of Trip Sets: $3.1 \%(2,105 / 67,132)$

Figure 4. The sampling fraction of 2003/2004 Observed trips to Vessel Trip Report trips, by data subset (New England groundfish - NEGF; Monkfish MONK; and summer flounder, scup and black sea bass - FSB) for otter trawl, gillnet and longline trips.

## Comparisons of Ave Kept (lb)



Figure 5. Comparison of average kept pounds of groundfish (natural log scale) in the Northeast Fisheries Observer Program and Vessel Trip Report data sets for 2003/2004. Each point represents the mean of an individual stratum.

## VTR vs Obsrvr Ave Kept Comparison




Figure 6. The distribution of differences between the average kept pounds (A) and the standard deviation (SD) of average kept pounds (B) of groundfish in the Northeast Fisheries Observer Program (Obsrvr) and the Vessel Trip Report (VTR) data for 2003/2004. Histograms are non-parametric smooths of the stratum specific differences.

## Comparisons of Ave Trip Duration



Figure 7. Comparison of average trip duration (in days) for trips that caught groundfish in the Northeast Fisheries Observer Program and Vessel Trip Report (VTR) data sets for 2003/2004. Each point represents the mean of an individual stratum.

## Ave Trip Duration Comparison




Figure 8. The distribution of differences in average trip duration (in days) (A) and the standard deviation of average trip duration (B) of trips that caught groundfish in the Northeast Fisheries Observer Program (Obsrvr) and the Vessel Trip Report (VTR) data for 2003/2004. Histograms are non-parametric smooths of the stratum specific differences.


Figure 9. Locations of otter trawl fishing effort (color squares) in 2003 from vessels using VMS (vessel monitoring systems). Locations are plotted only for vessels speeds $<=3.5$ knots and data are aggregated to 1' square. Blue squares represent 1-8 hours, green $9-25$ hours; yellow 26-63 hours; orange $64-145$ hours, and red $146-309$ hours. Observed otter trawl tows (white circles) in 2003. Locations are the starting positions of each tow. Taken from Murawski et al. (article in press).


Figure 10. The optimized coefficient of variation (CV) of the discard to kept ratio (d/k) for New England groundfish over a range of sea days; 2,708 sea days ( solid circle) are allocated to cover New England groundfish fisheries in 2005.


Figure 11. The 2003/2004 point estimates of the coefficient of variation (CV) of the discard to kept ( $\mathrm{d} / \mathrm{k}$ ) ratio for New England groundfish caught with otter trawl gear, and the expected coefficient of variation of the discard to kept ratio over a range of sample sizes (number of trips).


Figure 12. The 2003/2004 point estimates of the coefficient of variation (CV) of the discard to kept ( $\mathrm{d} / \mathrm{k}$ ) ratio for New England groundfish caught with gillnet gear, and the expected coefficient of variation of the discard to kept ratio over a range of sample sizes (number of trips).

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[^39]
## Appendix B <br> Detailed Tables and Figures from Chapter 5

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Figure B-1a. Comparison of bluefish discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

REGION


Figure B-1b. Comparison of bluefish discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group ( $\mathrm{sm}<5.5$ inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1c. Comparison of bluefish discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group ( $\mathbf{l g}=5.5$ to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1d. Comparison of bluefish discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1e. Comparison of herring discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm < 5.5 inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.

REGION


Figure B-1f. Comparison of herring discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1g. Comparison of herring discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1h. Comparison of herring discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; $\mathrm{sm}<5.5$ inches, and $\mathrm{xlg}>8$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1i. Comparison of red crab discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

REGION


Figure B-1j. Comparison of red crab discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1k. Comparison of red crab discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; $\mathbf{s m}<5.5$ inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-11. Comparison of red crab discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; $\mathrm{sm}<5.5$ inches, and xlg $>8$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1m. Comparison of scallop discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and $\lg$ => 5.5 inches); fourth root transformation used, each dot represents a trip.


Figure B-1n. Comparison of scallop discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-10. Comparison of scallop discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1p. Comparison of scallop discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; sm < 5.5 inches, and xlg $>8$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1q. Comparison of squid-butterfish-mackerel discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group ( $\mathrm{sm}<5.5$ inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.

REGION


Figure B-1r. Comparison of squid-butterfish-mackerel discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group ( $\mathrm{sm}<5.5$ inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1s. Comparison of squid-butterfish-mackerel discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; $\mathrm{sm}<5.5$ inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1t. Comparison of squid-butterfish-mackerel discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1u. Comparison of monkfish discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

REGION


Figure B-1v. Comparison of monkfish discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group ( $\mathrm{sm}<5.5$ inches, and $\lg =>5.5$ inches) ); fourth root transformation used, each dot represents a trip.


Figure B-1w. Comparison of monkfish discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group ( $\mathbf{l g}=5.5$ to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1x. Comparison of monkfish discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; $\mathbf{s m}<5.5$ inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1y. Comparison of Northeast multispecies (large-mesh) discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group ( $\mathrm{sm}<5.5$ inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1z. Comparison of Northeast multispecies (large-mesh) discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group ( $\mathrm{sm}<5.5$ inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1aa. Comparison of Northeast multispecies (large-mesh) discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; $\mathrm{sm}<5.5$ inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1bb. Comparison of Northeast multispecies (large-mesh) discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; $\mathrm{sm}<5.5$ inches, and xlg $>8$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1cc. Comparison of Northeast multispecies (small-mesh) discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group ( $\mathrm{sm}<5.5$ inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1dd. Comparison of Northeast multispecies (small-mesh) discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group ( $\mathrm{sm}<5.5$ inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1ee. Comparison of Northeast multispecies (small-mesh) discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; $\mathrm{sm}<5.5$ inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1ff. Comparison of Northeast multispecies (small-mesh) discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; $\mathrm{sm}<5.5$ inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1gg. Comparison of skates discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1hh. Comparison of skates discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group ( sm < 5.5 inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1ii. Comparison of skates discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group ( $\mathbf{l g}=5.5$ to 7.99 inches; $\mathrm{sm}<5.5$ inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1jj. Comparison of skates discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; $\mathbf{s m}<5.5$ inches, and $\mathbf{x l g}>8$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1kk. Comparison of spiny dogfish discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.


Figure B-1II. Comparison of spiny dogfish discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1mm. Comparison of spiny dogfish discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; $\mathbf{s m}<5.5$ inches, and xlg $>8$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1nn. Comparison of spiny dogfish discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-10o. Comparison of fluke-scup-black sea bass discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (; sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.


Figure B-1pp. Comparison of fluke-scup-black sea bass discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group ( sm < 5.5 inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1qq. Comparison of fluke-scup-black sea bass discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; $\mathrm{sm}<5.5$ inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1rr. Comparison of fluke-scup-black sea bass discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group ( $\mathbf{l g}=5.5$ to 7.99 inches; $\mathrm{sm}<5.5$ inches, and xlg $>8$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1ss. Comparison of surfclams/quahogs discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1tt. Comparison of surfclams/quahogs discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group ( sm < 5.5 inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1uu. Comparison of tilefish discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.


Figure B-1vv. Comparison of tilefish discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group ( $\mathrm{sm}<5.5$ inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip.


Figure B-1ww. Comparison of tilefish discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.


Figure B-1xx. Comparison of tilefish discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; $\mathrm{sm}<5.5$ inches, and $\mathrm{xlg}>8$ inches); fourth root transformation used, each dot represents a trip.


Figure B-2a. Comparison of sea turtles and trip duration (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.


Figure B-2b. Comparison of sea turtles and kept weight of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.


Figure B-2c. Comparison of seals and trip duration (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.


Figure B-2d. Comparison of seals and kept weight of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.


Figure B-2e. Comparison of whales and trip duration (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.


Figure B-2f. Comparison of whales and kept weight of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.


Figure B-2g. Comparison of dolphins/porpoises and trip duration (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.


Figure B-2h. Comparison of dolphins/porpoises and kept weight of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.


Figure B-2i. Comparison of sea birds and trip duration (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.


Figure B-2j. Comparison of sea birds and kept weight of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.


Figure B-3a. Comparison of Northeast multispecies (large-mesh) discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group ( $\mathrm{sm}<5.5$ inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip. Trips with zero discards of Northeast multispecies (large-mesh) are excluded.


Figure B-3b. Comparison of Northeast multispecies (large-mesh) discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group ( $\mathrm{sm}<5.5$ inches, and $\lg =>5.5$ inches); fourth root transformation used, each dot represents a trip. Trips with zero discards of Northeast multispecies (large-mesh) are excluded


Figure B-3c. Comparison of Northeast multispecies (large-mesh) discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; $\mathrm{sm}<5.5$ inches, and $x \lg >8$ inches); fourth root transformation used, each dot represents a trip. Trips with zero discards of Northeast multispecies (large-mesh) are excluded.


Kept (all species, lbs) Kept (all species, lbs)
Figure B-3d. Comparison of Northeast multispecies (large-mesh) discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group ( $\lg =5.5$ to 7.99 inches; $\mathrm{sm}<5.5$ inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip. Trips with zero discards of Northeast multispecies (large-mesh) are excluded.

## 010,NE



Figure B-4a. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England longline; each dot represents a species group and mesh size.

## 050,MA



Figure B-4b. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic otter trawl; each dot represents a species group and mesh size.

050,NE


Figure B-4c. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England otter trawl; each dot represents a species group and mesh size.

## 132,MA



Figure B-4d. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic scallop dredge; each dot represents a species group and mesh size.

132,NE


Figure B-4e. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England scallop dredge; each dot represents a species group and mesh size.
100,MA


Figure B-4f. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic gillnet; each dot represents a species group and mesh size.

100,NE


Figure B-4g. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England gillnet; each dot represents a species group and mesh size.

## SBRM Amendment

## 010,NE



Figure B-5a. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England longline; each dot represents a species group and mesh size.

## 050,MA



Figure B-5b. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic otter trawl; each dot represents a species group and mesh size.

## 050,NE



Figure B-5c. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England otter trawl; each dot represents a species group and mesh size.

## 132,MA



Figure B-5d. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic scallop dredge each dot represents a species group and mesh size

## 132,NE



Figure B-5e. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England scallop dredge each dot represents a species group and mesh size
100,MA


Figure B-5f. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic gillnet each dot represents a species group and mesh size.

## 100,NE



Figure B-5g. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England gillnet each dot represents a species group and mesh size.

## SBRM Amendment

## 010,NE



Figure B-5h. Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England longline; each dot represents a species group and mesh size.

050,MA


Figure B-5i. Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic otter trawl; each dot represents a species group and mesh size.

050,NE


Figure B-5j Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England otter trawl; each dot represents a species group and mesh size.

## 132,MA



Figure B-5k. Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic scallop dredge each dot represents a species group and mesh size

132,NE


Figure B-5I. Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England scallop dredge each dot represents a species group and mesh size
100,MA


Figure B-5m. Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic gillnet each dot represents a species group and mesh size.

100,NE


Figure B-5n. Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England gillnet each dot represents a species group and mesh size.

Longline with Region $=\mathrm{NE}$


Longline with Region $=\mathrm{NE}$


Figure B-6a. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard-to-daysabsent (DDA), top panel, and discard-to-kept (DK), bottom panel, for New England longline; each dot represents a species group and mesh size.

Otter Trawl with Region = NE


Otter Trawl with Region = NE


Figure B-6b. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3)for discard-to-daysabsent (DDA), top panel, and discard-to-kept (DK), bottom panel, for New England otter trawl; each dot represents a species group and mesh size.

## Otter Trawl Region $=$ MA




Figure B-6c. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3)for discard-to-daysabsent (DDA), top panel, and discard-to-kept (DK), bottom panel, for Mid-Atlantic otter trawl; each dot represents a species group and mesh size.

## Scallop Dredge with Region = NE



Scallop Dredge with Region = NE


Figure B-6d. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard-to-daysabsent (DDA), top panel, and discard-to-kept (DK), bottom panel, for New England scallop dredge; each dot represents a species group and mesh size.

Scallop Dredge with Region = MA


Scallop Dredge with Region = MA


Figure B-6e. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard-to-daysabsent (DDA), top panel, and discard-to-kept (DK), bottom panel, for Mid-Atlantic otter trawl; each dot represents a species group and mesh size.

## Gillnet with Region = NE



Gillnet with Region $=$ NE


Figure B-6f. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard-to-daysabsent (DDA), top panel, and discard-to-kept (DK), bottom panel, for New England gillnet; each dot represents a species group and mesh size.

## Gillnet with Region $=$ MA




Figure B-6g. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard-to-daysabsent (DDA), top panel, and discard-to-kept (DK), bottom panel, for Mid-Atlantic gillnet; each dot represents a species group and mesh size.

Bluefish
Comparisons of Avg Kept (Ib)


VTR Ave Kept (lb)

## Spiny Dogfish

Comparisons of Avg Kept (lb)


Figure B-7. Comparisons of average kept pounds (fourth root transformation used), by species group, in the Northeast Fisheries Observer Program and FVTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

## Fluke-Scup-Black Sea Bass

Comparisons of Avg Kept (Ib)


## Northeast multispecies (Large-mesh)

Comparisons of Avg Kept (lb)


Northeast multispecies (Small-mesh)
Comparisons of Avg Kept (Ib)


Herring
Comparisons of Avg Kept (Ib)


Figure B-7 continued. Comparisons of average kept pounds (fourth root transformation used), by species group, in the Northeast Fisheries Observer Program and FVTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

## Monkfish

Comparisons of Avg Kept (Ib)


## Red Crab

Comparisons of Avg Kept (Ib)


## Mackerel-Squid-Butterfish

Comparisons of Avg Kept (lb)


## Scallops

> Comparisons of Avg Kept (lb)


VTR Ave Kept (lb)
Figure B-7 continued. Comparisons of average kept pounds (fourth root transformation used), by species group, in the Northeast Fisheries Observer Program and FVTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

## Surfclam - Ocean Quahog

Comparisons of Avg Kept (lb)


## Skate Complex

Comparisons of Avg Kept (Ib)


Tilefish
Comparisons of Avg Kept (lb)


Figure B-7 continued. Comparisons of average kept pounds (fourth root transformation used), by species group, in the Northeast Fisheries Observer Program and FVTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

All Species
Comparisons of Avg Kept (lb)


## Bluefish

VTR vs Obsrvr Ave Kept Comparison


Spiny Dogfish
VTR vs Obsrvr Ave Kept Comparison


Figure B-8. The distribution of differences in the average kept pounds of species groups in the Northeast Fisheries Observer Program and the FVTR data for 2004.

## Fluke-Scup-Black Sea Bass

VTR vs Obsrvr Ave Kept Comparison


## Northeast multispecies (Large-mesh)

VTR vs Obsrvr Ave Kept Comparison


Northeast multispecies (Small-mesh)
VTR vs Obsrvr Ave Kept Comparison


## Herring

## VTR vs Obsrvr Ave Kept Comparison



Figure B-8 continued. The distribution of differences in the average kept pounds of species groups in the Northeast Fisheries Observer Program and the FVTR data for 2004.

## Monkfish

VTR vs Obsrvr Ave Kept Comparison


## Mackerel-Squid-Butterfish

VTR vs Obsrvr Ave Kept Comparison


Scallops
VTR vs Obsrvr Ave Kept Comparison


## Skate Complex

## VTR vs Obsrvr Ave Kept Comparison



Figure B-8 continued. The distribution of differences in the average kept pounds of species groups in the Northeast Fisheries Observer Program and the FVTR data for 2004.

## Tilefish

VTR vs Obsrvr Ave Kept Comparison


All species

## VTR vs Obsrvr Ave Kept Comparison



## Bluefish

VTR vs Obsrvr SD Kept Comparison


Spiny Dogfish
VTR vs Obsrvr SD Kept Comparison


Figure B-9. The distribution of difference between the standard deviation of average kept pounds of species groups in the Northeast Fisheries Observer Program and the FVTR data for 2004.

## Fluke-Scup-Black Sea Bass

VTR vs Obsrvr SD Kept Comparison


Northeast multispecies (Large-mesh)
VTR vs Obsrvr SD Kept Comparison


Northeast multispecies (small-mesh)
VTR vs Obsrvr SD Kept Comparison


Herring
VTR vs Obsrvr SD Kept Comparison


Figure B-9 continued. The distribution of difference between the standard deviation of average kept pounds of species groups in the Northeast Fisheries Observer Program and the FVTR data for 2004.

## Monkfish

VTR vs Obsrvr SD Kept Comparison


## Mackerel-Squid-butterfish

VTR vs Obsrvr SD Kept Comparison


Scallop
VTR vs Obsrvr SD Kept Comparison


Skate Complex
VTR vs Obsrvr SD Kept Comparison


Figure B-9 continued. The distribution of difference between the standard deviation of average kept pounds of species groups in the Northeast Fisheries Observer Program and the FVTR data for 2004.

Tilefish
VTR vs Obsrvr SD Kept Comparison


All Species
VTR vs Obsrvr SD Kept Comparison


## ALL TRIPS

Comparisons of Avg Trip Duration


Figure B-10. Comparison of average trip duration (days) for all trips in the Northeast Fisheries Observer Program and FVTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

## ALL TRIPS

Avg Trip Duration Comparison


SD Trip Duration Comparison


Figure B-11. The distribution of differences between the average trip duration (top), and standard deviation of average trip duration (bottom), for trips in the Northeast Fisheries Observer Program and the FVTR data for 2004

Table B-1. Precision (CV) of total composite discards, by species and fleet, based on 2004 observer data .


Note: when discard ratio $=0, \mathrm{CV}$ is null $\left(^{*}\right)$; Gray-shaded cells indicate unlikely species/gear combinations.

Table B-1 continued. Precision (CV) of total composite discards, by species and fleet, based on 2004 observer data .

| Gear Type | Access Area (OpenClosed) | Trip Category (General/ Limited) | Region | $\begin{gathered} \text { mesh } \\ \text { groups } \end{gathered}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 0.335 | 0.401 | 0.389 | * | * | * | * | 1.191 | * | * | * | * | 0.569 |  |
| Longline | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Otter Trawl | all | all | NE | small | 0.233 | 0.658 | 0.696 | 0.409 | 0.304 | 0.332 | 0.430 | 0.546 | 0.593 | 0.459 | 0.291 | 0.753 | 0.321 |  |
| Otter Trawl | all | all | NE | large | 0.101 | 0.176 | 0.265 | 0.222 | 0.254 | 0.145 | 0.429 | 0.640 | 0.248 | 0.235 | 0.206 | 0.424 | 0.161 |  |
| Otter Trawl | all | all | MA | small | 0.326 | * | * | 1.081 | 1.476 | 0.489 | 0.561 | * | 0.905 | 0.989 | 0.399 | * | 1.506 |  |
| Otter Trawl | all | all | MA | large | 0.251 | 3.122 | * | 0.669 | * | 0.292 | 0.413 | 3.122 | 0.974 | 3.133 | 0.312 | * | 0.477 |  |
| Scallop Trawl | open | limited | MA | all | 0.000 | * | * | * | * | * | * | * | * | * | 0.000 | * | * |  |
| Scallop Trawl | open | general | MA | all | 0.170 | * | * | 1.036 | * | 0.471 | 0.464 | * | * | 0.640 | 0.237 | * | * |  |
| Shrimp Trawl | all | all | NE | all | 0.224 | 0.352 | 0.659 | 0.552 | 0.305 | 0.928 | 0.269 | 0.473 | 0.374 | 0.232 | 0.207 | * | 0.960 |  |
| Shrimp Trawl | all | all | MA | all | * | * | * | * | * | * | * | * | * | * | * | * | * |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | * | * | * | * | * | * | * | * | * | * | * | * | * |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 0.092 | 0.121 | 0.186 | 0.198 | 0.281 | 0.406 | 0.288 | 0.182 | 0.261 | 0.231 | 0.432 | 0.449 | 0.437 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 0.159 | 0.175 | 0.246 | 0.361 | 0.337 | 1.018 | 0.557 | 0.317 | 0.364 | 0.372 | 0.815 | 0.436 | 0.421 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | * | * | * | * | * | * | * | * | * | * | * | * | * |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 0.868 | * | * | * | * | * | * | * | * | * | 0.868 | * | * |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | * | * | * | * | * | * | * | * | * | * | * | * | * |  |
| Scallop Dredge | open | limited | NE | all | 0.480 | 0.850 | 0.848 | 0.637 | 0.848 | 0.485 | 1.022 | 0.848 | * | 0.525 | 0.454 | * | 0.656 |  |
| Scallop Dredge | open | limited | MA | all | 0.242 | * | * | 0.705 | 0.809 | 0.496 | 0.581 | * | * | 0.521 | 0.323 | * | 1.091 |  |
| Scallop Dredge | open | general | NE | all | 0.358 | 1.226 | * | 0.494 | 0.908 | 0.902 | 0.213 | * | * | * | 0.438 | * | 1.287 |  |
| Scallop Dredge | open | general | MA | all | 0.311 | * | * | 0.865 | 0.857 | 0.650 | 0.421 | * | * | 0.653 | 0.333 | * | * |  |
| Scallop Dredge | closed | limited | NE | all | 0.159 | 0.510 | 0.423 | 0.211 | 0.829 | 0.188 | 0.200 | * | * | 0.478 | 0.355 | 0.179 | 0.427 |  |
| Scallop Dredge | closed | limited | MA | all | 0.712 | * | * | 1.256 | 0.320 | 0.350 | 1.269 | * | * | 0.602 | 0.886 | * | 1.239 |  |
| Scallop Dredge | closed | general | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Scallop Dredge | closed | general | MA | all | * | * | * | * | * | * | * | * | * | * | * | * | * |  |
| Mid-water paired \& single Trawl | all | all | NE | all | 0.669 | 1.198 | 0.951 | * | 1.155 | 1.203 | 1.298 | 0.967 | 0.996 | 1.604 | * | * | * |  |
| Mid-water paired \& single Trawl | all | all | MA | all | 0.708 | * | * | * | * | 1.146 | * | * | * | 0.541 | * | * | * |  |
| Fish Pots/ Traps | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fish Pots/ Traps | all | all | MA | all | * | * | * | * | * | * | * | * | * | * | * | * | * |  |
| Purse Seine | all | all | NE | all | 0.973 | * | * | * | * | * | * | * | 0.973 | * | * | * | * |  |
| Purse Seine | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Hand Line | all | all | NE | all | 4.030 | 4.030 | * | * | * | * | * | * | * | * | * | * | * |  |
| Hand Line | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Scottish Seine | all | all | NE | all | 0.289 | 0.279 | 0.279 | * | 0.279 | * | 0.543 | * | * | 0.279 | 0.354 | * | * |  |
| Clam Quahog Dredge | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Clam Quahog Dredge | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Crab Pots | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Crab Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lobster Pots | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lobster Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Note: when discard ratio $=0, \mathrm{CV}$ is null ( ${ }^{*}$ ); Gray-shaded cells indicate unlikely species/gear combinations.

Table B-1 continued. Precision (CV) of total composite discards, by species and fleet, based on 2004 observer data .

| Gear Type | Access Area (OpenClosed) | Trip Category (General/ Limited) | Region | mesh groups |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 0.910 | * | * | 0.910 | 0.614 | 0.654 | * | * | * | * | * | * |  |
| Longline | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Otter Trawl | all | all | NE | small | 0.235 | 0.219 | 1.511 | 0.406 | 0.691 | 0.322 | 0.309 | 0.276 | 0.551 | 0.708 | 1.028 | 0.304 |  |
| Otter Trawl | all | all | NE | large | 0.182 | 0.227 | 0.322 | 0.353 | 0.175 | 0.245 | 0.319 | 0.328 | 0.918 | 0.833 | 1.512 | 0.529 |  |
| Otter Trawl | all | all | MA | small | 0.508 | 0.625 | 0.683 | 0.587 | 0.222 | 0.367 | 0.386 | 0.278 | 0.560 | 0.502 | 0.464 | 1.155 |  |
| Otter Trawl | all | all | MA | large | 0.827 | 0.451 | * | 1.811 | 0.209 | 0.557 | 0.246 | 0.266 | 0.354 | 0.652 | 0.609 | * |  |
| Scallop Trawl | open | limited | MA | all | * | * | * | * | 0.000 | * | 0.000 | 0.000 | * | 0.000 | * | * |  |
| Scallop Trawl | open | general | MA | all | 0.496 | 0.508 | * | 1.141 | 0.347 | 0.675 | 0.505 | 0.608 | 0.731 | 0.638 | * | * |  |
| Shrimp Trawl | all | all | NE | all | 0.557 | 0.567 | * | 0.537 | 0.799 | 0.960 | * | * | * | * | * | * |  |
| Shrimp Trawl | all | all | MA | all | * | * | * | * | * | * | * | * | * | * | * | * |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | * | * | * | * | * | 0.000 | * | * | * | * | * | * |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 0.183 | 0.238 | * | 0.219 | 0.228 | 0.106 | 0.845 | 0.898 | * | 1.602 | * | * |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 0.624 | 0.207 | * | 0.864 | 0.117 | 0.162 | 0.233 | 0.233 | 0.904 | * | * | 0.256 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | * | * | * | * | * | 0.000 | 0.000 | 0.000 | * | * | * | * |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | * | * | * | * | 1.118 | 1.083 | * | * | * | * | * | * |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | * | * | * | * | 0.115 | 0.129 | 0.303 | 0.303 | * | * | * | * |  |
| Scallop Dredge | open | limited | NE | all | 0.414 | 0.764 | 1.173 | 0.352 | 0.236 | 0.515 | 0.458 | 0.474 | 0.322 | 0.622 | 0.391 | * |  |
| Scallop Dredge | open | limited | MA | all | 0.758 | 0.856 | 0.738 | 0.402 | 0.126 | 0.230 | 0.259 | 0.272 | 0.704 | 0.558 | 0.771 | * |  |
| Scallop Dredge | open | general | NE | all | 0.104 | 1.300 | * | 0.103 | 0.177 | 0.318 | 0.092 | 0.092 | * | * | 1.287 | * |  |
| Scallop Dredge | open | general | MA | all | 0.482 | 0.467 | * | 0.857 | 0.202 | 0.550 | 0.461 | 0.461 | * | * | 0.830 | * |  |
| Scallop Dredge | closed | limited | NE | all | 0.396 | 0.403 | 0.489 | 0.448 | 0.126 | 0.326 | 0.291 | 0.293 | 0.218 | 0.161 | 0.198 | * |  |
| Scallop Dredge | closed | limited | MA | all | 0.268 | 0.323 | * | 0.282 | 0.142 | 0.425 | 0.383 | 0.385 | 1.011 | 0.333 | 0.321 | * |  |
| Scallop Dredge | closed | general | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Scallop Dredge | closed | general | MA | all | * | * | * | * | 0.000 | * | 0.000 | 0.000 | * | * | * | * |  |
| Mid-water paired \& single Trawl | all | all | NE | all | 0.994 | 1.000 | * | 0.748 | 1.177 | 0.418 | 0.628 | * | 0.671 | 1.626 | * | * |  |
| Mid-water paired \& single Trawl | all | all | MA | all | 0.539 | 0.539 | * | 0.539 | * | 0.246 | 1.165 | 1.142 | * | 1.176 | * | * |  |
| Fish Pots/ Traps | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fish Pots/ Traps | all | all | MA | all | * | * | * | * | * | * | 0.161 | * | 0.163 | 0.161 | * | * |  |
| Purse Seine | all | all | NE | all | * | * | * | * | * | 0.972 | * | * | * | * | * | * |  |
| Purse Seine | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Hand Line | all | all | NE | all | * | * | * | * | * | * | * | * | * | * | * | * |  |
| Hand Line | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Scottish Seine | all | all | NE | all | 0.279 | 0.279 | * | 0.279 | 0.319 | * | 0.253 | 0.259 | 0.808 | 0.808 | * | * |  |
| Clam Quahog Dredge | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Clam Quahog Dredge | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Crab Pots | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Crab Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lobster Pots | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lobster Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |

Note: when discard ratio $=\mathbf{0}, \mathrm{CV}$ is null ( $\left.{ }^{( }\right)$; Gray-shaded cells indicate unlikely species/gear combinations.

Table B-1 continued. Precision (CV) of total composite discards, by species and fleet, based on 2004 observer data .


Note: when discard ratio $=0$, CV is null ( ${ }^{*}$ ); Gray-shaded cells indicate unlikely species/gear combinations.

Table B-1 continued. Precision (CV) of total composite discards, by species and fleet, based on 2004 observer data.


Note: when discard ratio = $0, \mathrm{CV}$ is null (*); Gray-shaded cells indicate unlikely species/gear combinations.

Table B-2. Ranking of total discards within fleet (fish and protected species ranked separately) based on 2004 observer data.


Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Table B-2 continued. Ranking of total discards within fleet (fish and protected species ranked separately) based on 2004 observer data.

| Gear Type | Access Area (OpenClosed) | Trip Category (General/ Limited) | Region | mesh groups |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 2 | - 4 | 8 | 8 | 8 | 8 | 6 | 8 | 8 | 8 | 8 | 5 |  |
| Longline | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Otter Trawl | all | all | NE | small | 18 | 13 | 22 | 20 | 14 | 15 | 28 | 24 | 17 | 26 | 30 | 21 |  |
| Otter Trawl | all | all | NE | large | 8 | 10 | 7 | 9 | 5 | 14 | 16 | 13 | 18 | 4 | 21 | 11 |  |
| Otter Trawl | all | all | MA | small | 28 | 28 | 24 | 25 | 17 | 16 | 28 | 21 | 23 | 12 | 28 | 19 |  |
| Otter Trawl | all | all | MA | large | 22 | 26 | 17 | 26 | 9 | 10 | 19 | 25 | 23 | 7 | 26 | 11 |  |
| Scallop Trawl | open | limited | MA | all | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 3 | 8 | 8 |  |
| Scallop Trawi | open | general | MA | all | 20 | 20 | 18 | 20 | 17 | 8 | 20 | 20 | 13 | 5 | 20 | 20 |  |
| Shrimp Trawl | all | all | NE | all | 8 | 15 | 7 | 3 | 13 | 5 | 6 | 12 | 11 | 9 | 20 | 16 |  |
| Shrimp Trawl | all | all | MA | all | * | * | * | * | * | * | * | * | * | * | * | * |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 2 | 10 | 5 | 13 | 21 | 7 | 4 | 11 | 6 | 20 | 18 | 17 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 4 | 13 | 10 | 20 | 26 | 15 | 7 | 22 | 9 | 25 | 17 | 12 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |  |
| Scallop Dredge | open | limited | NE | all | 19 | 22 | 11 | 23 | 7 | 6 | 25 | 26 | 20 | 10 | 26 | 15 |  |
| Scallop Dredge | open | limited | MA | all | 24 | 24 | 16 | 21 | 8 | 15 | 24 | 24 | 10 | 6 | 24 | 17 |  |
| Scallop Dredge | open | general | NE | all | 13 | 17 | 4 | 12 | 10 | 5 | 17 | 17 | 17 | 8 | 17 | 14 |  |
| Scallop Dredge | open | general | MA | all | 16 | 16 | 13 | 13 | 11 | 6 | 16 | 16 | 10 | 4 | 16 | 16 |  |
| Scallop Dredge | closed | limited | NE | all | 15 | 14 | 4 | 10 | 11 | 9 | 29 | 29 | 16 | 6 | 26 | 21 |  |
| Scallop Dredge | closed | limited | MA | all | 25 | 25 | 6 | 18 | 7 | 11 | 25 | 25 | 16 | 8 | 25 | 22 |  |
| Scallop Dredge | closed | general | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Scallop Dredge | closed | general | MA | all | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |  |
| Mid-water paired \& single Trawl | all | all | NE | all | 16 | 6 | 23 | 13 | 18 | 19 | 8 | 5 | 14 | 23 | 23 | 23 |  |
| Mid-water paired \& single Trawl | all | all | MA | all | 15 | 15 | 15 | 15 | 13 | 15 | 15 | 15 | 12 | 15 | 15 | 15 |  |
| Fish Pots/ Traps | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fish Pots/ Traps | all | all | MA | all | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |  |
| Purse Seine | all | all | NE | all | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 5 | 5 | 5 | 5 |  |
| Purse Seine | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Hand Line | all | all | NE | all | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |  |
| Hand Line | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Scottish Seine | all | all | NE | all | 7 | 11 | 13 | 8 | 13 | 9 | 13 | 13 | 11 | 2 | 13 | 13 |  |
| Clam Quahog Dredge | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Clam Quahog Dredge | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Crab Pots | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Crab Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lobster Pots | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lobster Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |

Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Table B-2 continued. Ranking of total discards within fleet (fish and protected species ranked separately) based on 2004 observer data.


Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Table B-2 continued. Ranking of total discards within fleet (fish and protected species ranked separately) based on 2004 observer data.


Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Table B-2 continued. Ranking of total discards within fleet (fish and protected species ranked separately) based on 2004 observer data.


Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Table B-3. Ranking of total discards within species group (fish and protected species ranked separately) based on 2004 observer data.

| Gear Type | Access Area (OpenClosed) | Trip Category (General/ Limited) | Region | mesh groups |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 14 | 13 | * | 11 | 19 | 13 | 15 | 14 | 16 | 21 |  |  |
| Longline | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |
| Otter Trawl | all | all | NE | small | 2 | 2 | * | 2 | 13 | 2 | 1 | 1 | 1 | 4 |  |  |
| Otter Trawl | all | all | NE | large | 4 | 5 | * | 1 | 11 | 7 | 4 | 8 | 7 | 3 |  |  |
| Otter Trawl | all | all | MA | small | 3 | 7 | * | 6 | 10 | 3 | 2 | 2 | 2 | 11 |  |  |
| Otter Trawl | all | all | MA | large | 8 | 9 | * | 11 | 7 | 8 | 8 | 3 | 5 | 10 |  |  |
| Scallop Trawl | open | limited | MA | all | 14 | 13 | * | 11 | 3 | 13 | 15 | 6 | 16 | 13 |  |  |
| Scallop Trawl | open | general | MA | all | 11 | 13 | * | 3 | 8 | 13 | 13 | 9 | 8 | 14 |  |  |
| Shrimp Trawl | all | all | NE | all | 14 | 3 | * | 11 | 16 | 13 | 15 | 14 | 12 | 19 |  |  |
| Shrimp Trawl | all | all | MA | all | * | * | * | * | * | * | * | * | * | * |  |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 14 | 13 | * | 11 | 19 | 6 | 15 | 14 | 16 | 21 |  |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 7 | 6 | * | 4 | 17 | 5 | 10 | 14 | 11 | 15 |  |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 5 | 8 | * | 5 | 15 | 4 | 15 | 14 | 13 | 5 |  |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 14 | 13 | * | 11 | 19 | 13 | 15 | 14 | 3 | 21 |  |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 1 | 13 | * | 11 | 19 | 13 | 15 | 14 | 16 | 21 |  |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | 6 | 13 | * | 11 | 14 | 13 | 15 | 14 | 16 | 12 |  |  |
| Scallop Dredge | open | limited | NE | all | 14 | 13 | * | 7 | 2 | 13 | 5 | 5 | 6 | 1 |  |  |
| Scallop Dredge | open | limited | MA | all | 14 | 13 | * | 8 | 1 | 10 | 7 | 4 | 9 | 2 |  |  |
| Scallop Dredge | open | general | NE | all | 14 | 13 | * | 11 | 9 | 13 | 12 | 14 | 16 | 6 |  |  |
| Scallop Dredge | open | general | MA | all | 14 | 13 | * | 11 | 6 | 13 | 15 | 13 | 16 | 9 |  |  |
| Scallop Dredge | closed | limited | NE | all | 10 | 12 | * | 9 | 4 | 12 | 14 | 7 | 14 | 7 |  |  |
| Scallop Dredge | closed | limited | MA | all | 13 | 11 | * | 10 | 5 | 9 | 11 | 11 | 15 | 8 |  |  |
| Scallop Dredge | closed | general | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |
| Scallop Dredge | closed | general | MA | all | 14 | 13 | * | 11 | 12 | 13 | 15 | 14 | 16 | 16 |  |  |
| Mid-water paired \& single Trawl | all | all | NE | all | 9 | 1 | * | 11 | 18 | 1 | 6 | 10 | 4 | 17 |  |  |
| Mid-water paired \& single Trawl | all | all | MA | all | 12 | 10 | * | 11 | 19 | 11 | 3 | 12 | 10 | 18 |  |  |
| Fish Pots/ Traps | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |
| Fish Pots/ Traps | all | all | MA | all | 14 | 13 | * | 11 | 19 | 13 | 15 | 14 | 16 | 20 |  |  |
| Purse Seine | all | all | NE | all | 14 | 4 | * | 11 | 19 | 13 | 9 | 14 | 16 | 21 |  |  |
| Purse Seine | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |
| Hand Line | all | all | NE | all | 14 | 13 | * | 11 | 19 | 13 | 15 | 14 | 16 | 21 |  |  |
| Hand Line | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |
| Scottish Seine | all | all | NE | all | 14 | 13 | * | 11 | 19 | 13 | 15 | 14 | 16 | 21 |  |  |
| Clam Quahog Dredge | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |
| Clam Quahog Dredge | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |
| Crab Pots | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |
| Crab Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |
| Lobster Pots | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |
| Lobster Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |

Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Table B-3 continued. Ranking of total discards within species group (fish and protected species ranked separately) based on 2004 observer data.

| Gear Type | Access Area (OpenClosed) | Trip Category (General/ Limited) | Region | mesh groups |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 3 | - 3 | 15 | 15 | 17 | 17 | 8 | 10 | 17 | 18 | 6 | 5 |  |
| Longline | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Otter Trawl | all | all | NE | small | 5 | 1 | 3 | 2 | 2 | 1 | 4 | 2 | 1 | 10 | 3 | 2 |  |
| Otter Trawl | all | all | NE | large | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 |  |
| Otter Trawl | all | all | MA | small | 14 | 11 | 12 | 10 | 6 | 4 | 10 | 5 | 7 | 4 | 6 | 6 |  |
| Otter Trawl | all | all | MA | large | 10 | 11 | 9 | 15 | 4 | 5 | 7 | 9 | 13 | 3 | 6 | 3 |  |
| Scallop Trawl | open | limited | MA | all | 14 | 11 | 15 | 15 | 17 | 17 | 10 | 10 | 17 | 2 | 6 | 14 |  |
| Scallop Trawl | open | general | MA | all | 14 | 11 | 14 | 15 | 14 | 13 | 10 | 10 | 12 | 11 | 6 | 14 |  |
| Shrimp Trawil | all | all | NE | all | 7 | 8 | 7 | 3 | 10 | 7 | 5 | 6 | 6 | 14 | 6 | 10 |  |
| Shrimp Trawl | all | all | MA | all | * | * | * | * | * | * | * | * | * | * | * | * |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 14 | 11 | 15 | 15 | 17 | 17 | 10 | 10 | 17 | 18 | 6 | 14 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 2 | 5 | 4 | 5 | 12 | 10 | 2 | 4 | 4 | 16 | 4 | 8 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 4 | 6 | 8 | 8 | 16 | 12 | 3 | 8 | 5 | 17 | 2 | 7 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 14 | 11 | 15 | 15 | 17 | 17 | 10 | 10 | 17 | 18 | 6 | 14 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 14 | 11 | 15 | 15 | 17 | 17 | 10 | 10 | 17 | 6 | 6 | 14 |  |
| Sink, Anchor, Drift Gillnet\| | all | all | MA | xlg | 14 | 11 | 15 | 15 | 17 | 17 | 10 | 10 | 17 | 18 | 6 | 14 |  |
| Scallop Dredge | open | limited | NE | all | 8 | 9 | 5 | 13 | 3 | 3 | 9 | 10 | 9 | 9 | 6 | 4 |  |
| Scallop Dredge | open | limited | MA | all | 14 | 11 | 11 | 12 | 5 | 11 | 10 | 10 | 3 | 5 | 6 | 9 |  |
| Scallop Dredge | open | general | NE | all | 13 | 11 | 6 | 7 | 9 | 8 | 10 | 10 | 17 | 12 | 6 | 11 |  |
| Scallop Dredge | open | general | MA | all | 14 | 11 | 13 | 11 | 11 | 9 | 10 | 10 | 10 | 8 | 6 | 14 |  |
| Scallop Dredge | closed | limited | NE | all | 9 | 7 | 2 | 4 | 7 | 6 | 10 | 10 | 11 | 7 | 5 | 12 |  |
| Scallop Dredge | closed | limited | MA | all | 14 | 11 | 10 | 14 | 8 | 14 | 10 | 10 | 14 | 15 | 6 | 13 |  |
| Scallop Dredge | closed | general | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Scallop Dredge | closed | general | MA | all | 14 | 11 | 15 | 15 | 17 | 17 | 10 | 10 | 17 | 18 | 6 | 14 |  |
| Mid-water paired \& single Trawi\| | all | all | NE | all | 11 | - 4 | 15 | 6 | 13 | 16 | 6 | 3 | 8 | 18 | 6 | 14 |  |
| Mid-water paired \& single Trawl | all | all | MA | all | 14 | 11 | 15 | 15 | 15 | 17 | 10 | 10 | 15 | 18 | 6 | 14 |  |
| Fish Pots/ Traps | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fish Pots/ Traps | all | all | MA | all | 14 | 11 | 15 | 15 | 17 | 17 | 10 | 10 | 17 | 18 | 6 | 14 |  |
| Purse Seine | all | all | NE | all | 14 | 11 | 15 | 15 | 17 | 17 | 10 | 7 | 17 | 18 | 6 | 14 |  |
| Purse Seine | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Hand Line | all | all | NE | all | 6 | 11 | 15 | 15 | 17 | 17 | 10 | 10 | 17 | 18 | 6 | 14 |  |
| Hand Line | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Scottish Seine | all | all | NE | all | 12 | 10 | 15 | 9 | 17 | 15 | 10 | 10 | 16 | 13 | 6 | 14 |  |
| Clam Quahog Dredge | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Clam Quahog Dredge | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Crab Pots | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Crab Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lobster Pots | all | all | NE | all |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lobster Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  |  |  |  |  |

Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Table B-3 continued. Ranking of total discards within species group (fish and protected species ranked separately) based on 2004 observer data.


Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Table B-3 continued. Ranking of total discards within species group (fish and protected species ranked separately) based on 2004 observer data.


Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Table B-3 continued. Ranking of total discards within species group (fish and protected species ranked separately) based on 2004 observer data.

| Gear Type | Access Area (OpenClosed) | Trip Category (General/ Limited) | Region | mesh groups |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 4 | * | * * | 5 | 3 | 2 | 4 | * | 12 |  |
| Longline | all | all | MA | all | * | * | * | * | * | * | * | * | * | pilot |
| Otter Trawl | all | all | NE | small | 1 | * | * | 3 | 1 | 2 | 4 | * | 6 |  |
| Otter Trawl | all | all | NE | large | 2 | * | * | 1 | 3 | 2 | 4 | * | 5 |  |
| Otter Trawl | all | all | MA | small | 4 | * | * | 5 | 2 | 2 | 4 | * | 11 |  |
| Otter Trawl | all | all | MA | large | 4 | * | * | 5 | 3 | 2 | 4 | * | 3 |  |
| Scallop Trawl | open | limited | MA | all | 4 | * | * | 5 | 3 | 2 | 4 | * | 14 | pilot |
| Scallop Trawl | open | general | MA | all | * | * | * | * | * | * | * | * | * | pilot |
| Shrimp Trawl | all | all | NE | all | * | * | * | * | * | * | * | * | * |  |
| Shrimp Trawl | all | all | MA | all | * | * | * | * | * | * | * | * | * | pilot |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | * | * | * | * | * | * | * | * | * | pilot |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 4 | * | * | 4 | 3 | 2 | 2 | * | 1 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 4 | * | * | 5 | 3 | 1 | 1 | * | 9 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 4 | * | * | 5 | 3 | 2 | 4 | * | 8 | pilot for fish |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 4 | * | * | 5 | 3 | 2 | 4 | * | 7 | pilot for fish |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | 4 | * | * | 5 | 3 | 2 | 3 | * | 10 | pilot for fish |
| Scallop Dredge | open | limited | NE | all | 4 | * | * | 5 | 3 | 2 | 4 | * | 4 |  |
| Scallop Dredge | open | limited | MA | all | 4 | * | * | 5 | 3 | 2 | 4 | * | 14 |  |
| Scallop Dredge | open | general | NE | all | * | * | * | * | * | * | * | * | * | pilot |
| Scallop Dredge | open | general | MA | all | * | * | * | * | * | * | * | * | * |  |
| Scallop Dredge | closed | limited | NE | all | 4 | * | * | 5 | 3 | 2 | 4 | * | 13 |  |
| Scallop Dredge | closed | limited | MA | all | * | * | * | * | * | * | * | * | * |  |
| Scallop Dredge | closed | general | NE | all |  |  |  |  |  |  |  |  |  | pilot |
| Scallop Dredge | closed | general | MA | all | * | * | * | * | * | * | * | * | * | pilot |
| Mid-water paired \& single Trawl | all | all | NE | all | 3 | * | * | 2 | 3 | 2 | 4 | * | 2 |  |
| Mid-water paired \& single Trawl | all | all | MA | all | * | * | * | * | * | * | * | * | * |  |
| Fish Pots/ Traps | all | all | NE | all |  |  |  |  |  |  |  |  |  | pilot |
| Fish Pots/ Traps | all | all | MA | all | * | * | * | * | * | * | * | * | * | pilot |
| Purse Seine | all | all | NE | all | * | * | * | * | * | * | * | * | * |  |
| Purse Seine | all | all | MA | all | * | * | * | * | * | * | * | * | * | pilot |
| Hand Line | all | all | NE | all | * | * | * | * | * | * | * | * | * | pilot |
| Hand Line | all | all | MA | all | * | * | * | * | * | * | * | * | * | pilot |
| Scottish Seine | all | all | NE | all | * | * | * | * | * | * | * | * | * | pilot |
| Clam Quahog Dredge | all | all | NE | all | * | * | * | * | * | * | * | * | * | pilot |
| Clam Quahog Dredge | all | all | MA | all |  |  |  |  |  |  |  |  |  | pilot |
| Crab Pots | all | all | NE | all |  |  |  |  |  |  |  |  |  | pilot |
| Crab Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  | pilot |
| Lobster Pots | all | all | NE | all | * | * | * | * | * | * | * | * | * | pilot |
| Lobster Pots | all | all | MA | all |  |  |  |  |  |  |  |  |  | pilot |

Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Table B-4. Number of sea days needed to achieve a CV of 30 percent based on the total composite discards.


Gray-shaded cells indicate unlikely combinations of species/gear.

Table B-4 continued. Number of sea days needed to achieve a CV of 30 percent based on the total composite discards.


Gray-shaded cells indicate unlikely combinations of species/gear.

Table B-4 continued. Number of sea days needed to achieve a CV of 30 percent based on the total composite discards.


Gray-shaded cells indicate unlikely combinations of species/gear.

Table B-4 continued. Number of sea days needed to achieve a CV of 30 percent based on the total composite discards.


Gray-shaded cells indicate unlikely combinations of species/gear.

Table B-4 continued. Number of sea days needed to achieve a CV of 30 percent based on the total composite discards.


Gray-shaded cells indicate unlikely combinations of species/gear.

Table B-5. Number of trips needed to achieve a CV of 30 percent based on the total composite discards.

| Gear Type | Access Area (OpenClosed) | Trip Category (General/ Limited) | Region | mesh groups |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 |  |
| Longline | all | all | MA | all | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Otter Trawl | all | all | NE | small | 364 | 291 | 70 | 280 | 659 | 82 | 576 | 161 | 150 | 209 | 250 |  |
| Otter Trawl | all | all | NE | large | 11227 | 5420 | 304 | 336 | 520 | 1331 | 1088 | 4138 | 1501 | 2216 | 34 |  |
| Otter Trawl | all | all | MA | small | 1189 | 995 | 104 | 2885 | 619 | 599 | 1513 | 725 | 904 | 618 | 265 |  |
| Otter Trawl | all | all | MA | large | 1879 | 458 | 177 | 177 | 161 | 125 | 194 | 390 | 170 | 204 | 72 |  |
| Scallop Trawl | open | limited | MA | all | 12 | -12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Scallop Trawl | open | general | MA | all | 72 | - 25 | 25 | 196 | 56 | 85 | 25 | 132 | 94 | 129 | 54 |  |
| Shrimp Trawl | all | all | NE | all | 42 | - 91 | 42 | 42 | 350 | 361 | 42 | 42 | 42 | 361 | 22 |  |
| Shrimp Trawl | all | all | MA | all | 13 | \| 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 12 | -12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 327 | - 359 | 104 | 1913 | 3216 | 2774 | 2900 | 3990 | 104 | 4517 | 301 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 175 | 657 | 94 | 2139 | 822 | 1114 | 1119 | 94 | 94 | 2760 | 156 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 58 | -58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 100 | - 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | 94 | - 51 | 51 | 51 | 211 | 51 | 51 | 51 | 51 | 51 | 76 |  |
| Scallop Dredge | open | limited | NE | all | 25 | 5 25 | 25 | 146 | 7 | 126 | 25 | 65 | 298 | 558 | 29 |  |
| Scallop Dredge | open | limited | MA | all | 36 | 36 | 36 | 966 | 31 | 71 | 966 | 184 | 109 | 280 | 24 |  |
| Scallop Dredge | open | general | NE | all | 71 | 71 | 71 | 71 | 149 | 130 | 71 | 130 | 71 | 71 | 89 |  |
| Scallop Dredge | open | general | MA | all | 69 | -69 | 69 | 69 | 39 | 210 | 69 | 69 | 210 | 69 | 12 |  |
| Scallop Dredge | closed | limited | NE | all | 449 | 40 | 15 | 171 | 19 | 151 | 38 | 66 | 178 | 32 | 50 |  |
| Scallop Dredge | closed | limited | MA | all | 194 | 84 | 12 | 37 | 17 | 37 | 83 | 40 | 108 | 35 | 31 |  |
| Scallop Dredge | closed | general | NE | all | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Scallop Dredge | closed | general | MA | all | 15 | - 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |  |
| Mid-water paired \& single Trawl | all | all | NE | all | 266 | 285 | 21 | 21 | 683 | 132 | 132 | 316 | 681 | 652 | 274 |  |
| Mid-water paired \& single Trawi\| | all | all | MA | all | 52 | 130 | 12 | 12 | 12 | 48 | 52 | 47 | 52 | 52 | 141 |  |
| Fish Pots/ Traps | all | all | NE | all | 19 | - 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |  |
| Fish Pots/ Traps | all | all | MA | all | 37 | - 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 97 |  |
| Purse Seine | all | all | NE | all | 10 | 108 | 10 | 10 | 10 | 102 | 10 | 102 | 10 | 10 | 10 |  |
| Purse Seine | all | all | MA | all | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |  |
| Hand Line | all | all | NE | all | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 |  |
| Hand Line | all | all | MA | all | 126 | - 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 |  |
| Scottish Seine | all | all | NE | all | 12 | \| 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Clam Quahog Dredge | all | all | NE | all | 69 | - 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |  |
| Clam Quahog Dredge | all | all | MA | all | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |  |
| Crab Pots | all | all | NE | all | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Crab Pots | all | all | MA | all | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |  |
| Lobster Pots | all | all | NE | all | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 |  |
| Lobster Pots | all | all | MA | all | 75 | - 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 |  |
| Total Trips |  |  |  |  | 17,678 | 10,260 | 2,306 | 10,588 | 8,647 | 8,594 | 10,019 | 11,808 | 5,891 | 13,889 | 3,015 |  |
| Total Trips excluding shaded cells |  |  |  |  | 15,925 | 9,034 | 0 | 1,539 | 2,468 | 7,333 | 8,922 | 6,413 | 4,300 | 5,539 | 2,219 |  |

Gray-shaded cells indicate unlikely combinations of species/gear.

Table B-5 continued. Number of trips needed to achieve a CV of 30 percent based on the total composite discards.

| Gear Type | Access Area (OpenClosed) | Trip Category (General/ Limited) | Region | $\begin{gathered} \text { mesh } \\ \text { groups } \\ \hline \end{gathered}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 21 | 130 | 28 | 86 | 26 | 26 | 26 | 242 | 26 | 26 | 26 | 26 | 59 |  |
| Longline | all | all | MA | all | 12 | 212 | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Otter Trawl | all | all | NE | small | 88 | $8{ }^{614}$ | 4 624 | 4255 | 146 | 173 | 281 | 446 | 497 | 319 | 133 | 702 | 161 |  |
| Otter Trawl | all | all | NE | large | 45 | 5135 | 303 | 313 | 279 | 92 | 774 | 1572 | 266 | 239 | 185 | 755 | 113 |  |
| Otter Trawl | all | all | MA | small | 229 | 9104 | 104 | 41472 | 2050 | 481 | 624 | 104 | 1210 | 1374 | 337 | 104 | 2083 |  |
| Otter Trawi | all | all | MA | large | 52 | 2.3040 | 177 | 7351 | 177 | 71 | 141 | 3040 | 681 | 3048 | 81 | 177 | 185 |  |
| Scallop Trawl | open | limited | MA | all | 12 | 212 | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Scallop Trawi | open | general | MA | all |  | 1.25 | 25 | 5424 | 25 | 125 | 207 | 25 | 25 | 196 | 81 | 25 | 25 |  |
| Shrimp Trawl | all | all | NE | all | 20 | 20 49 | 169 | 9 120 | 37 | 325 | 29 | 89 | 56 | 22 | 17 | 42 | 346 |  |
| Shrimp Trawl | all | all | MA | all | 13 | 3 13 | 13 | 313 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 12 | $2{ }^{12}$ | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 61 | $1{ }^{105}$ | 236 | 266 | 512 | 978 | 534 | 232 | 448 | 360 | 1107 | 1131 | 1110 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 135 | 163 | 310 | 631 | 545 | 2171 | 1197 | 491 | 621 | 641 | 1893 | 839 | 815 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 58 | 5 5 58 | 58 | 8 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 17 | $7 \quad 27$ | 27 | $7 \quad 27$ | 27 | 27 | 27 | 27 | 27 | 27 | 17 | 27 | 27 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | x lg | 51 | 51.51 | - 51 | 1 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 |  |
| Scallop Dredge | open | limited | NE | all | 65 | 5 170 | 147 | 7 99 | 147 | 67 | 261 | 147 | 25 | 78 | 58 | 25 | 119 |  |
| Scallop Dredge | open | limited | MA | all | 46 | 6.36 | 36 | 300 | 350 | 184 | 234 | 36 | 36 | 187 | 79 | 36 | 726 |  |
| Scallop Dredge | open | general | NE | all | 64 | 4 91 | 71 | 1 66 | 84 | 109 | 71 | 71 | 71 | 71 | 70 | 71 | 140 |  |
| Scallop Dredge | open | general | MA | all | 29 | 99 69 | 69 | 210 | 206 | 123 | 53 | 69 | 69 | 124 | 33 | 69 | 69 |  |
| Scallop Dredge | closed | limited | NE | all | 26 | 6202 | 152 | 245 | 361 | 37 | 41 | 15 | 15 | 183 | 115 | 51 | 155 |  |
| Scallop Dredge | closed | limited | MA | all | 124 | 4 | 12 | 2199 | 36 | 44 | 200 | 12 | 12 | 87 | 154 | 12 | 197 |  |
| Scallop Dredge | closed | general | NE | all | 12 | 212 | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Scallop Dredge | closed | general | MA | all | 15 | 5 15 | 15 | 515 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |  |
| Mid-water paired \& single Trawl | all | all | NE | all | 262 | $25^{553}$ | 326 | 6 21 | 548 | 395 | 616 | 464 | 465 | 430 | 21 | 21 | 21 |  |
| Mid-water paired \& single Trawl | all | all | MA | all | 81 | 1 12 | 12 | 212 | 12 | 157 | 12 | 12 | 12 | 50 | 12 | 12 | 12 |  |
| Fish Pots/ Traps | all | all | NE | all | 19 | 9 19 | 19 | 9 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |  |
| Fish Pots/ Traps | all | all | MA | all | 37 | 7 37 | 37 | $7{ }^{37}$ | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 |  |
| Purse Seine | all | all | NE | all | 107 | $7{ }^{10}$ | 10 | 10 | 10 | 10 | 10 | 10 | 107 | 10 | 10 | 10 | 10 |  |
| Purse Seine | all | all | MA | all |  | 9 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |  |
| Hand Line | all | all | NE | all | 129 | 29 129 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 |  |
| Hand Line | all | all | MA | all | 126 | 6 126 | - 126 | \| 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 |  |
| Scottish Seine | all | all | NE | all |  | 14 12 | 12 | 212 | 12 | 12 | 18 | 12 | 12 | 12 | 15 | 12 | 12 |  |
| Clam Quahog Dredge | all | all | NE | all |  | $69 \quad 69$ | 69 | 969 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |  |
| Clam Quahog Dredge | all | all | MA | all |  | $69 \quad 69$ | -69 | 969 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |  |
| Crab Pots | all | all | NE | all |  | 2 12 | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Crab Pots | all | all | MA | all |  | 27 27 | 27 | 7 27 | 27 | - 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |  |
| Lobster Pots | all | all | NE | all | 353 | 353 | 353 | $3{ }^{3} 5$ | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 |  |
| Lobster Pots | all | all | MA | all |  | 75 75 | -75 | 5 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 |  |
| Total Trips |  |  |  |  | 2,641 | 6,572 | 3,902 | 5,630 | 6,641 | 6,657 | 6,407 | 8,167 | 5,730 | 8,536 | 5,495 | 5,198 | 7,437 |  |
| Total Trips excluding shaded cells |  |  |  |  | 2,464 | 6,143 | 2,403 | 3 4,676 | 2,717 | 5,239 | 5,685 | 3,669 | 2,618 | 7,001 | 4,602 | 3,710 | 6,881 |  |

Table B-5 continued. Number of trips needed to achieve a CV of 30 percent based on the total composite discards.

| Gear Type | Access Area (OpenClosed) | Trip Category (General/ Limited) | Region | mesh groups |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 144 | 4 26 | 26 | 6144 | 69 | 78 | 26 | 26 | 26 | 26 | 26 | 26 |  |
| Longline | all | all | MA | all | 12 | 2.12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Otter Trawl | all | all | NE | small | 89 | 9 77 | 1692 | 251 | 668 | 162 | 150 | 120 | 443 | 698 | 1260 | 146 |  |
| Otter Trawl | all | all | NE | large | 143 | 3223 | 444 | 529 | 133 | 259 | 436 | 460 | 3065 | 2623 | 6570 | 1134 |  |
| Otter Trawl | all | all | MA | small | 503 | 705 | 900 | 638 | 108 | 283 | 311 | 167 | 596 | 507 | 445 | 1628 |  |
| Otter Trawl | all | all | MA | large | 517 | 7166 | 177 | 1762 | 36 | 249 | 51 | 59 | 104 | 333 | 303 | 177 |  |
| Scallop Trawl | open | limited | MA | all | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Scallop Trawl | open | general | MA | all | 142 | 2144 | 25 | 72 | 39 | 216 | 200 | 36 | 48 | 195 | 25 | 25 |  |
| Shrimp Trawi | all | all | NE | all | 122 | 2127 | 42 | 1 114 | 245 | 346 | 42 | 42 | 42 | 42 | 42 | 42 |  |
| Shrimp Trawl | all | all | MA | all | 13 | 313 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 231 | 1380 | 104 | 424 | 356 | 81 | 2780 | 2967 | 104 | 4646 | 104 | 104 |  |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 1348 | 8 226 | 94 | 41900 | 71 | 140 | 273 | 273 | 2753 | 94 | 94 | 329 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 58 | $8{ }^{58}$ | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 27 | $7{ }^{7}$ | 27 | 27 | 95 | 91 | 27 | 27 | 27 | 27 | 27 | 27 |  |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | 51 | 1 51 | 51 | 51 | 42 | 44 | 87 | 87 | 51 | 51 | 51 | 51 |  |
| Scallop Dredge | open | limited | NE | all | 49 | 9156 | 330 | 36 | 16 | 74 | 59 | 63 | 30 | 107 | 44 | 25 |  |
| Scallop Dredge | open | limited | MA | all | 342 | 2406 | 382 | 120 | 13 | 41 | 52 | 57 | 293 | 230 | 328 | 36 |  |
| Scallop Dredge | open | general | NE | all | 102 | 2149 | 71 | 111 | 91 | 91 | 71 | 71 | 71 | 71 | 140 | 71 |  |
| Scallop Dredge | open | general | MA | all | 69 | 965 | 69 | 206 | 12 | 89 | 63 | 63 | 69 | 69 | 194 | 69 |  |
| Scallop Dredge | closed | limited | NE | all | 137 | 7 141 | 188 | 167 | 17 | 100 | 82 | 83 | 52 | 29 | 44 | 15 |  |
| Scallop Dredge | closed | limited | MA | all | 31 | $1{ }^{17}$ | 12 | 33 | 10 | 62 | 53 | 53 | 171 | 41 | 37 | 12 |  |
| Scallop Dredge | closed | general | NE | all | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Scallop Dredge | closed | general | MA | all | 15 | 515 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |  |
| Mid-water paired \& single Trawl | all | all | NE | all | 464 | 4 467 | 21 | 1315 | 394 | 121 | 266 | 21 | 304 | 432 | 21 | 21 |  |
| Mid-water paired \& single Trawl | all | all | MA | all | 52 | 2.52 | 12 | 52 | 12 | 12 | 160 | 156 | 12 | 161 | 12 | 12 |  |
| Fish Potsl Traps | all | all | NE | all | 19 | 919 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |  |
| Fish Potsl Traps | all | all | MA | all | 37 | 7 37 | 37 | 37 | 37 | 37 | 37 | 37 | 69 | 37 | 37 | 37 |  |
| Purse Seine | all | all | NE | all | 10 | - 10 | 10 | 10 | 10 | 107 | 10 | 10 | 10 | 10 | 10 | 10 |  |
| Purse Seine | all | all | MA | all | 9 | 9 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |  |
| Hand Line | all | all | NE | all | 68 | 8 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 |  |
| Hand Line | all | all | MA | all | 126 | $6{ }^{126}$ | 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 |  |
| Scottish Seine | all | all | NE | all | 12 | 212 | 12 | 12 | 12 | 12 | 30 | 30 | 30 | 30 | 12 | 12 |  |
| Clam Quahog Dredge | all | all | NE | all | 69 | 969 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |  |
| Clam Quahog Dredge | all | all | MA | all | 69 | 9 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |  |
| Crab Pots | all | all | NE | all | 12 | $2{ }^{12}$ | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |  |
| Crab Pots | all | all | MA | all | 27 | 7 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |  |
| Lobster Pots | all | all | NE | all | 353 | $3{ }^{353}$ | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 |  |
| Lobster Pots | all | all | MA | all | 75 | 5 75 | 75 | 75 | -75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 |  |
| Total Trips |  |  |  |  | 5,584 | 4,647 | 5,688 | 7,873 | 3,447 | 3,658 | 6,227 | 5,872 | 9,332 | 11,423 | 10,788 | 4,971 |  |
| Total Trips excluding shaded cells |  |  |  |  | 4,637 | $7 \quad 3,673$ | 2,211 | 6,842 | 2,243 | 2,511 | 4,981 | 4,874 | 4,476 | 4,543 | 139 | 3,180 |  |

Gray-shaded cells indicate unlikely combinations of species/gear.

Table B-5 continued. Number of trips needed to achieve a CV of 30 percent based on the total composite discards.


Gray-shaded cells indicate unlikely combinations of species/gear.

Table B-5 continued. Number of trips needed to achieve a CV of 30 percent based on the total composite discards.

| Gear Type | Access Area (OpenClosed) | Trip Category (General/ Limited) | Region | mesh groups |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Longline | all | all | NE | all | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 208 | 44 |
| Longline | all | all | MA | all | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Otter Trawl | all | all | NE | small | 1016 | 1016 | 70 | 70 | 747 | 1022 | -855 | 70 | 70 | 70 | 617 | 60 |
| Otter Trawl | all | all | NE | large | 4435 | 5435 | 304 | 304 | 890 | 890 | 304 | 304 | 304 | 304 | 1364 | 67 |
| Otter Trawl | all | all | MA | small | 104 | 4104 | 104 | 104 | 620 | 104 | 4620 | 104 | 104 | 104 | 1001 | 133 |
| Otter Trawl | all | all | MA | large | 177 | 1777 | 177 | 177 | 177 | 177 | 177 | 177 | 177 | 177 | 377 | 29 |
| Scallop Trawl | open | limited | MA | all | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Scallop Trawl | open | general | MA | all | 25 | 25 | 25 | 25 | 25 | 25 | 525 | 25 | 25 | 25 | 25 | 18 |
| Shrimp Trawl | all | all | NE | all | 42 | 2 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 38 |
| Shrimp Trawl | all | all | MA | all | 13 | 1313 | 13 | 13 | 13 | 13 | 13 13 | 13 | 13 | 13 | 13 | 9 |
| Sink, Anchor, Drift Gillnet | all | all | NE | small | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Sink, Anchor, Drift Gillnet | all | all | NE | large | 104 | 4104 | 104 | 104 | 1032 | 2688 | 104 | 104 | 1149 | 104 | 964 | 61 |
| Sink, Anchor, Drift Gillnet | all | all | NE | xlg | 94 | 4.94 | 94 | 94 | 528 | 94 | 94 | 2499 | 570 | 94 | 1742 | 38 |
| Sink, Anchor, Drift Gillnet | all | all | MA | small | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 835 | 58 |
| Sink, Anchor, Drift Gillnet | all | all | MA | large | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 288 | 91 |
| Sink, Anchor, Drift Gillnet | all | all | MA | xlg | 51 | 151 | 51 | 51 | 955 | 51 | 1 51 | 51 | 955 | 51 | 605 | 39 |
| Scallop Dredge | open | limited | NE | all | 25 | 525 | 25 | 25 | 25 | 25 | 25 | - 25 | 25 | 25 | 292 | 11 |
| Scallop Dredge | open | limited | MA | all | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 10 |
| Scallop Dredge | open | general | NE | all | 71 | 171 | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 69 |
| Scallop Dredge | open | general | MA | all | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 10 |
| Scallop Dredge | closed | limited | NE | all | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 47 | 15 |
| Scallop Dredge | closed | limited | MA | all | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 7 |
| Scallop Dredge | closed | general | NE | all | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | - 12 |
| Scallop Dredge | closed | general | MA | all | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Mid-water paired \& single Trawl | all | all | NE | all | 612 | 2612 | 21 | 21 | 558 | 558 | 21 | 21 | 21 | 21 | 308 | 73 |
| Mid-water paired \& single Trawl | all | all | MA | all | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 32 |
| Fish Pots/ Traps | all | all | NE | all | 19 | \| 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | - 19 |
| Fish Pots/ Traps | all | all | MA | all | 37 | 7 37 | 37 | - 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | - 34 |
| Purse Seine | all | all | NE | all | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 71 |
| Purse Seine | all | all | MA | all | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Hand Line | all | all | NE | all | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 129 |
| Hand Line | all | all | MA | all | 126 | - 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 |
| Scottish Seine | all | all | NE | all | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 20 |
| Clam Quahog Dredge | all | all | NE | all | 69 | -69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| Clam Quahog Dredge | all | all | MA | all | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| Crab Pots | all | all | NE | all | 12 | 212 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Crab Pots | all | all | MA | all | 27 | 7 27 | 1 27 | 27 | 27 | 27 | 1 27 | 27 | 27 | 27 | 27 | 27 |
| Lobster Pots | all | all | NE | all | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 | 353 |
| Lobster Pots | all | all | MA | all | 75 | -75 | 75 | 75 | 75 | 75 | 7 75 | 75 | 75 | 75 | 75 | 75 |
| Total Trips |  |  |  |  | 7,975 | 7,975 | 2,306 | 2,306 | 6,887 | 6,965 | 3,607 | 4,711 | 4,731 | 2,306 | 9,877 | 1,992 |
| Total Trips excluding shaded cells |  |  |  |  | 7,720 | 7,720 | 1,550 | 2,051 | 6,887 | 6,965 | 3,607 | 4,429 | 4,698 | 2,306 | 9,877 | 1,992 |

Gray-shaded cells indicate unlikely combinations of species/gear.

# Appendix C <br> I mportance Filter Worksheets for All Fishing Modes 

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N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^40]* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^41]* $=$ Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^42]* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^43]* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^44]* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* $=$ Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^45]* $=$ Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* $=$ Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.

## Northeast Region SBRM Importance Filter Worksheet -- Option A Mid-Atlantic Small-Mesh Otter Trawl

| 2004 <br> Observed Sea <br> Days | 2004 <br> Observed <br> Trips | 2004 <br> FVTR <br> Trips | Percent <br> Covered |  |
| :---: | :---: | :---: | :---: | :--- |
| 471 | 194 | 5,222 | $4 \%$ | Fish |
| 499 | 205 | 5,222 | $4 \%$ | Protected Species |


| Top Species: <br> Projected observer days needed: | tilefish $3,057$ | bluefish $2,231$ | herring <br> 1,869 | scallop $1,162$ | $\begin{aligned} & \text { M/S/B } \\ & 1,125 \\ & \hline \end{aligned}$ | small- <br> mesh <br> mults <br> 944 | $\begin{gathered} \text { SF/S/BSB } \\ 584 \\ \hline \end{gathered}$ | dogfish $532$ | monkfish $497$ | large-mesh mults 429 | skate <br> 202 | sea turtles $1,229$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Average trip length (days): | 0.90 |  |  |  |  |  |  |  |  |  |  |  |
| Estimated \% coverage level required: | 65\% | 47\% | 40\% | 25\% | 24\% | 20\% | 12\% | 11\% | 11\% | 9\% | 4\% | 26\% |
| Realized CV for 2004: | 115.5\% | 90.3\% | 78.4\% | 57.4\% | 56.1\% | 50.8\% | 38.6\% | 36.7\% | 35.4\% | 32.6\% | 22.2\% | 57.3\% |
| Percent of trips w/ zero discard: Encounter rate: | $\begin{gathered} \hline 99 \% \\ 1 \% \end{gathered}$ | $\begin{aligned} & 90 \% \\ & 10 \% \end{aligned}$ | $\begin{gathered} 96 \% \\ 4 \% \end{gathered}$ | $\begin{aligned} & 90 \% \\ & 10 \% \end{aligned}$ | $\begin{aligned} & 55 \% \\ & 45 \% \end{aligned}$ | $\begin{aligned} & \hline 73 \% \\ & 27 \% \end{aligned}$ | $\begin{aligned} & 28 \% \\ & 72 \% \end{aligned}$ | $\begin{aligned} & 37 \% \\ & 63 \% \end{aligned}$ | $\begin{aligned} & 67 \% \\ & 33 \% \end{aligned}$ | $\begin{aligned} & 44 \% \\ & 56 \% \end{aligned}$ | $\begin{aligned} & \hline 23 \% \\ & 77 \% \end{aligned}$ | $\begin{gathered} 99 \% \\ 2 \% \end{gathered}$ |
| Rank of total discards (out of 13): | 13 | 8 | 11 | 9 | 2 | 5 | 4 | 3 | 7 | 6 | 1 | N/A |
| Observed discards (lb): | 6 | 6,645 | 144 | 6,303 | 119,995 | 75,491 | bsb | 94,574 | 7,744 | 7,560 | 110,445 | Yes |
| Obs. discard percent of all obs. discards: | 0.00\% | 0.86\% | 0.02\% | 0.81\% | 15.45\% | 9.72\% | \#VALUE! | 12.18\% | 1.00\% | 0.97\% | 14.22\% | N/A |
| 2004 commercial landings (lb, all gears): | 2,316,000 | 7,512,000 | 187,387,000 | 64,506,000 | 212,528,000 | 19,387,000 | 30,616,000 | 1,965,000 | 23,036,000 | 83,523,000 | 20,388,000 | N/A |
| 2004 recreational landings (lb, all gears): | 0 | 15,146,000 | 27,000 | 0 | 1,134,000 | 35,000 | 17,982,000 | 0 | 0 | 5,383,000 | 0 | NA |
| Obs. discards as \% of comm landings: | 7.25\% | 7.82\% | 0.00\% | 7.56\% | 6.22\% | 7.48\% | \#VALUE! | 6.20\% | 7.02\% | 3.98\% | 5.29\% | N/A |
| Discards as \% of comm landings: | 0.00\% | 1.13\% | 0.00\% | 0.13\% | 0.91\% | 5.20\% | 4.56\% | 77.63\% | 0.48\% | 0.23\% | 10.24\% | N/A |
| Discards as \% ot total landings: | 0.00\% | 0.38\% | 0.00\% | 0.13\% | 0.90\% | 5.19\% | 2.87\% | 77.63\% | 0.48\% | 0.21\% | 10.24\% | N/A |

N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^46]* $=$ Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^47]* $=$ Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^48]* $=$ Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^49]* $=$ Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^50]* $=$ Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^51]* $=$ Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^52]* $=$ Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.

| Northeast Region SBRM Importance Filter Worksheet -- Option A |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Scottish Seine |  |  |  |  |  |  |  |  |  |  |  |
| 2004 2004 <br> Observed Sea Observed <br> Days Trips | $\begin{gathered} 2004 \\ \text { FVTR } \\ \text { Trips } \end{gathered}$ | Percent Covered |  |  |  |  |  |  |  |  |  |
| 5 | 95 | 5\% |  |  |  |  |  |  |  |  |  |
| 8 8 | 95 | 8\% | Protected | cies |  |  |  |  |  |  |  |
| Top Species: <br> Projected observer days needed: | SF/S/BSB $30$ | large-mesh mults 14 | bluefish $12$ | herring $12$ | scallop <br> 12 | M/S/B <br> 12 | monkfish $12$ | smallmesh mults 12 | skates $12$ | dogfish $12$ | sea turtles $12$ |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Average trip length (days): | 0.30 |  |  |  |  |  |  |  |  |  |  |
| Estimated \% coverage level required: | 105\% | 49\% | 42\% | 42\% | 42\% | 42\% | 42\% | 42\% | 42\% | 42\% | 42\% |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Realized CV for 2004: | 25.3\% | 28.9\% | * | * | * | * | * | 27.9\% | 31.9\% | * | * |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Percent of trips w/ zero discard: Encounter rate: | $\begin{aligned} & \hline 60 \% \\ & 40 \% \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 0 \% \\ 100 \% \end{gathered}$ | $\begin{gathered} 100 \% \\ 0 \% \end{gathered}$ | $\begin{gathered} 100 \% \\ 0 \% \end{gathered}$ | $\begin{gathered} 100 \% \\ 0 \% \end{gathered}$ | $\begin{gathered} 100 \% \\ 0 \% \end{gathered}$ | $\begin{gathered} 100 \% \\ 0 \% \end{gathered}$ | $\begin{aligned} & \hline 80 \% \\ & 20 \% \end{aligned}$ | $\begin{aligned} & 40 \% \\ & 60 \% \end{aligned}$ | $\begin{gathered} 100 \% \\ 0 \% \end{gathered}$ | $\begin{gathered} 100 \% \\ 0 \% \end{gathered}$ |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Rank of total discards (out of 13): | 1 | 2 | 5 | 5 | 5 | 5 | 5 | 3 | 4 | 5 | N/A |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Observed discards (lb): | 269 | 218 | 0 | 0 | 0 | 0 | 0 | 130 | 32 | 0 | 0 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Obs. discard percent of all obs. discards: | 3.39\% | 2.74\% | 0.00\% | 0.00\% | 0.00\% | 0.00\% | 0.00\% | 1.64\% | 0.40\% | 0.00\% | N/A |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 2004 commercial landings (lb, all gears): | 30,616,000 | 83,523,000 | 7,512,000 | 187,387,000 | 64,506,000 | 212,528,000 | 23,036,000 | 19,387,000 | 20,388,000 | 1,965,000 | N/A |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 2004 recreational landings (lb, all gears): | 17,982,000 | 5,383,000 | 15,146,000 | 27,000 | 0 | 1,134,000 | 0 | 35,000 | 0 | 0 | N/A |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Obs. discards as \% of comm landings: | 0.00\% | 0.00\% | 0.00\% | 0.00\% | 0.00\% | 0.00\% | 0.00\% | 0.00\% | 0.00\% | 0.00\% | N/A |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Discards as \% of comm landings: | 0.04\% | 0.01\% | 0.00\% | 0.00\% | 0.00\% | 0.00\% | 0.00\% | 0.01\% | 0.00\% | 0.00\% | N/A |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Discards as \% ot total landings: | 0.03\% | 0.00\% | 0.00\% | 0.00\% | 0.00\% | 0.00\% | 0.00\% | 0.01\% | 0.00\% | 0.00\% | N/A |

N/A = No observations in 2004.

* = Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^53]* $=$ Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.


[^54]* $=$ Zero (0) discards observed in 2004.

Note: Projected observer days needed in bold/italics represent PILOT LEVEL coverage, rather than the level calculated to achieve a CV of 30 percent.

| Fishing Mode | BaselineLevels(No Filters) | Grey-Cell Filter | CV-Target Met Filter | Discard \% of Discards Filter |  |  | Discard \% of Catch Filter |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | 0.5\% | 1.0\% | 3.0\% | 0.5\% | 1.0\% | 3.0\% |
| NE Clam Dredge | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| MA Clam Dredge | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 |
| NE Crab Pot | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 |
| MA Crab Pot | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 |
| NE Fish Pot | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| MA Fish Pot | 103 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| NE Small-mesh Gillnet | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| MA Small-mesh Gillnet | 1,259 | 1,259 | 1,259 | 1,259 | 1,259 | 1,259 | 1,259 | 1,259 | 1,259 |
| NE Large-mesh Gillnet | 4,357 | 3,767 | 3,767 | 482 | 482 | 141 | 482 | 141 | 141 |
| MA Large-mesh Gillnet | 653 | 653 | 653 | 653 | 653 | 653 | 653 | 653 | 653 |
| NE X-Large-mesh Gillnet | 3,266 | 2,059 | 2,059 | 267 | 214 | 214 | 214 | 214 | 214 |
| MA X-Large-mesh Gillnet | 468 | 468 | 468 | 468 | 468 | 468 | 468 | 468 | 468 |
| NE Handline | 137 | 137 | 137 | 137 | 137 | 137 | 72 | 72 | 72 |
| MA Handline | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 |
| NE Lobster Pot | 439 | 439 | 439 | 439 | 439 | 439 | 439 | 439 | 439 |
| MA Lobster Pot | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 |
| NE Longline | 185 | 185 | 185 | 99 | 99 | 99 | 99 | 99 | 99 |
| MA Longline | 76 | 76 | 76 | 76 | 76 | 76 | 76 | 76 | 76 |
| NE Mid-Water Trawl | 1,793 | 1,218 | 1,218 | 1,218 | 1,218 | 747 | 346 | 346 | 346 |
| MA Mid-Water Trawl | 557 | 492 | 492 | 492 | 182 | 182 | 43 | 43 | 35 |
| NE Small-mesh Trawl | 3,822 | 2,024 | 2,024 | 2,024 | 2,024 | 2,024 | 2,024 | 2,024 | 2,024 |
| MA Small-mesh Trawl | 5,417 | 3,057 | 3,057 | 2,231 | 1,229 | 1,229 | 1,229 | 1,229 | 1,229 |
| NE Large-mesh Trawl | 26,644 | 26,644 | 26,644 | 730 | 730 | 730 | 730 | 730 | 730 |
| MA Large-mesh Trawl | 3,625 | 3,625 | 3,625 | 481 | 481 | 481 | 481 | 481 | 481 |
| NE Purse Seine | 219 | 219 | 219 | 219 | 219 | 219 | 217 | 217 | 217 |
| MA Purse Seine | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| NE Scallop Dredge OL | 1,596 | 1,596 | 1,596 | 320 | 320 | 320 | 320 | 320 | 320 |
| MA Scallop Dredge OL | 8,713 | 3,080 | 3,080 | 280 | 280 | 280 | 280 | 280 | 280 |
| NE Scallop Dredge CL | 3,861 | 1,473 | 1,473 | 703 | 703 | 429 | 703 | 429 | 145 |
| MA Scallop Dredge CL | 1,777 | 1,136 | 1,136 | 283 | 283 | 283 | 283 | 283 | 88 |
| NE Scallop Dredge OG | 204 | 204 | 120 | 117 | 117 | 117 | 117 | 117 | 92 |
| MA Scallop Dredge OG | 293 | 124 | 124 | 54 | 54 | 54 | 54 | 54 | 17 |
| NE Scallop Dredge CG | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| MA Scallop Dredge CG | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| MA Scallop Trawl OL | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| MA Scallop Trawl OG | 443 | 443 | 443 | 443 | 443 | 443 | 443 | 443 | 443 |
| NE Scottish Seine | 30 | 30 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| NE Shrimp Trawl | 364 | 364 | 364 | 247 | 247 | 247 | 42 | 42 | 42 |
| MA Shrimp Trawl | 76 | 76 | 76 | 76 | 76 | 76 | 76 | 76 | 76 |
| Total Sea Days Needed: | 71,043 | 55,554 | 55,452 | 14,516 | 13,151 | 12,065 | 11,868 | 11,253 | 10,704 |

Summary results (at-sea fisheries observer sea days needed) of applying the proposed importance filters (Option A) to the 39 fishing modes subject to the Northeast Region SBRM.

| Fishing Mode | Baseline Levels (No Filters) | Grey-Cell Filter | Discard \% of Discards Filter |  |  | Discard \% of Mortality Filter |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 99.0\% | 95.0\% | 90.0\% | 99.0\% | 95.0\% | 90.0\% |
| NE Clam Dredge | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| MA Clam Dredge | 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 |
| NE Crab Pot | 101 | 101 | 101 | 101 | 101 | 101 | 101 | 101 |
| MA Crab Pot | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 |
| NE Fish Pot | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| MA Fish Pot | 103 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| NE Small-mesh Gillnet | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| MA Small-mesh Gillnet | 1,259 | 1,259 | 1,259 | 1,259 | 1,259 | 1,259 | 1,259 | 1,259 |
| NE Large-mesh Gillnet | 4,357 | 3,767 | 443 | 141 | 141 | 141 | 141 | 141 |
| MA Large-mesh Gillnet | 653 | 653 | 653 | 653 | 653 | 653 | 653 | 653 |
| NE X-Large-mesh Gillnet | 3,266 | 2,059 | 417 | 267 | 238 | 214 | 214 | 144 |
| MA X-Large-mesh Gillnet | 468 | 468 | 468 | 468 | 468 | 468 | 468 | 468 |
| NE Handline | 137 | 137 | 72 | 72 | 72 | 72 | 72 | 72 |
| MA Handline | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 |
| NE Lobster Pot | 439 | 439 | 439 | 439 | 439 | 439 | 439 | 439 |
| MA Lobster Pot | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 |
| NE Longline | 185 | 185 | 99 | 35 | 35 | 99 | 35 | 35 |
| MA Longline | 76 | 76 | 76 | 76 | 76 | 76 | 76 | 76 |
| NE Mid-Water Trawl | 1,793 | 1,218 | 1,218 | 747 | 747 | 316 | 316 | 56 |
| MA Mid-Water Trawl | 557 | 492 | 35 | 35 | 35 | 35 | 35 | 35 |
| NE Small-mesh Trawl | 3,822 | 2,024 | 2,024 | 2,024 | 2,024 | 2,024 | 2,024 | 2,024 |
| MA Small-mesh Trawl | 5,417 | 3,057 | 2,231 | 2,231 | 2,231 | 1,229 | 1,229 | 1,229 |
| NE Large-mesh Trawl | 26,644 | 26,644 | 26,644 | 26,644 | 2,692 | 798 | 730 | 730 |
| MA Large-mesh Trawl | 3,625 | 3,625 | 481 | 481 | 481 | 481 | 481 | 481 |
| NE Purse Seine | 219 | 219 | 219 | 219 | 19 | 217 | 19 | 19 |
| MA Purse Seine | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| NE Scallop Dredge OL | 1,596 | 1,596 | 708 | 708 | 708 | 320 | 177 | 177 |
| MA Scallop Dredge OL | 8,713 | 3,080 | 3,080 | 465 | 280 | 280 | 114 | 114 |
| NE Scallop Dredge CL | 3,861 | 1,473 | 703 | 429 | 429 | 145 | 139 | 139 |
| MA Scallop Dredge CL | 1,777 | 1,136 | 481 | 283 | 108 | 108 | 108 | 108 |
| NE Scallop Dredge OG | 204 | 204 | 120 | 117 | 117 | 92 | 92 | 92 |
| MA Scallop Dredge OG | 293 | 124 | 88 | 17 | 17 | 17 | 17 | 17 |
| NE Scallop Dredge CG | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| MA Scallop Dredge CG | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| MA Scallop Trawl OL | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| MA Scallop Trawl OG | 443 | 443 | 119 | 51 | 51 | 80 | 51 | 51 |
| NE Scottish Seine | 30 | 30 | 12 | 12 | 12 | 12 | 12 | 12 |
| NE Shrimp Trawl | 364 | 364 | 123 | 92 | 92 | 42 | 42 | 42 |
| MA Shrimp Trawl | 76 | 76 | 76 | 76 | 76 | 76 | 76 | 76 |
| Total Sea Days Needed: | 71,043 | 55,554 | 42,995 | 38,749 | 14,208 | 10,400 | 9,726 | 9,395 |

Summary results (at-sea fisheries observer sea days needed) of applying the proposed importance filters (Option B) to the 39 fishing modes subject to the Northeast Region SBRM. Note that in this option, there is no "CV-met filter."

| Fishing Mode | Baseline Levels (No Filters) | Grey-Cell Filter | 95\% of Discards \& 98\% of Mortality | 95\% of Discards \& 99\% of Mortality | 98\% of Discards \& 99\% of Mortality |
| :---: | :---: | :---: | :---: | :---: | :---: |
| NE Clam Dredge | 50 | 50 | 50 | 50 | 50 |
| MA Clam Dredge | 84 | 84 | 84 | 84 | 84 |
| NE Crab Pot | 101 | 101 | 101 | 101 | 101 |
| MA Crab Pot | 28 | 28 | 28 | 28 | 28 |
| NE Fish Pot | 20 | 20 | 20 | 20 | 20 |
| MA Fish Pot | 103 | 40 | 40 | 40 | 40 |
| NE Small-mesh Gillnet | 12 | 12 | 12 | 12 | 12 |
| MA Small-mesh Gillnet | 1,259 | 1,259 | 1,259 | 1,259 | 1,259 |
| NE Large-mesh Gillnet | 4,357 | 3,767 | 141 | 141 | 141 |
| MA Large-mesh Gillnet | 653 | 653 | 653 | 653 | 653 |
| NE X-Large-mesh Gillnet | 3,266 | 2,059 | 214 | 214 | 214 |
| MA X-Large-mesh Gillnet | 468 | 468 | 468 | 468 | 468 |
| NE Handline | 137 | 137 | 72 | 72 | 72 |
| MA Handline | 133 | 133 | 133 | 133 | 133 |
| NE Lobster Pot | 439 | 439 | 439 | 439 | 439 |
| MA Lobster Pot | 89 | 89 | 89 | 89 | 89 |
| NE Longline | 185 | 185 | 35 | 35 | 99 |
| MA Longline | 76 | 76 | 76 | 76 | 76 |
| NE Mid-Water Trawl | 1,793 | 1,218 | 316 | 316 | 316 |
| MA Mid-Water Trawl | 557 | 492 | 35 | 35 | 35 |
| NE Small-mesh Trawl | 3,822 | 2,024 | 2,024 | 2,024 | 2,024 |
| MA Small-mesh Trawl | 5,417 | 3,057 | 1,229 | 1,229 | 1,229 |
| NE Large-mesh Trawl | 26,644 | 26,644 | 730 | 798 | 798 |
| MA Large-mesh Trawl | 3,625 | 3,625 | 481 | 481 | 481 |
| NE Purse Seine | 219 | 219 | 19 | 19 | 217 |
| MA Purse Seine | 9 | 9 | 9 | 9 | 9 |
| NE Scallop Dredge OL | 1,596 | 1,596 | 320 | 320 | 320 |
| MA Scallop Dredge OL | 8,713 | 3,080 | 114 | 280 | 280 |
| NE Scallop Dredge CL | 3,861 | 1,473 | 145 | 145 | 145 |
| MA Scallop Dredge CL | 1,777 | 1,136 | 108 | 108 | 108 |
| NE Scallop Dredge OG | 204 | 204 | 92 | 92 | 92 |
| MA Scallop Dredge OG | 293 | 124 | 17 | 17 | 17 |
| NE Scallop Dredge CG | 24 | 24 | 24 | 24 | 24 |
| MA Scallop Dredge CG | 21 | 21 | 21 | 21 | 21 |
| MA Scallop Trawl OL | 95 | 95 | 95 | 95 | 95 |
| MA Scallop Trawl OG | 443 | 443 | 51 | 51 | 80 |
| NE Scottish Seine | 30 | 30 | 12 | 12 | 12 |
| NE Shrimp Trawl | 364 | 364 | 42 | 42 | 42 |
| MA Shrimp Trawl | 76 | 76 | 76 | 76 | 76 |
| Total Sea Days Needed: | 71,043 | 55,554 | 9,874 | 10,108 | 10,400 |

Summary results (at-sea fisheries observer sea days needed) of applying the proposed importance filters to the 39 fishing modes subject to the Northeast Region SBRM (continued). This table indicates the specific combinations of filter thresholds considered, after refining the broader threshold levels identified on the previous table. The recommendation of the SBRM FMAT is to set the filters at $95 \%$ of discards and $98 \%$ of mortality.

## EXAMPLE - EXAMPLE - EXAMPLE - EXAMPLE - EXAMPLE

## Northeast Region SBRM Review Report

[Note:This is an example report to illustrate one possible structure for presenting information relevant for reviewing and evaluating the Northeast Region SBRM. An alternative example could be the SBRM 3-yr Review Report 2011, published in two Center Reference Documents (CRD11-09 ${ }^{1}$ and CRD12-27²). This information should be considered preliminary and is not intended for Council action. If the Councils select options for both a SBRM review report and a discard report, the SBRM review report may provide a review of previous discard estimations without repeating previously estimated discards.]

## Monkfish

## Background

Amendment 3 to the Monkfish Fishery Management Plan (FMP), part of the Omnibus Standardized Bycatch Reporting Methodology (SBRM) Amendment to the Northeast Region FMPs, implemented several requirements regarding the reporting of bycatch information for the monkfish fishery. This amendment was developed under the authority of section 303(11)(a) of the Magnuson-Stevens Act, which requires that all FMPs establish an SBRM. The SBRM Amendment addressed four elements: (1) The bycatch reporting and monitoring mechanisms used to obtain information on discards in Northeast fisheries; (2) the analytical techniques used to estimate discards and to allocate at-sea observer effort; (3) establishing a precision-based performance standard for the SBRM; and (4) requiring a periodic review and reporting process as part of the SBRM.

This document complies with the fourth element of the SBRM implemented under Amendment 3: The periodic SBRM Report. This report is intended to provide information with which the New England and Mid-Atlantic Fishery Management Councils (Councils) and NOAA Fisheries Service would consider the effectiveness of the SBRM and, if necessary, take appropriate steps to improve the SBRM. As described in Amendment 3, the SBRM Report would provide the following information: (1) A review of the recent levels of observer coverage in each applicable fishery; (2) a review of recent observed encounters with each species in each fishery, and a summary of observed discards by weight; (3) a review of the coefficient of variation (CV) of the discard information collected for each fishery; (4) an estimate of the total amount of discards associated with each fishery (these estimates may differ from estimates generated and used in stock assessments, as different methods and stratification may be used in each case); (5) an evaluation of the effectiveness of the SBRM at meeting the specified target for each fishery; (6) a description of the methods used to calculate the reported CVs and to determine target observer coverage levels, if the methods used are different from those

[^55]described and evaluated in the SBRM Amendment; and (7) an evaluation of the implications for management of the discard information collected under the SBRM.

The information to be provided in the report for the purpose of determining the effectiveness of the SBRM in meeting the CV standards should not be confused with the level of information a Council may want or need to address specific management issues. More detailed discard-related information, structured in a way and at a scale meaningful for the particular management issue, can always be provided at the Councils' request.

## Analytical Overview

This report focuses on the monkfish fishery, as managed under the Monkfish FMP, but addresses the discards of all species in the monkfish fishery as well as the discards of monkfish in other fisheries. There are three primary fishing gear modes that comprise the monkfish fishery: New England large-mesh otter trawl; New England extra-large-mesh gillnet; and Mid-Atlantic extra-large-mesh gillnet. This analysis will examine the discards of all species that occur in these three fishing modes.

In addition to the three primary monkfish fishing modes identified above, there are another 17 fishing modes for which at least some amount of monkfish was discarded in 2004. Of these, there are nine that contributed at least 1 percent of the total estimated monkfish discards in 2004: New England and Mid-Atlantic open area, limited access scallop dredge; New England and Mid-Atlantic small-mesh otter trawl; New England and Mid-Atlantic open area, general category scallop dredge; New England and Mid-Atlantic closed area, limited access scallop dredge; and Mid-Atlantic large-mesh otter trawl. This analysis will examine monkfish discards in these fishing modes.

## Review of Recent Levels of Observer Coverage

Table 1 identifies the observer coverage in 2004 for the primary monkfish fishery and monkfish discard fishing modes. This table also identifies the number of FVTR reports submitted for each fishing mode, in order to calculate an observer coverage rate for 2004.

| Fishing Mode | Observed Trips | Observed Sea <br> Days | FVTR Trips | Coverage Rate |
| :--- | :---: | :---: | :---: | :---: |
| NE large-mesh otter trawl | $386(153)$ | $1,076(871)$ | 16,156 | $2 \%(3 \%)$ |
| NE x-large-mesh gillnet | $445(124)$ | $533(168)$ | 4,712 | $9 \%(12 \%)$ |
| MA x-large-mesh gillnet | $27(115)$ | $30(122)$ | 2,568 | $1 \%(6 \%)$ |
| NE OL scallop dredge | $26(10)$ | $344(113)$ | 1,229 | $2 \%(3 \%)$ |
| MA OL scallop dredge | $69(9)$ | $591(84)$ | 1,822 | $4 \%(4 \%)$ |
| NE small-mesh otter trawl | $142(58)$ | $449(128)$ | 3,484 | $4 \%(6 \%)$ |
| NE OG scallop dredge | $9(11)$ | $11(13)$ | 3,566 | $0.25 \%(1 \%)$ |
| NE CL scallop dredge | 86 | 805 | 292 | $29 \%$ |
| MA CL scallop dredge | 35 | 373 | 78 | $45 \%$ |
| MA OG scallop dredge | $22(17)$ | $33(22)$ | 3,433 | $1 \%(1 \%)$ |
| MA large-mesh otter trawl | $75(1)$ | $183(3)$ | 8,850 | $1 \%(1 \%)$ |
| MA small-mesh otter trawl | $194(11)$ | $471(18)$ | 5,222 | $4 \%(4 \%)$ |

Table 1. 2004 observer coverage rates for the primary fishing modes associated with either the monkfish fishery (landings) or monkfish discards. Numbers in parentheses represent additional

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observer coverage included in the protected resources dataset (either training trips or "limited protocol" trips). For modes with no number in parentheses, there were no additional trips in the protected resources dataset.

## Recent Observed and Estimated Discards

## Discards in the Monkfish Fishery

As noted above, there are three primary fishing modes that comprise the monkfish fishery: New England large-mesh otter trawl; New England extra-large-mesh gillnet; and Mid-Atlantic extra-large-mesh gillnet. Together, three fishing modes accounted for over 92 percent of monkfish landings in 2004 (see Table 2). Although there were 142 species observed to be discarded in 2004 by these three fishing modes, the top 10 discard species accounted for 83 percent, by weight, of the total observed discards (see Table 3). Winter and little skates were the primary discard species, together comprising over 41 percent of observed discards. All skates combined represented 58 percent of all observed discards in these three fishing modes. Spiny dogfish accounted for another 14 percent of observed discards; monkfish, 4 percent; Jonah crab, 3.2 percent; American lobster, 2.9 percent; and thorny skate, 2.8 percent. All other discard species represented 1 percent or less of the total observed discards for these three fishing modes. Attachments 1, 2, and 3, identify all observed discards, by weight, for the three primary monkfish fishing modes.

| Fishing Mode | $\mathbf{2 0 0 4}$ Monkfish <br> Landings (lb) (FVTR) | Percent of Total <br> $\mathbf{2 0 0 4}$ Monkfish <br> Landings | Cumulative <br> Percentage of <br> Landings |
| :--- | :---: | :---: | :---: |
| NE Large-mesh Trawl | $14,955,163$ | $47.6 \%$ | $47.6 \%$ |
| NE X-Large-mesh Gillnet | $9,836,119$ | $31.3 \%$ | $78.9 \%$ |
| MA X-Large-mesh Gillnet | $4,301,618$ | $13.7 \%$ | $92.6 \%$ |
| NE Scallop Dredge | 878,931 | $2.8 \%$ | $95.4 \%$ |
| NE Large-mesh Gillnet | 615,585 | $2.0 \%$ | $97.3 \%$ |
| MA Scallop Dredge | 348,132 | $1.1 \%$ | $98.4 \%$ |
| MA Large-mesh Trawl | 346,457 | $1.1 \%$ | $99.5 \%$ |
| NE Small-mesh Trawl | 49,150 | $0.2 \%$ | $99.7 \%$ |
| MA Small-mesh Trawl | 36,600 | $0.1 \%$ | $99.8 \%$ |
| MA Scallop Trawl | 32,555 | $0.1 \%$ | $99.9 \%$ |

Table 2. 2004 monkfish landings, by weight, by fishing mode (FVTR).

| Discard Species | Total 2004 Observed <br> Discards (lb) | Percent of Total <br> Observed Discards | Cumulative Percent of <br> Observed Discards |
| :--- | :---: | :---: | :---: |
| Winter skate | 386,292 | $21.5 \%$ | $21.5 \%$ |
| Little skate | 353,072 | $19.6 \%$ | $41.1 \%$ |
| Spiny dogfish | 253,710 | $14.1 \%$ | $55.2 \%$ |
| Skate, NK | 219,095 | $12.2 \%$ | $67.3 \%$ |
| Monkfish | 72,706 | $4.0 \%$ | $71.4 \%$ |
| Jonah crab | 57,026 | $3.2 \%$ | $74.5 \%$ |
| American lobster | 51,748 | $2.9 \%$ | $77.4 \%$ |
| Thorny skate | 50,240 | $2.8 \%$ | $80.2 \%$ |
| Atlantic cod | 27,633 | $1.5 \%$ | $81.7 \%$ |
| Windowpane flounder | 23,448 | $1.3 \%$ | $83.0 \%$ |

Table 3. Top ten discard species, by weight, and percent of total 2004 observed discards in the New England large-mesh otter trawl, and New England and Mid-Atlantic extra-large-mesh gillnet fishing modes, combined.

## Discards of Monkfish in Other Fisheries

As noted above, there are 20 fishing modes, including the three primary modes in the monkfish fishery, for which at least some amount of monkfish was discarded in 2004. Table 4 identifies the discards of monkfish in 2004, based on observed fishing trips in these 20 fishing modes. The table identifies both the observed discards, the ratio of observed monkfish discards to total observed discards (which indicates the degree to which monkfish is a component of the total discards in the fishing mode), an estimate of the total discards of monkfish in these fishing modes (based on the techniques described in the SBRM Amendment), and the percent (and cumulative percent) of the estimated total monkfish discards in these fishing modes.

|  | Observed <br> Monkfish <br> Discards (lb) | Observed <br> Discards, All <br> Species (lb) | Ratio of <br> Monkfish to <br> Total Discards | Estimate of Total <br> Monkfish <br> Discards (lb) | Percent of Total <br> Monkfish <br> Discards | Cumulative <br> Percent of <br> Discards |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| NE Scallop Dredge OL | 37,877 | 806,792 | $4.7 \%$ | $2,896,875$ | $29.71 \%$ | $29.71 \%$ |
| MA Scallop Dredge OL | 45,211 | 787,116 | $5.7 \%$ | $2,027,711$ | $20.79 \%$ | $50.50 \%$ |
| NE Large-mesh Otter Trawl | 41,061 | $1,545,623$ | $2.7 \%$ | $1,313,457$ | $13.47 \%$ | $63.97 \%$ |
| NE Small-mesh Otter Trawl | 26,577 | $1,108,074$ | $2.4 \%$ | $1,136,577$ | $11.66 \%$ | $75.63 \%$ |
| NE X-Large-mesh Gillnet | 29,933 | 241,610 | $12.4 \%$ | 635,797 | $6.52 \%$ | $82.15 \%$ |
| NE Scallop Dredge OG | 3,330 | 9,918 | $33.6 \%$ | 402,741 | $4.13 \%$ | $86.28 \%$ |
| NE Scallop Dredge CL | 123,828 | $1,477,622$ | $8.4 \%$ | 377,988 | $3.88 \%$ | $90.15 \%$ |
| MA Scallop Dredge CL | 67,163 | 960,608 | $7.0 \%$ | 245,389 | $2.52 \%$ | $92.67 \%$ |
| MA Scallop Dredge OG | 1,307 | 3,400 | $3.9 \%$ | 209,696 | $2.15 \%$ | $94.82 \%$ |
| MA Large-mesh Otter Trawl | 3,629 | 208,137 | $1.7 \%$ | 166,051 | $1.70 \%$ | $96.52 \%$ |
| MA Small-mesh Otter Trawl | 7,744 | 776,602 | $1.0 \%$ | 110,351 | $1.13 \%$ | $97.65 \%$ |
| MA X-Large-mesh Gillnet | 1,712 | 13,386 | $12.8 \%$ | 103,961 | $1.07 \%$ | $98.72 \%$ |
| MA Scallop Trawl OL | 275 | 16,019 | $1.7 \%$ | 76,078 | $0.78 \%$ | $99.50 \%$ |
| MA Scallop Trawl OG | 585 | 37,893 | $1.5 \%$ | 28,377 | $0.29 \%$ | $99.79 \%$ |
| NE Large-mesh Gillnet | 878 | 555,903 | $0.2 \%$ | 11,021 | $0.11 \%$ | $99.90 \%$ |
| MA Scallop Dredge CG | 11 | 394 | $2.8 \%$ | 6,106 | $0.06 \%$ | $99.97 \%$ |
| NE Midwater Trawl | 269 | 402,297 | $0.1 \%$ | 2,241 | $0.02 \%$ | $99.99 \%$ |
| MA Midwater Trawl | 94 | 18,637 | $0.5 \%$ | 461 | $0.00 \%$ | $99.99 \%$ |
| NE Shrimp Trawl | 2 | 2,175 | $0.1 \%$ | 428 | $0.00 \%$ | $100.00 \%$ |
| MA Fish Pot | 1 | $0.0 \%$ | 234 | $0.00 \%$ | $100.00 \%$ |  |

Table 4. 2004 discards of monkfish, both observed and estimated total discards, by weight, for the 20 Northeast Region fishing modes with at least 1 lb of observed discards. The ratio of monkfish to total discards indicates, based on observer data, the relative proportion of the total observed discards that are accounted for by discards of monkfish. For example, the data collected by at-sea observers in 2004 suggest that monkfish comprise one-third of all discards in the New England open area, general category scallop dredge fishing mode.

## Precision of Discard Estimates

Based on the information presented in the SBRM Amendment, a CV is a measure of the precision of the data used in developing discard estimates. Table 5 and Table 6 provide the CVs associated with the discard estimates for the fishing modes most relevant to this report. Table 5 identifies the CVs for all relevant species and species groups for the New England large-mesh otter trawl, and the Mid-Atlantic and New England extra-large-mesh
gillnet fishing modes (the primary three fishing modes associated with the monkfish fishery). Table 6 identifies the CVs for monkfish discards for the 12 fishing modes for which the discards of monkfish accounted for at least 1 percent of the total monkfish discards in 2004.

| Discard Species/Species Group |  |  |  |
| :---: | :---: | :---: | :---: |
| Bluefish | 247\% | 18\% | 30\% |
| Atlantic herring | 131\% | 38\% | * |
| Deep-sea red crab | 28\% | N/A | N/A |
| Sea scallop | 35\% | N/A | N/A |
| Mackerel, squid, butterfish | 57\% | 50\% | * |
| Monkfish | 9\% | 17\% | 27\% |
| Large-mesh multispecies | 10\% | 16\% | * |
| Small-mesh multispecies | 18\% | 62\% | N/A |
| Skates | 17\% | 12\% | 11\% |
| Spiny dogfish | 24\% | 16\% | 13\% |
| Summer flounder, scup, black sea bass | 32\% | 23\% | 30\% |
| Surfclam, ocean quahog | N/A | N/A | N/A |
| Tilefish | 53\% | N/A | N/A |
| Sea turtles | * | * | 49\% |

Table 5. The CV of total discards, by fleet and species group, derived from the 2004 Northeast Region Fisheries Observer Program, for the primary three fishing modes associated with the monkfish fishery. "*" indicates that there were zero discards in 2004. "N/A" indicates that the particular combination of species and fishing mode is excluded from the review.

| Fishing Mode | Monkfish <br> Discards |
| :--- | :---: |
| NE Scallop Dredge OL | $32 \%$ |
| MA Scallop Dredge OL | $\mathbf{1 7 \%}$ |
| NE Large-mesh Otter Trawl | $\mathbf{9} \%$ |
| NE Small-mesh Otter Trawl | $40 \%$ |
| NE X-Large-mesh Gillnet | $\mathbf{1 7 \%}$ |
| NE Scallop Dredge OG | $56 \%$ |
| NE Scallop Dredge CL | $\mathbf{2 5 \%}$ |
| MA Scallop Dredge CL | $\mathbf{2 6 \%}$ |
| MA Scallop Dredge OG | $\mathbf{2 0 \%}$ |
| MA Large-mesh Otter Trawl | $\mathbf{2 9 \%}$ |
| MA Small-mesh Otter Trawl | $\mathbf{3 5 \%}$ |
| MA X-Large-mesh Gillnet | $\mathbf{2 7 \%}$ |

Table 6. The CV of total monkfish discards, by fleet, derived from the 2004 Northeast Region Fisheries Observer Program, for the 12 fishing modes for which each mode's monkfish discards account for at least 1 percent of total monkfish discards.

## Evaluation of Effectiveness of Meeting the SBRM Standard

The SBRM Amendment [proposes to] implement a performance standard of a CV of no more than 30 percent for each relevant combination of fishing mode and species/species group in the Northeast Region. The intent of this standard is to ensure that the data obtained through the Northeast Region SBRM is sufficiently precise to enable scientists and managers to confidently use the resulting data for conducting stock assessments and making management decisions.

Based on the information presented in Table 5 and Table 6, we can evaluate whether the SBRM has met the performance standard for the fishing modes relevant to the subject of this report, monkfish. For the three primary monkfish fishing modes, there are five species groups for which a CV could not be calculated because there were no (zero) discards observed in these fishing modes. There were also 10 species groups which are not included due to the "gray-cell" filter process (see SBRM Amendment for explanation of the gray-cell process). Of the remaining 27 combinations of fishing modes and species groups, 17 have CVs of 30 percent or less. Many of these have CVs considerably better than the SBRM standard (e.g., monkfish in New England large-mesh otter trawl, 9 percent; spiny dogfish in Mid-Atlantic extra-large-mesh gillnet, 13 percent). The remaining 10 combinations have CVs that exceeded the standard, and ranged from 32 percent to 247 percent.

For the 12 fishing modes with monkfish discards included in Table 6, 8 have CVs of 30 percent or less. The other four fishing modes have CVs that range from 32 to 56 percent. Overall, of the 41 unique fishing mode and species group combinations subject to the SBRM standard and related to monkfish, 14 (one-third) have CVs that exceed the standard. The remaining 27 combinations either meet the CV standard or have zero discards.

## Implications for Management

In addition to determining whether or not the SBRM standard was met for each applicable combination of fishing mode and species group, it is also important to examine the potential management implications of not meeting the standard. The reasons for not meeting the standard can vary and include: Insufficient sampling; highly variable discard events; rare discard events; etc. Taking stock of the discard information driving the high CVs can be informative for both understanding the implications of not meeting the standard as well as setting priorities for redressing the issues. Table 7 displays, for each of the three primary monkfish fishing modes, the species groups for which the 2004 CV exceeds the SBRM standard and the observed discards, the estimated total discards, and the percent of total catch represented by the estimated total discards. Table 8 shows similar information for monkfish discards by the primary discard fishing modes for which the 2004 exceeds the SBRM standard.

|  | Discard Species/Species Group |  |  | Estimated <br> Total | Discards as <br> Percent of Total <br> Landings |
| :--- | :--- | :---: | :---: | :---: | :---: |
| (lb) |  |  |  |  |  |

Table 7. Summary information regarding the potential impact of discards for species/species groups for which the 2004 CV exceeded the SBRM standard.

| Fishing Mode | $\mathbf{2 0 0 4} \mathbf{~ C V}$ <br> (Monkfish) | Observed <br> Discards (lb) | Estimated <br> Total <br> Discards (lb) | Discards as <br> Percent of Total <br> Landings |
| :--- | :---: | :---: | :---: | :---: |
| NE Scallop Dredge OL | $32 \%$ | 37,877 | $2,896,875$ | $12.58 \%$ |
| NE Small-mesh Otter Trawl | $40 \%$ | 26,577 | $1,136,577$ | $4.93 \%$ |
| NE Scallop Dredge OG | $56 \%$ | 3,330 | 402,741 | $1.75 \%$ |
| MA Small-mesh Otter Trawl | $35 \%$ | 7.744 | 166,051 | $0.48 \%$ |

Table 8. Summary information regarding the potential impact of monkfish discards for fishing modes for which the 2004 CV exceeded the SBRM standard.

Examining the information presented above provides insight into the potential implications for management of the relatively high CVs associated with the discard information collected in 2004 for the primary monkfish fishery fishing modes. With the possible exception of summer flounder, scup, and black sea bass discards in the New England large-mesh otter trawl mode, and sea turtle encounters in the Mid-Atlantic extra-large-mesh gillnet mode, the impacts of the discards associated with relatively high CVs are very likely to be trivial. Except as noted, estimated total discards do not exceed $40,000 \mathrm{lb}$ for any species/species group, and for most cases, the estimated total discards represent less than $1 / 10$ of 1 percent of the total (recreational and commercial) landings. Within the fishing modes that discard monkfish, although New England open area, limited access scallop dredge contributes the most monkfish discards, the CV (32 percent) is very close to the SBRM standard. Mid-Atlantic small-mesh otter trawl also has a CV (35 percent) relatively close to the SBRM standard, and the estimated total discards represent less than $1 / 2$ of 1 percent of the total monkfish landings for 2004.

Further examination of the summer flounder, scup, and black sea bass discards in the New England large-mesh otter trawl fishing mode indicates that over 90 percent of the observed discards for this species group are summer flounder ( $19,723 \mathrm{lb}$ out of 21,854 lb). Table 9 provides additional information on these three species for this fishing mode. In this case, the highest CVs are associated with scup and black sea bass, but estimated total discards for these two species are relatively low ( 0.45 percent and 0.15 percent, respectively, of total (commercial and recreational) 2004 landings). Most of the discards within this species group are summer flounder, but even though the CV is greater than the SBRM standard, it remains relatively close ( 33 percent rather than 30 percent).
$\left.\begin{array}{lcccc}\hline & \text { Individual Species } & \mathbf{2 0 0 4} \mathbf{~ C V} & \begin{array}{c}\text { Observed } \\ \text { Discards (Ib) }\end{array} & \begin{array}{c}\text { Estimated } \\ \text { Total } \\ \text { Discards (lb) }\end{array}\end{array} \begin{array}{c}\text { Discards as } \\ \text { Percent of Total } \\ \text { Landings }\end{array}\right]$

Table 9. Additional summary information regarding the potential impact of discards for species for which the 2004 CV exceeded the SBRM standard.

The implications of CVs exceeding the SBRM target, based on this information, are likely to be most important for the discards of monkfish in the New England small-mesh otter trawl and New England open area, general category scallop dredge fishing modes.

## Trends in Discards

There is no information to be presented at this time on recent or developing trends in discards for the subject fishing modes.

## Notes on the Example

This information should be considered to be preliminary. It is not presented for Council action, but rather is intended solely as an example of the potential structure and content that could be used in preparing future SBRM Reports.

The information presented in this example report was collected prior to the development and implementation of the Northeast Region SBRM. Future evaluations of the SBRM data should be conducted based on information collected after the SBRM is implemented.

Were this an actual SBRM report, additional information could be utilized and incorporated into the report, such as trend information on discards over time. Also, additional information could be presented depending on the specific needs of the Councils, Plan Development Teams, Fishery Management Action Teams, or Monitoring Committees.

Attachment 1: Observed Discards in the NE Large-mesh Otter Trawl Fishing Mode

|  | Species Name | Observed Discards (lb) | Observed <br> Discards, All <br> Species (lb) | Ratio of Discards to All Discards | Cumulative Percent of Total Discards |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | SKATE, WINTER (BIG) | 366,380 | 1,545,623 | 23.70\% | 23.70\% |
| 2 | SKATE, LITTLE | 347,835 | 1,545,623 | 22.50\% | 46.21\% |
| 3 | SKATE, NK | 217,238 | 1,545,623 | 14.06\% | 60.26\% |
| 4 | DOGFISH, SPINY | 149,701 | 1,545,623 | 9.69\% | 69.95\% |
| 5 | CRAB, JONAH | 49,502 | 1,545,623 | 3.20\% | 73.15\% |
| 6 | SKATE, THORNY | 47,074 | 1,545,623 | 3.05\% | 76.20\% |
| 7 | MONKFISH (ANGLER, GOOSEFISH) | 41,061 | 1,545,623 | 2.66\% | 78.85\% |
| 8 | LOBSTER, AMERICAN | 29,328 | 1,545,623 | 1.90\% | 80.75\% |
| 9 | FLOUNDER, SAND DAB (WINDOWPANE) | 23,446 | 1,545,623 | 1.52\% | 82.27\% |
| 10 | FLOUNDER, WITCH (GREY SOLE) | 22,266 | 1,545,623 | 1.44\% | 83.71\% |
| 11 | FLOUNDER, SUMMER (FLUKE) | 19,723 | 1,545,623 | 1.28\% | 84.99\% |
| 12 | SKATE, SMOOTH | 18,832 | 1,545,623 | 1.22\% | 86.20\% |
| 13 | FLOUNDER, YELLOWTAIL | 17,016 | 1,545,623 | 1.10\% | 87.30\% |
| 14 | RAVEN, SEA | 15,844 | 1,545,623 | 1.03\% | 88.33\% |
| 15 | SPONGE, NK | 15,118 | 1,545,623 | 0.98\% | 89.31\% |
| 16 | COD, ATLANTIC | 13,711 | 1,545,623 | 0.89\% | 90.19\% |
| 17 | FLOUNDER, AMERICAN PLAICE | 12,086 | 1,545,623 | 0.78\% | 90.98\% |
| 18 | SCULPIN, LONGHORN | 9,979 | 1,545,623 | 0.65\% | 91.62\% |
| 19 | HADDOCK | 9,724 | 1,545,623 | 0.63\% | 92.25\% |
| 20 | OCEAN POUT | 9,242 | 1,545,623 | 0.60\% | 92.85\% |
| 21 | BASS, STRIPED | 9,217 | 1,545,623 | 0.60\% | 93.45\% |
| 22 | CRAB, TRUE, NK | 8,419 | 1,545,623 | 0.54\% | 93.99\% |
| 23 | SKATE, BARNDOOR | 7,846 | 1,545,623 | 0.51\% | 94.50\% |
| 24 | STARFISH, SEASTAR,NK | 7,529 | 1,545,623 | 0.49\% | 94.99\% |
| 25 | REDFISH, NK (OCEAN PERCH) | 7,220 | 1,545,623 | 0.47\% | 95.45\% |
| 26 | CRAB, DEEPSEA, RED | 6,660 | 1,545,623 | 0.43\% | 95.88\% |
| 27 | CRAB, SPIDER, NK | 4,945 | 1,545,623 | 0.32\% | 96.20\% |
| 28 | FISH, NK | 4,499 | 1,545,623 | 0.29\% | 96.49\% |
| 29 | FLOUNDER, FOURSPOT | 4,474 | 1,545,623 | 0.29\% | 96.78\% |
| 30 | FLOUNDER, WINTER (BLACKBACK) | 3,871 | 1,545,623 | 0.25\% | 97.03\% |
| 31 | HAKE, SILVER (WHITING) | 3,648 | 1,545,623 | 0.24\% | 97.27\% |
| 32 | POLLOCK | 3,570 | 1,545,623 | 0.23\% | 97.50\% |
| 33 | LUMPFISH | 3,481 | 1,545,623 | 0.23\% | 97.73\% |
| 34 | SKATE, CLEARNOSE | 2,997 | 1,545,623 | 0.19\% | 97.92\% |
| 35 | CRAB, ROCK | 2,961 | 1,545,623 | 0.19\% | 98.11\% |
| 36 | ANEMONE, NK | 2,364 | 1,545,623 | 0.15\% | 98.26\% |
| 37 | RAY, TORPEDO | 2,358 | 1,545,623 | 0.15\% | 98.42\% |
| 38 | SHARK, BASKING | 2,000 | 1,545,623 | 0.13\% | 98.55\% |
| 39 | DOGFISH, SMOOTH | 1,999 | 1,545,623 | 0.13\% | 98.68\% |
| 40 | SCUP | 1,879 | 1,545,623 | 0.12\% | 98.80\% |
| 41 | SCULPIN, NK | 1,742 | 1,545,623 | 0.11\% | 98.91\% |
| 42 | HAKE, WHITE | 1,674 | 1,545,623 | 0.11\% | 99.02\% |
| 43 | HAKE, RED (LING) | 1,280 | 1,545,623 | 0.08\% | 99.10\% |
| 44 | CRAB, NORTHERN STONE | 1,253 | 1,545,623 | 0.08\% | 99.18\% |
| 45 | SEA ROBIN, STRIPED | 1,197 | 1,545,623 | 0.08\% | 99.26\% |
| 46 | SCALLOP, SEA | 1,191 | 1,545,623 | 0.08\% | 99.34\% |
| 47 | HALIBUT, ATLANTIC | 942 | 1,545,623 | 0.06\% | 99.40\% |
| 48 | FLOUNDER, NK | 875 | 1,545,623 | 0.06\% | 99.45\% |
| 49 | BLUEFISH | 854 | 1,545,623 | 0.06\% | 99.51\% |
| 50 | CRAB, HORSESHOE | 716 | 1,545,623 | 0.05\% | 99.56\% |
| 51 | CRAB, SNOW | 590 | 1,545,623 | 0.04\% | 99.59\% |
| 52 | HERRING, ATLANTIC | 563 | 1,545,623 | 0.04\% | 99.63\% |
| 53 | CRAB, HERMIT, NK | 468 | 1,545,623 | 0.03\% | 99.66\% |


|  | Species Name | Observed Discards (lb) | Observed Discards, All Species (lb) | Ratio of Discards to All Discards | Cumulative Percent of Total Discards |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 54 | CUSK | 435 | 1,545,623 | 0.03\% | 99.69\% |
| 55 | CRAB, CANCER, NK | 288 | 1,545,623 | 0.02\% | 99.71\% |
| 56 | TILEFISH, GOLDEN | 285 | 1,545,623 | 0.02\% | 99.73\% |
| 57 | SEA ROBIN, NK | 267 | 1,545,623 | 0.02\% | 99.74\% |
| 58 | SEA ROBIN, NORTHERN | 260 | 1,545,623 | 0.02\% | 99.76\% |
| 59 | SEA BASS, BLACK | 253 | 1,545,623 | 0.02\% | 99.78\% |
| 60 | WOLFFISH, ATLANTIC | 251 | 1,545,623 | 0.02\% | 99.79\% |
| 61 | SNAIL, MOONSHELL, NK | 241 | 1,545,623 | 0.02\% | 99.81\% |
| 62 | SKATE, ROSETTTE | 236 | 1,545,623 | 0.02\% | 99.82\% |
| 63 | WHITING, BLACK (HAKE, OFFSHORE) | 214 | 1,545,623 | 0.01\% | 99.84\% |
| 64 | SEA CUCUMBER, NK | 179 | 1,545,623 | 0.01\% | 99.85\% |
| 65 | SHARK, PORBEAGLE (MACKEREL SHARK) | 175 | 1,545,623 | 0.01\% | 99.86\% |
| 66 | RAY, NK | 164 | 1,545,623 | 0.01\% | 99.87\% |
| 67 | SQUID, SHORT-FIN | 154 | 1,545,623 | 0.01\% | 99.88\% |
| 68 | SNAIL, NK | 140 | 1,545,623 | 0.01\% | 99.89\% |
| 69 | MUSSEL, NK | 126 | 1,545,623 | 0.01\% | 99.90\% |
| 70 | HERRING, BLUEBACK | 111 | 1,545,623 | 0.01\% | 99.91\% |
| 71 | WRYMOUTH | 108 | 1,545,623 | 0.01\% | 99.91\% |
| 72 | LUMPSUCKER, ATL SPNY | 100 | 1,545,623 | 0.01\% | 99.92\% |
| 73 | CLAM, NK | 100 | 1,545,623 | 0.01\% | 99.93\% |
| 74 | QUAHOG, OCEAN (BLACK CLAM) | 86 | 1,545,623 | 0.01\% | 99.93\% |
| 75 | SQUID, NK | 82 | 1,545,623 | 0.01\% | 99.94\% |
| 76 | TAUTOG (BLACKFISH) | 77 | 1,545,623 | 0.00\% | 99.94\% |
| 77 | SHAD, AMERICAN | 69 | 1,545,623 | 0.00\% | 99.95\% |
| 78 | HAKE, NK | 67 | 1,545,623 | 0.00\% | 99.95\% |
| 79 | ROSEFISH,BLACK BELLY | 66 | 1,545,623 | 0.00\% | 99.95\% |
| 80 | MACKEREL, ATLANTIC | 62 | 1,545,623 | 0.00\% | 99.96\% |
| 81 | SEA URCHIN, NK | 43 | 1,545,623 | 0.00\% | 99.96\% |
| 82 | WHELK, CHANNELED (SMOOTH) | 43 | 1,545,623 | 0.00\% | 99.96\% |
| 83 | Sturgeon, NK | 40 | 1,545,623 | 0.00\% | 99.97\% |
| 84 | SQUIRRELFISH, NK | 35 | 1,545,623 | 0.00\% | 99.97\% |
| 85 | SHRIMP, NK | 34 | 1,545,623 | 0.00\% | 99.97\% |
| 86 | ALEWIFE | 33 | 1,545,623 | 0.00\% | 99.97\% |
| 87 | HAKE, SPOTTED | 30 | 1,545,623 | 0.00\% | 99.97\% |
| 88 | SQUID, ATL LONG-FIN | 30 | 1,545,623 | 0.00\% | 99.98\% |
| 89 | BUTTERFISH | 29 | 1,545,623 | 0.00\% | 99.98\% |
| 90 | HAKE, RED/WHITE MIX | 29 | 1,545,623 | 0.00\% | 99.98\% |
| 91 | CLAM, SURF | 26 | 1,545,623 | 0.00\% | 99.98\% |
| 92 | WHELK, NK, CONCH | 25 | 1,545,623 | 0.00\% | 99.98\% |
| 93 | CUNNER (YELLOW PERCH) | 21 | 1,545,623 | 0.00\% | 99.99\% |
| 94 | SHARK, ATL SHARPNOSE | 21 | 1,545,623 | 0.00\% | 99.99\% |
| 95 | SEA SQUIRT, NK | 17 | 1,545,623 | 0.00\% | 99.99\% |
| 96 | DOGFISH, NK | 17 | 1,545,623 | 0.00\% | 99.99\% |
| 97 | CUSK-EEL, NK | 16 | 1,545,623 | 0.00\% | 99.99\% |
| 98 | HERRING, NK (SHAD) | 15 | 1,545,623 | 0.00\% | 99.99\% |
| 99 | SHARK, SANDBAR (BROWN SHARK) | 15 | 1,545,623 | 0.00\% | 99.99\% |
| 100 | HAGFISH, ATLANTIC | 13 | 1,545,623 | 0.00\% | 99.99\% |
| 101 | CRAB, SPIDER, PORTLY | 13 | 1,545,623 | 0.00\% | 99.99\% |
| 102 | OCTOPUS, NK | 12 | 1,545,623 | 0.00\% | 99.99\% |
| 103 | EEL, NK | 11 | 1,545,623 | 0.00\% | 99.99\% |
| 104 | EELPOUT, NK | 11 | 1,545,623 | 0.00\% | 100.00\% |
| 105 | CRAB, LADY | 11 | 1,545,623 | 0.00\% | 100.00\% |
| 106 | DORY, BUCKLER (JOHN) | 10 | 1,545,623 | 0.00\% | 100.00\% |
| 107 | SHAD, HICKORY | 7 | 1,545,623 | 0.00\% | 100.00\% |
| 108 | CRAB, BLUE | 5 | 1,545,623 | 0.00\% | 100.00\% |


|  | Species Name | Observed <br> Oiscards (lb) | Ratio of <br> Discards, All <br> Species (lb) | Discards to All <br> Discards | Cumulative Percent <br> of Total Discards |
| :--- | :--- | :---: | :---: | :---: | :---: |
| 109 | MENHADEN, ATLANTIC | 5 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 110 | JELLYFISH, NK | 5 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 111 | FLOUNDER, LEFTEYE, NK | 5 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 112 | WHELK, KNOBBED | 4 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 113 | INVERTEBRATE, NK | 4 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 114 | TRIGGERFISH, NK (LEATHERJACKET) | 3 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 115 | WEAKFISH (SQUETEAGUE SEA TROUT) | 2 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 116 | ROCKLING, FOURBEARD | 2 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 117 | MACKEREL, NK | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 118 | SHRIMP, MANTIS | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 119 | SHRIMP, PANDALID, NK (NORTHERN) | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 120 | TOADFISH, OYSTER | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 121 | STARGAZER, NK | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 122 | GRENADIER, COMMON (MARLINSPIKE) | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 123 | SEA ROBIN, ARMORED | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 124 | SCALLOP, BAY | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |

Attachment 2: Observed Discards in the NE Extra-Large-Mesh Gillnet

|  | Species Name | Observed Discards <br> (lb) | Observed Discards, All Species (lb) | Ratio of Discards to All Discards | Cumulative Percent of Total Discards |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | DOGFISH, SPINY | 100,388 | 241,610 | 41.55\% | 41.55\% |
| 2 | MONKFISH (ANGLER, GOOSEFISH) | 29,933 | 241,610 | 12.39\% | 53.94\% |
| 3 | LOBSTER, AMERICAN | 22,402 | 241,610 | 9.27\% | 63.21\% |
| 4 | SKATE, WINTER (BIG) | 19,309 | 241,610 | 7.99\% | 71.20\% |
| 5 | COD, ATLANTIC | 13,922 | 241,610 | 5.76\% | 76.96\% |
| 6 | SKATE, BARNDOOR | 7,871 | 241,610 | 3.26\% | 80.22\% |
| 7 | CRAB, JONAH | 7,444 | 241,610 | 3.08\% | 83.30\% |
| 8 | CRAB, ROCK | 4,831 | 241,610 | 2.00\% | 85.30\% |
| 9 | RAVEN, SEA | 4,266 | 241,610 | 1.77\% | 87.07\% |
| 10 | SKATE, LITTLE | 3,768 | 241,610 | 1.56\% | 88.63\% |
| 11 | SKATE, THORNY | 3,167 | 241,610 | 1.31\% | 89.94\% |
| 12 | TUNA, BLUEFIN | 2,875 | 241,610 | 1.19\% | 91.13\% |
| 13 | FLOUNDER, SUMMER (FLUKE) | 2,416 | 241,610 | 1.00\% | 92.13\% |
| 14 | FISH, NK | 2,286 | 241,610 | 0.95\% | 93.07\% |
| 15 | BLUEFISH | 1,935 | 241,610 | 0.80\% | 93.88\% |
| 16 | CRAB, TRUE, NK | 1,577 | 241,610 | 0.65\% | 94.53\% |
| 17 | SKATE, NK | 1,535 | 241,610 | 0.64\% | 95.16\% |
| 18 | POLLOCK | 1,526 | 241,610 | 0.63\% | 95.79\% |
| 19 | BASS, STRIPED | 1,219 | 241,610 | 0.50\% | 96.30\% |
| 20 | STARFISH, SEASTAR,NK | 1,169 | 241,610 | 0.48\% | 96.78\% |
| 21 | SHARK, PORBEAGLE (MACKEREL SHARK) | 721 | 241,610 | 0.30\% | 97.08\% |
| 22 | SPONGE, NK | 631 | 241,610 | 0.26\% | 97.34\% |
| 23 | LUMPFISH | 515 | 241,610 | 0.21\% | 97.56\% |
| 24 | HAKE, WHITE | 437 | 241,610 | 0.18\% | 97.74\% |
| 25 | SHARK, THRESHER | 400 | 241,610 | 0.17\% | 97.90\% |
| 26 | MACKEREL, ATLANTIC | 392 | 241,610 | 0.16\% | 98.06\% |
| 27 | SHARK, MAKO, NK | 300 | 241,610 | 0.12\% | 98.19\% |
| 28 | CRAB, NORTHERN STONE | 294 | 241,610 | 0.12\% | 98.31\% |
| 29 | MUSSEL, NK | 289 | 241,610 | 0.12\% | 98.43\% |
| 30 | RAY, TORPEDO | 282 | 241,610 | 0.12\% | 98.55\% |
| 31 | HAKE, RED (LING) | 277 | 241,610 | 0.11\% | 98.66\% |
| 32 | SKATE, SMOOTH | 258 | 241,610 | 0.11\% | 98.77\% |
| 33 | FLOUNDER, YELLOWTAIL | 200 | 241,610 | 0.08\% | 98.85\% |
| 34 | OCEAN POUT | 176 | 241,610 | 0.07\% | 98.92\% |
| 35 | HADDOCK | 176 | 241,610 | 0.07\% | 98.99\% |
| 36 | FLOUNDER, WINTER (BLACKBACK) | 153 | 241,610 | 0.06\% | 99.06\% |
| 37 | CRAB, SPIDER, NK | 126 | 241,610 | 0.05\% | 99.11\% |
| 38 | SHARK, MAKO, SHORTFIN | 120 | 241,610 | 0.05\% | 99.16\% |
| 39 | CRAB, HORSESHOE | 116 | 241,610 | 0.05\% | 99.21\% |
| 40 | SCULPIN, LONGHORN | 115 | 241,610 | 0.05\% | 99.26\% |
| 41 | Sturgeon, ATLANTIC | 113 | 241,610 | 0.05\% | 99.30\% |
| 42 | SKATE, CLEARNOSE | 107 | 241,610 | 0.04\% | 99.35\% |
| 43 | STURGEON, SHORT-NOSE | 100 | 241,610 | 0.04\% | 99.39\% |
| 44 | DOGFISH, SMOOTH | 99 | 241,610 | 0.04\% | 99.43\% |
| 45 | DORY, BUCKLER (JOHN) | 97 | 241,610 | 0.04\% | 99.47\% |
| 46 | HAKE, SILVER (WHITING) | 97 | 241,610 | 0.04\% | 99.51\% |
| 47 | TUNA, NK | 95 | 241,610 | 0.04\% | 99.55\% |
| 48 | SEA ROBIN, NORTHERN | 88 | 241,610 | 0.04\% | 99.58\% |
| 49 | HALIBUT, ATLANTIC | 82 | 241,610 | 0.03\% | 99.62\% |
| 50 | TUNA, YELLOWFIN | 71 | 241,610 | 0.03\% | 99.65\% |
| 51 | TILEFISH, GOLDEN | 71 | 241,610 | 0.03\% | 99.68\% |
| 52 | DOGFISH, NK | 69 | 241,610 | 0.03\% | 99.71\% |


|  | Species Name | Observed Discards <br> (Ib) | Observed Discards, All Species (lb) | Ratio of Discards to All Discards | Cumulative Percent of Total Discards |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 53 | SEA URCHIN, NK | 69 | 241,610 | 0.03\% | 99.73\% |
| 54 | FLOUNDER, NK | 50 | 241,610 | 0.02\% | 99.75\% |
| 55 | SCALLOP, SEA | 49 | 241,610 | 0.02\% | 99.78\% |
| 56 | SNAIL, NK | 48 | 241,610 | 0.02\% | 99.80\% |
| 57 | HERRING, ATLANTIC | 46 | 241,610 | 0.02\% | 99.81\% |
| 58 | FLOUNDER, FOURSPOT | 43 | 241,610 | 0.02\% | 99.83\% |
| 59 | CRAB, CANCER, NK | 36 | 241,610 | 0.01\% | 99.85\% |
| 60 | SCULPIN, NK | 33 | 241,610 | 0.01\% | 99.86\% |
| 61 | CLAM, NK | 30 | 241,610 | 0.01\% | 99.87\% |
| 62 | CRAB, DEEPSEA, RED | 26 | 241,610 | 0.01\% | 99.88\% |
| 63 | SEA BASS, NK | 24 | 241,610 | 0.01\% | 99.89\% |
| 64 | FLOUNDER, AMERICAN PLAICE | 22 | 241,610 | 0.01\% | 99.90\% |
| 65 | SHARK, NK | 20 | 241,610 | 0.01\% | 99.91\% |
| 66 | STURGEON, NK | 20 | 241,610 | 0.01\% | 99.92\% |
| 67 | CRAB, HERMIT, NK | 19 | 241,610 | 0.01\% | 99.93\% |
| 68 | WHELK, NK, CONCH | 18 | 241,610 | 0.01\% | 99.93\% |
| 69 | SEA CUCUMBER, NK | 18 | 241,610 | 0.01\% | 99.94\% |
| 70 | TAUTOG (BLACKFISH) | 17 | 241,610 | 0.01\% | 99.95\% |
| 71 | SHAD, AMERICAN | 16 | 241,610 | 0.01\% | 99.96\% |
| 72 | SEA ROBIN, STRIPED | 13 | 241,610 | 0.01\% | 99.96\% |
| 73 | FLOUNDER, LEFTEYE, NK | 12 | 241,610 | 0.00\% | 99.97\% |
| 74 | REDFISH, NK (OCEAN PERCH) | 11 | 241,610 | 0.00\% | 99.97\% |
| 75 | CUNNER (YELLOW PERCH) | 9 | 241,610 | 0.00\% | 99.97\% |
| 76 | ANEMONE, NK | 9 | 241,610 | 0.00\% | 99.98\% |
| 77 | SEA SQUIRT, NK | 8 | 241,610 | 0.00\% | 99.98\% |
| 78 | SNAIL, MOONSHELL, NK | 8 | 241,610 | 0.00\% | 99.98\% |
| 79 | WRYMOUTH | 5 | 241,610 | 0.00\% | 99.99\% |
| 80 | HERRING, BLUEBACK | 4 | 241,610 | 0.00\% | 99.99\% |
| 81 | HAKE, NK | 4 | 241,610 | 0.00\% | 99.99\% |
| 82 | JELLYFISH, NK | 3 | 241,610 | 0.00\% | 99.99\% |
| 83 | LAMPREY, NK | 3 | 241,610 | 0.00\% | 99.99\% |
| 84 | CUSK | 2 | 241,610 | 0.00\% | 99.99\% |
| 85 | FLOUNDER, SAND DAB (WINDOWPANE) | 2 | 241,610 | 0.00\% | 99.99\% |
| 86 | SEA ROBIN, NK | 2 | 241,610 | 0.00\% | 99.99\% |
| 87 | DOGFISH, CHAIN | 2 | 241,610 | 0.00\% | 99.99\% |
| 88 | CORAL, STONY, NK | 2 | 241,610 | 0.00\% | 100.00\% |
| 89 | STARFISH, BRITTLE,NK | 2 | 241,610 | 0.00\% | 100.00\% |
| 90 | SEA ROBIN, ARMORED | 2 | 241,610 | 0.00\% | 100.00\% |
| 91 | HAGFISH, ATLANTIC | 1 | 241,610 | 0.00\% | 100.00\% |
| 92 | INVERTEBRATE, NK | 1 | 241,610 | 0.00\% | 100.00\% |
| 93 | BUTTERFISH | 1 | 241,610 | 0.00\% | 100.00\% |
| 94 | FLOUNDER, WITCH (GREY SOLE) | 1 | 241,610 | 0.00\% | 100.00\% |
| 95 | SCUP | 1 | 241,610 | 0.00\% | 100.00\% |
| 96 | SKATE, ROSETTTE | 1 | 241,610 | 0.00\% | 100.00\% |
| 97 | WORM, NK | 1 | 241,610 | 0.00\% | 100.00\% |

Attachment 3: Observed Discards in the MA Extra-Large-Mesh Gillnet

|  | Species Name | Observed Discards (lb) | Observed Discards, All Species (lb) | Ratio of Discards to All Discards | Cumulative Percent of Total Discards |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | DOGFISH, SPINY | 3,620 | 13,386 | 27.05\% | 27.05\% |
| 2 | CRAB, HORSESHOE | 2,107 | 13,386 | 15.74\% | 42.79\% |
| 3 | MONKFISH (ANGLER, GOOSEFISH) | 1,712 | 13,386 | 12.79\% | 55.58\% |
| 4 | SKATE, LITTLE | 1,469 | 13,386 | 10.97\% | 66.55\% |
| 5 | SKATE, WINTER (BIG) | 603 | 13,386 | 4.50\% | 71.05\% |
| 6 | STARFISH, SEASTAR,NK | 600 | 13,386 | 4.48\% | 75.53\% |
| 7 | STURGEON, ATLANTIC | 547 | 13,386 | 4.09\% | 79.62\% |
| 8 | BASS, STRIPED | 453 | 13,386 | 3.38\% | 83.00\% |
| 9 | FISH, NK | 379 | 13,386 | 2.83\% | 85.83\% |
| 10 | BLUEFISH | 328 | 13,386 | 2.45\% | 88.28\% |
| 11 | SKATE, NK | 322 | 13,386 | 2.40\% | 90.68\% |
| 12 | STURGEON, NK | 235 | 13,386 | 1.76\% | 92.44\% |
| 13 | SPONGE, NK | 192 | 13,386 | 1.43\% | 93.87\% |
| 14 | FLOUNDER, SUMMER (FLUKE) | 113 | 13,386 | 0.84\% | 94.71\% |
| 15 | STURGEON, SHORT-NOSE | 110 | 13,386 | 0.82\% | 95.53\% |
| 16 | SKATE, CLEARNOSE | 107 | 13,386 | 0.80\% | 96.33\% |
| 17 | DOGFISH, SMOOTH | 89 | 13,386 | 0.66\% | 97.00\% |
| 18 | CRAB, JONAH | 80 | 13,386 | 0.60\% | 97.59\% |
| 19 | CRAB, ROCK | 60 | 13,386 | 0.45\% | 98.04\% |
| 20 | SCALLOP, SEA | 60 | 13,386 | 0.44\% | 98.49\% |
| 21 | CRAB, TRUE, NK | 27 | 13,386 | 0.20\% | 98.69\% |
| 22 | MENHADEN, ATLANTIC | 23 | 13,386 | 0.17\% | 98.86\% |
| 23 | CRAB, SPIDER, NK | 23 | 13,386 | 0.17\% | 99.03\% |
| 24 | LOBSTER, AMERICAN | 18 | 13,386 | 0.13\% | 99.17\% |
| 25 | CROAKER, ATLANTIC | 18 | 13,386 | 0.13\% | 99.30\% |
| 26 | FLOUNDER, NK | 15 | 13,386 | 0.11\% | 99.41\% |
| 27 | DOGFISH, NK | 15 | 13,386 | 0.11\% | 99.53\% |
| 28 | Stargazer, NK | 14 | 13,386 | 0.10\% | 99.63\% |
| 29 | RAY, TORPEDO | 12 | 13,386 | 0.09\% | 99.72\% |
| 30 | WHELK, NK, CONCH | 8 | 13,386 | 0.06\% | 99.78\% |
| 31 | CRAB, CANCER, NK | 7 | 13,386 | 0.05\% | 99.83\% |
| 32 | ANCHOVY, NK | 5 | 13,386 | 0.04\% | 99.87\% |
| 33 | STARFISH, BRITTLE,NK | 5 | 13,386 | 0.04\% | 99.91\% |
| 34 | WEAKFISH (SQUETEAGUE SEA TROUT) | 4 | 13,386 | 0.03\% | 99.94\% |
| 35 | CRAB, HERMIT, NK | 2 | 13,386 | 0.01\% | 99.95\% |
| 36 | MACKEREL, FRIGATE | 1 | 13,386 | 0.01\% | 99.96\% |
| 37 | HERRING, BLUEBACK | 1 | 13,386 | 0.01\% | 99.97\% |
| 38 | SEA ROBIN, STRIPED | 1 | 13,386 | 0.01\% | 99.98\% |
| 39 | CLAM, NK | 1 | 13,386 | 0.01\% | 99.99\% |
| 40 | MUSSEL, NK | 1 | 13,386 | 0.01\% | 99.99\% |
| 41 | SEA ROBIN, NORTHERN | 1 | 13,386 | 0.00\% | 100.00\% |
| 42 | SEA URCHIN, NK | 1 | 13,386 | 0.00\% | 100.00\% |

## Examples of how observer discard data can be queried and analyzed to support management decisions.

## Example 1

The follow excerpts are from pages 137, 152, and 153 of Framework 40A to the Northeast Multispecies FMP. This example demonstrates the use of observer discard data to make predictions of possible biological impacts of management alternatives. The complete document is available at: http://www.nefmc.org/nemulti/index.html.

## ENVIRONMENTAL CONSEQUENCES - ANALYSIS OF IMPACTS

Proposed Action

## CAII Haddock SAP

An experiment has not been conducted that estimates the incidental catch species that will be taken during the CAII haddock SAP. As a result, this analysis uses recent observer reports from the area and the results of several gear experiments to evaluate the impacts of this SAP on incidental catch species. First examined were observer reports for trawl trips in SA 561 and 562 from calendar years 2001 through 2003. A summary of observed tows by area and quarter is provided in Table 45. The analyses focus on 2002 and 2003 because of the higher level of observer coverage in SA 562. Note that for these tows, there was no requirement to use a haddock separator trawl. Catches of the top fifteen species are shown by statistical area for calendar years 2002 and 2003 in Table 57 and Table 58. Of the regulated groundfish species in this list, the stocks of concern that were caught most frequently in both years were cod, white hake, plaice, and witch flounder. Large quantities of skates were also caught and these catches will be discussed in a following section that analyzes bycatch.

The proposed SAP is allocated a portion of the GB cod incidental catch TAC. The observed trips were examined further to determine catch rates of cod and to estimate the number of days that may be fished before the cod TAC is caught. Cod catches on observed tows in 2002 averaged $109 \mathrm{lbs} . /$ tow for the entire area. The difference between the average cod/tow in SA 561 (166) and SA 562 (75) was statistically significant. Catch per tow on observed tows in 2003 was 245 lbs./tow. Once again, the catch per tow in SA 561 (365) was significantly higher than that in SA 562 (141). Catches for plaice, white hake, and witch flounder were less than 25 lbs./tow. 2003 tows were analyzed to determine the mean catch of cod on tows targeting haddock. For both areas, the average cod catch/tow was 235 lbs for tows targeting haddock. The cod catch/tow in SA 561 ( 457 lbs .) was significantly different than that in SA 562 (110 lbs.). According to the data, catches per tow of cod are higher in SA 561, while catches of haddock are higher in SA 562.

|  | Number of Observed Tows |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathbf{2 0 0 1}$ |  |  | $\mathbf{2 0 0 2}$ |  |  | $\mathbf{5 0 0 3}$ |  |  |  |
| Quarter | Both | $\mathbf{5 6 1}$ | $\mathbf{5 6 2}$ | Both | $\mathbf{5 6 1}$ | $\mathbf{5 6 2}$ | Both | 561 | 562 |  |
| 1 | 68 | 63 | 5 | 29 | 20 | 9 | 192 | 108 | 84 |  |
| 2 | 54 | 52 | 2 | 135 | 41 | 94 | 576 | 321 | 255 |  |
| 3 | 9 | 9 | 0 | 208 | 58 | 150 | 240 | 67 | 173 |  |
| 4 | 30 | 29 | 1 | 72 | 49 | 23 | 189 | 55 | 134 |  |
| Total | 161 | 153 | 8 | 444 | 168 | 276 | 1197 | 551 | 646 |  |

Table 45 - Observed otter trawl tows, calendar years 2001 - 2003, statistical areas 561 and 562 (NMFS OBDBS database)

| S Species | SA 561 |  | SA 562 |  | Grand <br> Total |
| :--- | ---: | ---: | ---: | ---: | ---: |
|  | Discarded |  | Kept | Discarded | Kept |

Table 57 - Top fifteen species caught by otter trawls on observed tows in SAs 561 and 562, 2002 (pounds) (NMFS OBDBS)

| S Species | SA 561 |  | SA 562 |  | Grand <br> Total |
| :--- | ---: | ---: | ---: | ---: | ---: |
|  | Discarded | Kept | Discarded | Kept |  |
| ANGLER | 3,787 | 72,916 | 1,939 | 11,309 | 89,951 |
| COD | 11,210 | 190,872 | 1,412 | 89,895 | 293,388 |
| FLOUNDER, AM. PLAICE | 1,210 | 16,384 | 53 | 1,630 | 19,277 |
| FLOUNDER, WINTER | 1,554 | 85,278 | 432 | 354,303 | 441,566 |
| FLOUNDER, WITCH | 1,304 | 9,192 | 329 | 1,181 | 12,006 |
| FLOUNDER, YELLOWTAIL | 954 | 83,699 | 4,012 | 131,763 | 220,428 |
| HADDOCK | 3,313 | 39,560 | 6,656 | 199,215 | 248,743 |
| HAKE, SILVER | 759 | 243 | 212 | 17,111 | 18,325 |
| LOBSTER | 6,581 | 25,037 | 3,995 | 15,038 | 50,651 |
| POLLOCK | 24 | 19,115 |  | 445 | 19,584 |
| SCALLOP, SEA | 2,554 | 7,268 | 15,794 | 12,745 | 38,360 |
| SEA RAVEN | 5,027 |  | 7,412 |  | 12,439 |
| SKATE, LITTLE | 56,812 |  | 282,885 |  | 339,697 |
| SKATE, WINTER(BIG) | 66,581 | 46,318 | 330,624 | 56,742 | 500,264 |
| SKATES | 16,018 | 14,742 | 87,040 | 20,611 | 138,410 |
| Grand Total | 177,687 | 610,622 | 742,794 | 911,986 | $2,443,089$ |

Table 58 - Top fifteen species caught by otter trawls on observed tows in SAs 561 and 562, 2003 (pounds round weight), 2003 (NMFS OBDBS)

## Example 2

The following excerpt is from page 205 of Framework 42 to the Northeast Multispecies FMP. This is a good example of how observer discard data can be used to examine a specific program in a defined area and time period, in this case, the Yellowtail Flounder Special Access Program in Closed Area II. The complete document is available at: http://www.nefmc.org/nemulti/index.html.

### 6.5.2.4 Closed Area II Yellowtail Flounder Special Access Program

Yellowtail flounder discards in the SAP were reviewed to determine the cause. Thirty-one (out of 319, or 9.7 percent) trawl trips in the CAII Yellowtail Flounder SAP were observed. Yellowtail flounder ( $600,805 \mathrm{lbs}$.), haddock ( $156,378 \mathrm{lbs}$.), sea scallops ( 88,634 lbs.), monkfish ( $68,417 \mathrm{lbs}$.), and winter skates ( $47,517 \mathrm{lbs}$.) were the top five kept species on these observed trips. The top discarded species were skates ( $704,205 \mathrm{lbs}$. , all species), sea scallops ( $32,610 \mathrm{lbs}$.), yellowtail flounder ( $30,290 \mathrm{lbs}$. ), and haddock ( $22,178 \mathrm{lbs}$. ). The primary reason for yellowtail flounder discards on observed trips was that the fish were smaller than the regulatory minimum size ( $21,289 \mathrm{lbs}$., or 70 percent of observed discards). Vessels that had filled their quota discarded another 3,409 lbs. on observed trips, while $4,081 \mathrm{lbs}$. were discarded due to market conditions.

## Example 3

The following excerpts are from page 211-215 of Framework 42 to the Northeast Multispecies FMP. In this example, observer discard data are used to help evaluate the performance of the haddock separator trawl in commercial fishing operations. The complete document is available at: http://www.nefmc.org/nemulti/index.html.

### 6.5.2.8 Haddock Separator Trawl

This action proposes two measures that require use of the haddock separator trawl: an extension of the Eastern U.S./CA Haddock SAP, and a proposal to require the use of the separator trawl when participating in the Category B (regular) DAS Program (which may be renewed). There are a limited number of observed trips by vessels using the separator trawl which can be used to supplement experimental data on the performance of the trawl.

The observer (OBDBS) database was queried to identify trawl trips that used a separator panel (excluder device='3') in CY 2005. A total of 20 observed trips were identified in the database as of December 14, 2005. Additional observed trips may have occurred but may not yet be entered into the database. Fourteen trips were recorded as U.S./CA area trips while six trips were recorded as Category B (regular) DAS trips. This designation is made by the observer, and it is possible that they are not exclusive (e.g. a Category B (regular) program trip may occur in the U.S./CA area). Seven trips made tows both with and without the panel. Most trips used the separator panel in the Eastern U.S./Canada area (SAs 561 and 562).

Catches (kept and discarded) of the top twenty-five species on tows using a separator panel are shown in Table 74. Regulated groundfish accounted for sixty-five percent of the catch, with haddock, yellowtail flounder, cod, and winter flounder as the four largest regulated groundfish components. Combined catches of skates ( $207,136 \mathrm{lbs}$.) exceeded the haddock catch (199,634 lbs.). The overall ratio of haddock to yellowtail flounder was 2.6:1, the ratio
of haddock to cod was 4.2:1, and the ratio of haddock to winter flounder was 3.2:1. Monkfish, witch flounder, and plaice were also caught in substantial quantities.

The ratio of haddock to other species was compared for trips identified as occurring in the Category B (regular) DAS program and trips identified as taking place in the U.S./CA area. With only five observed trips using the separator trawl in the Category B (regular) DAS program these results should not be considered definitive. While the ratio of haddock to winter flounder in both programs was similar (3.1:1 in the U.S./CA area, 3.4:1 in the Category B(regular) DAS program), the ratio of haddock to yellowtail flounder was 4.1:1 in the U.S./CA program but 1.1:1 in the Category B (regular) DAS Pilot Program. The ratio of haddock to cod in the U.S./CA program was 3.8:1, while it was 7:1 in the Category B (regular) DAS program. The ratio of haddock to monkfish was similar in both programs.

Haddock discards accounted for six percent of the haddock catch (12,466 lbs.), with almost all discards due to the fish being smaller than the regulatory minimum. Cod discards accounted for fifty percent ( $21,504 \mathrm{lbs}$.) of the cod catch; sixty-seven percent of these discards were due to a filled vessel quota, twenty-three percent were due to high grading, and various other reasons were given for the remaining discards. Ninety-four percent of the skates caught were discarded, totaling 193,937 pounds. Winter skate ( $49,716 \mathrm{lbs}$.) and little skates ( $54,369 \mathrm{lbs}$.) were the largest components identified by species, but an additional $78,711 \mathrm{lbs}$. was identified as skates (NK). There were also $10,609 \mathrm{lbs}$. of barndoor skates caught, all discarded, and 532 lbs. of smooth skates.

Catch composition on tows using the separator trawl was examined by trip, focusing on regulated groundfish. All twenty trips caught haddock and cod while using a separator trawl, seventeen trips caught yellowtail, winter flounder, or monkfish, fifteen trips caught plaice, and thirteen trips caught grey sole (witch flounder). The ratio of haddock to cod for the twenty trips ranged from $0.2: 1$ to 22.4:1. For the seventeen observed trips that caught winter flounder, the ratio of haddock to winter flounder ranged from 0.1:1 to 186.8:1. For the trips that caught yellowtail flounder, the ratio of haddock to yellowtail flounder ranged from 0.1:1 to 5,230:1.

There were a total of 405 observed tows that used a separator trawl on these fifteen trips. Over these tows, haddock was caught on 370 tows (ninety-one percent), cod on 309 tows (seventy-six percent), yellowtail flounder on 266 tows (sixty-six percent), and winter flounder on 243 tows (sixty percent). The average catch of haddock per tow was 493 lbs., yellowtail flounder was 189 lbs., cod was 117 lbs., and winter flounder was 156 lbs. In comparison to the observed data, FW 40A estimated that the cod catch per tow would be between 47 and 92 lbs. and the haddock catch per tow would be 765 lbs . There was considerable variation in the catch of regulated groundfish between trips and tows. For example, four trips did not have any tows catching yellowtail flounder, four trips had occasional tows that caught small amounts, one trip had yellowtail catches decline as the trip passed, and six trips had frequent tows catching sizeable amounts of yellowtail flounder.

As reported earlier, seven trips made tows both with and without the separator trawl. These trips were examined to contrast the performance of tows using the separator trawl with tows that did not use the separator trawl by vessels that used both on the same trip. While this approach reduces the likelihood that any differences are due to differences between vessels, it does not resolve the issue that catches may be the result not just of the gear used,
but numerous other factors: location, depth fished, etc. Catch composition differed: haddock accounted for twelve percent of the catch on tows without the separator trawl, and thirty-three percent of the catch on tows with the trawl (Table 75). Overall, the ratio of haddock to cod for these trips, while not using the separator trawl, was 1.4:1, the ratio of haddock to yellowtail flounder was 0.7:1, the ratio of haddock to winter flounder was 11.8:1, and the ratio of haddock to monkfish was 1:1. While using a separator trawl, for these vessels the ratio of haddock to cod on the same trip was 2.5:1, the ratio of haddock to yellowtail flounder was 7.4:1, the ratio of haddock to winter flounder was 3.1:1, and the ratio of haddock to monkfish was 6.3:1. In an effort to reduce the influence of tows in different areas, five trips were examined that fished in SA 561 and 562. The results, while not detailed here, were similar.

Table 73 - Observed trips using a separator panel, CY 2005 (OBDBS data available as of December 14, 2005)

| Program | Month | 521 | 522 | 525 | 561 | 562 | Total |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| US/CA | 01 | 0 | 0 | 0 | 0 | 1 | 1 |
|  | 03 | 1 | 0 | 0 | 4 | 3 | 5 |
|  | 05 | 0 | 1 | 0 | 5 | 5 | 5 |
|  | 06 | 0 | 0 | 1 | 0 | 2 | 2 |
|  | 07 | 0 | 0 | 1 | 1 | 1 | 1 |
|  |  | 1 | 1 | 1 | 10 | 10 | 14 |
| Sub-Total |  | 1 | 1 | 0 | 0 | 0 | 1 |
| CAT B | 03 | 0 | 0 | 1 | 0 | 2 | 2 |
| (regular) | 05 | 2 | 2 | 1 | 0 | 0 | 2 |
|  | 06 | 0 | 1 | 0 | 0 | 0 | 1 |
|  | 07 | 3 | 3 | 2 | 0 | 4 | 6 |
| Sub-Total |  | 4 | 4 | 3 | 10 | 14 | 20 |
| Grand   <br> Total   |  |  |  |  |  |  |  |

Table 74 - Catches (pounds, live weight, kept and discarded) by statistical area on observed tows using a haddock separator trawl, CY 2005

| COMNAME | 521 | 522 | 525 | 552 | 561 | 562 | Grand Total |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| HADDOCK | 8,445 | 31,152 | 142 | 18 | 47,946 | 140,234 | 227,937 |
| SKATE, LITTLE | 25 | 83,432 | 1,977 | 500 | 5,975 | 44,916 | 136,825 |
| FLOUNDER, YELLOWTAIL | 1 | 1,375 | 4,633 | 30 | 3,834 | 91,623 | 101,496 |
| MONKFISH (ANGLER, GOOSEFISH) | 9,368 | 43,446 | 341 | 0 | 23,475 | 14,187 | 90,817 |
| SKATE, WINTER (BIG) | 2,105 | 10,700 | 357 | 693 | 21,087 | 51,773 | 86,715 |
| SKATE, NK | 1,770 | 235 | 1,500 | 0 | 8,766 | 70,805 | 83,076 |
| FLOUNDER, WINTER (BLACKBACK) | 5 | 174 | 67 | 420 | 9,461 | 54,546 | 64,673 |
| COD, ATLANTIC | 12,712 | 1,591 | 41 | 339 | 32,955 | 16,339 | 63,977 |
| FLOUNDER, AMERICAN PLAICE | 876 | 2,681 | 54 | 0 | 24,635 | 1,898 | 30,144 |
| FLOUNDER, WITCH (GREY SOLE) | 14,813 | 1,415 | 105 | 0 | 9,583 | 3,331 | 29,247 |
| LOBSTER, AMERICAN | 1,785 | 2,130 | 34 | 0 | 13,902 | 3,776 | 21,627 |
| SKATE, BARNDOOR | 98 | 434 | 306 | 0 | 515 | 10,369 | 11,722 |
| CRAB, JONAH | 11 | 9,310 | 0 | 0 | 24 | 157 | 9,502 |
| POLLOCK | 873 | 1,344 | 0 | 0 | 6,226 | 238 | 8,681 |
| HAKE, WHITE | 191 | 930 | 0 | 0 | 4,400 | 9 | 5,530 |
| FLOUNDER, SAND DAB | 0 | 3 | 136 | 15 | 70 | 3,813 | 4,037 |
| (WINDOWPANE) | 0 | 112 | 1 | 0 | 303 | 3,289 | 3,705 |
| SCALLOP, SEA | 114 | 114 | 217 | 10 | 711 | 2,515 | 3,681 |
| RAVEN, SEA | 185 | 186 | 0 | 0 | 2,895 | 201 | 3,467 |
| DOGFISH, SPINY | 0 | 42 | 210 | 0 | 51 | 2,238 | 2,541 |
| FLOUNDER, FOURSPOT | 8 | 7 | 138 | 0 | 1,393 | 218 | 1,764 |
| HAKE, RED (LING) | 0 | 1,482 | 0 | 0 | 4 | 0 | 1,486 |
| HERRING, ATLANTIC | 6 | 717 | 2 | 0 | 11 | 713 | 1,449 |
| STARFISH, SEASTAR,NK | 0 | 89 | 80 | 10 | 24 | 955 | 1,158 |
| FLOUNDER, SUMMER (FLUKE) | 9 | 41 | 8 | 0 | 128 | 804 | 990 |
| OCEAN POUT | 53,400 | 193,142 | 10,349 | 2,035 | 218,374 | 518,947 | 996,247 |
| Grand Total |  |  |  |  |  |  |  |

Table 75 - Catch composition (pounds, live weight) for seven trips that made tows with and without the separator panel, CY 2005 (Source: NMFS OBDBS as of December 12, 2005)

| COMNAME | Without <br> Separator | With Separator | Grand <br> Total |
| :--- | :---: | :---: | :---: |
| HADDOCK | 17,679 | 40,893 | 58,572 |
| SKATE, WINTER (BIG) | 21,960 | 14,207 | 36,167 |
| FLOUNDER, YELLOWTAIL | 23,750 | 5,560 | 29,310 |
| COD, ATLANTIC | 12,920 | 16,146 | 29,066 |
| MONKFISH (ANGLER, GOOSEFISH) | 17,117 | 6,489 | 23,606 |
| SKATE, LITTLE | 14,346 | 5,754 | 20,100 |
| SKATE, NK | 2,875 | 14,163 | 17,038 |
| FLOUNDER, WINTER (BLACKBACK) | 1,494 | 13,209 | 14,703 |
| FLOUNDER, AMERICAN PLAICE | 10,462 | 1,416 | 11,878 |
| LOBSTER, AMERICAN | 7,109 | 3,359 | 10,468 |
| FLOUNDER, WITCH (GREY SOLE) | 4,135 | 1,715 | 5,850 |
| POLLOCK | 4,300 | 623 | 4,923 |
| HAKE, WHITE | 3,490 | 469 | 3,959 |
| SCALLOP, SEA | 2,766 | 150 | 2,916 |
| DOGFISH, SPINY | 1,893 | 98 | 1,991 |
| HAKE, RED (LING) | 1,410 | 0 | 1,410 |
| SKATE, BARNDOOR | 1,083 | 24 | 1,107 |
| RAVEN, SEA | 365 | 394 | 759 |
| FLOUNDER, FOURSPOT | 618 | 1 | 619 |
| FLOUNDER, SAND DAB (WINDOWPANE) | 48 | 407 | 455 |
| OCEAN POUT | 213 | 101 | 314 |
| LUMPFISH | 276 | 12 | 288 |
| HALIBUT, ATLANTIC | 0 | 263 | 113 |
| FLOUNDER, SUMMER (FLUKE) | 50 | 63 | 58 |
| WOLFFISH, ATLANTIC | 25 | 33 | 275,933 |
| Grand Total | 150,384 | 125,549 |  |

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# Appendix D <br> Northeast Fisheries Observer Program Data Flow Process 

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# Summary of Northeast Fisheries Observer Program DATA FLOW 

The Northeast Fisheries Observer Program collects, maintains, and distributes data to be used for scientific and management purposes. Since 1989, the Northeast Fisheries Observer Program has deployed observers on commercial fishing vessels in various fisheries. Trips have ranged from 1-15 days at sea. The observed sea days have ranged from 2,000-12,000 annually, completed by 20-120 certified observers. The trips consist of data logs containing a variety of information including but not limited to:

- Trip information (target species, dates/times, gears fished, primary species landed, etc.)
- Economic information (trip level costs such as vessel/gear repair, fuel, etc.)
- Haul information (dates/times, weather, water depth, location, etc.)
- Species information (species, disposition, weights, etc.)
- Sampling information (lengths, weights, \# of age structures collected, etc.)
- Incidental Take information (species, samples collected, lengths, etc.)
- Safety information (EPIRB on board, Coast Guard Documentation sticker, etc.)

Depending on the fishery observed and the associated reporting requirements, the flow of data can be very complex as it migrates from various sources before it is loaded to the main Oracle database. The outline below describes what happens to these data once an observer returns to port from an observed trip.

1. COMPLETION OF PAPER LOGS - The observer verifies that their paper logs are filled out completely and accurately.
2. ELECTRONIC DATA SUBMISSION - The observer enters a subset of their paper log data electronically and uploads the data to Oracle tables. For certain fisheries, this subset of data is used for preliminary analysis.
3. DATA REVIEW - All data are fully reviewed for completeness and accuracy, including any media and biological samples submitted. Observers are debriefed as needed to verify data or clarify inconsistencies.
4. DATA ENTRY AND AUDITING - Paper log data are fully entered and a thorough audit is completed. The audit continues until all errors and warnings have been addressed. Data are loaded to the main Oracle database.

## ***At this point the data have been loaded in the main Oracle database and are accessible to end users***

5. DATA ERROR REPORTS - If errors are found after data has been loaded to the main Oracle database, error reports are generated and the appropriate changes are made directly to the main Oracle database.
6. DATA ARCHIVING - All data collected from the Northeast Fisheries Program are scanned in order to alleviate space and enable observer data to be viewed on a secure website. Original paper logs are archived at a secure facility.

Note: This is not a complete description of the data flow process used by the Northeast Fisheries Observer Program, but is instead a summary intended to provide an overview of how the data are reviewed, edited, and processed.

## Appendix E <br> Comments on the Draft Amendment

This appendix contains comments received on the draft 2007 SBRM Omnibus Amendment, as well as comments received on the current SBRM Omnibus Amendment. The public comment period for the draft 2007 SBRM Omnibus Amendment was October 31 through December 29, 2006. The public comment period on the draft of the current SBRM Omnibus Amendment was September 27, 2013, through October 27, 2013. The comment period was then reopened from November 19, 2013, through December 19, 2013.

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# Summary of Comments Received on the Draft Amendment 

Comment Period: October 31-December 29, 2006

NOAA's National Marine Fisheries Service (NMFS), on behalf of the Mid-Atlantic and New England Fishery Management Councils, published a Federal Register notice on October 31, 2006, to announce the availability of the draft SBRM Amendment and associated environmental assessment (EA) for review and to solicit comments on the document. The Federal Register notice announced two public hearings held on November 14, 2006, in Gloucester, MA, and on December 13, 2006, in New York, NY. Written comments were accepted through December 29, 2006.

A total of 48 individuals attended the public hearings, and 9 individuals offered public testimony on the amendment. In addition to those speaking at the public hearings, NMFS received seven comment letters. Several of these letters restated opinions voiced at the public hearings. One letter was submitted on behalf of six fishing industry organizations, with a second letter endorsing the first. Three of the letters were from conservation organizations, two of which endorsed the more detailed comments of the third. The two remaining letters were submitted by private citizens.

Several comment letters recognized the considerable effort expended to date on the development of the amendment and applauded the progress that has been made. However, with the exception of two letters, one focused entirely on the cost estimates for electronic monitoring and one on the state of fisheries in general and recommending improved enforcement, the comment letters indicated dissatisfaction with a variety of elements of the draft amendment and several expressed doubt that the amendment would satisfy the Court orders stemming from the Amendment 10 and Amendment 13 lawsuits. The following summarizes all comments provided during testimony at the public hearings and in the written letters; however, in cases where the same individual or organization provided the same comment more than once (e.g., during a public hearing and also in a follow-up letter), the comment is summarized once.

## General Comments on the Amendment

Comment 1. One commenter expressed concern that the SBRM Amendment does not strike an adequate balance between specificity and generality. The commenter suggested that it is overly specific when it stratifies the bycatch reporting regime into "tens of hundreds" of strata, and it is too general in that it prescribes a uniform precision target across all fisheries.

Response: The commenter's claim of "tens of hundreds" of strata is incorrect. The SBRM Amendment stratifies fishing activities into 39 fishing modes that represent
the appropriate gear type and area-based divisions to best serve as the basis for assigning observer coverage. Against these 39 strata, the implications of observer coverage are assessed for each species and species group managed under the Councils 13 FMPs, plus sea turtles, encountered by each fishing mode. While this creates a matrix composed of 585 cells, the Councils consider this to be an appropriate framework for the analysis conducted in support of the SBRM and with the appropriate level of specificity. The Councils do not consider the CV-based performance standard to be too general in its application across all fisheries. The CVbased methodology establishes the process by which observer coverage levels are determined and allocated across the wide variety of fisheries managed under the Northeast Region FMPs. Using a global standard (a CV of 30 percent) across all fisheries does not mean that all fisheries would be allocated the same level of observer coverage (as would occur under a process by which all fisheries were required to achieve, for example, 20 percent coverage), but recognizes inherently that some fisheries-those that have more highly variable catches-require higher levels of observer coverage than those with more consistent (less variable) catches. In this way, the differences among fisheries that would affect observer coverage levels are accounted for while ensuring that the data collected by observers on discards in all fisheries achieve a consistent and standard level of precision.

Given that the expectations for the discard data obtained by at-sea fisheries observers should be consistent across all fisheries for which the data are used in similar ways (e.g., to obtain reasonably precise and accurate estimates of discards for use in stock assessments and to determine the stock-level implications of discarding), it stands to reason that a generally-derived performance standard is appropriate, particularly given the overlaps and inter-relationships among fisheries and species caught (see chapter 3). When the discard data are used for different purposes in certain specific fisheries (e.g., for real-time area-based quota monitoring), the generally-derived performance standard may need to be supplemented to more appropriately reflect the needs of the specific application. This amendment would not preclude either Council from modifying the SBRM process established through this amendment to accomplish such a change on an FMP-by-FMP basis as management needs dictate. In fact, the SBRM Amendment has been designed to ensure such flexibility remains available to the Councils (see section 6.5). The ability of the Councils to develop changes to the SBRM through the framework adjustment and/or annual specifications process preserves the flexibility suggested by the commenter.

Comment 2. The same commenter further stated that the SBRM Amendment does not comport with NMFS's nationwide bycatch reporting technical guidance because it establishes blanket standards of precision across all fishing modes, rather than considering the needs and requirements of each fishery.

Response: The Councils intend to establish a rigorous methodology with which to ensure that the discard data obtained by at-sea observers is of the highest quality possible, with high levels of precision and accuracy to meet the needs of the scientists and managers that utilize the data. Establishing a uniform, global CV level is warranted to ensure a consistent and standard minimum level of precision in the data
collected by at-sea fisheries observers under the SBRM. As noted in the response to comment 1 , using a global standard (a CV of 30 percent) across all fisheries does not mean that all fisheries would be allocated the same level of observer coverage (as would occur under a process by which all fisheries were required to achieve, for example, 20 percent coverage), but recognizes inherently that some fisheries-those that have more highly variable catches-require higher levels of observer coverage than those with more consistent (less variable) catches. Also, the use of the importance filters (section 6.2.3) provides a mechanism to accommodate differences in discard levels among the subject fishing modes and to account for the overall mortality to a stock associated with discards in the various fishing modes. In this way, the differences among fisheries that would affect observer coverage levels are accounted for while ensuring that the data collected by observers on discards in all fisheries achieve a consistent and standard level of precision.

The option of evaluating and setting the CV-based performance standard on a cell-bycell basis was considered during the development of the SBRM Amendment, but ultimately rejected as an unnecessary and impracticable approach to address the need for establishing a minimum level of precision (see section 6.8.4). The process proposed in this amendment does not preclude adjusting the fishery-specific CV levels as conditions in any fisheries warrant (this ability is created in the proposed framework adjustment provisions, see section 6.5). In effect, this amendment establishes a baseline CV level that applies to all fisheries to serve as an initial minimum level of precision, and provides a mechanism to adjust the standard as appropriate.

Comment 3. The same commenter stated that the SBRM Amendment should provide the Councils and NMFS with a process only and some ground rules that can be used to develop and implement fisheries-specific monitoring systems in fishery management plan (FMP) specific contexts. The SBRM Amendment, he wrote, should establish a broad program structure with the details left to development by plan development teams (PDTs) (or some other knowledgeable working group) in the context of the individual FMPs and with full consideration of specific FMP needs.

Response: The Councils disagree with the suggestion that the SBRM Amendment should implement a process only and not actually establish the SBRM to be implemented in the fisheries. The Court order clearly remanded to the agency the responsibility to establish the actual SBRM, not simply create a framework or guidelines for establishing an SBRM at some later date. The Councils considered addressing the Court order on an FMP-by-FMP basis, but ultimately decided it would be more effective and efficient to handle this requirement in an omnibus amendment to all Northeast Region FMPs.

Comment 4. A commenter expressed dissatisfaction with the process used by the Fishery Management Action Team (FMAT), with concern that it disengaged interested parties from the development of the amendment except for periodic updates to the Councils.

Response: NMFS and the Councils disagree that the use of the FMAT disengaged interested parties from the development of the amendment. The FMAT served as a technical working group of NMFS and Council staff to develop the technical elements of the SBRM Amendment and provide input to the Joint SBRM Oversight Committee and the Councils for their consideration. Public input from interested parties was encouraged and accepted at seven meetings of the Joint SBRM Oversight Committee, six meetings of the Mid-Atlantic Council, seven meetings of the New England Council, two public hearings on the draft amendment, and a meeting of members of the two Councils' Science and Statistical Committees (SSC). This represents a total of 23 meetings at which members of the public were welcome to engage the Councils on issues related to the development of the amendment. By contrast, there were nine meetings of the FMAT. For a complete list of all public meetings at which the SBRM Amendment was discussed, see chapter 9.

Comment 5. One commenter was critical of the objectives identified for the amendment, citing that the public hearing document did not define the objectives for the SBRM program. This commenter stated that it was insufficient to prescribe a blanket CV requirement and term this an objective.

Response: Section 1.4 has been clarified to identify the purpose of both the SBRM Amendment and the resulting SBRM itself. The SBRM is intended to ensure that the biologic sampling programs used to obtain discard data minimize bias and maximize precision to the extent practicable. The CV of 30 percent is not, in itself, an objective of the SBRM, but is rather an objective criterion to be used to gauge the level of success in achieving the objectives of the SBRM.

Comment 6. A commenter stated that NMFS should ensure the amendment document undergoes external peer review by a party such as the Center for Independent Experts. The peer review panel, he wrote, should be given the opportunity to comment on the technical issues and issues related to management and integration of the SBRM into stock assessments.

Response: The Councils agree that this amendment is an important document warranting external peer-review. On August 22, 2006, four members of the MidAtlantic and New England Councils' SSCs (two members from each SSC) met to conduct a review of the technical components of the SBRM Amendment. In a report prepared by the SSC reviewers, they concluded that the document does "a commendable job of formulating a comprehensive approach to the problem of assessing bycatch rates in multiple fisheries." The overall consensus of the reviewers is that the document "provides a rigorous objective framework for addressing the problem of bycatch monitoring."

Regarding the proposed CV of 30 percent, the reviewers concluded that this was "a reasonable objective from a statistical perspective" but they did caution the Councils that "it may not be possible to achieve this objective for all species and fleet sectors simply by reallocating the present number of trip days observed" and that "additional observations may be needed." The focus of the report was on several technical
changes in the formulas used to estimate discards and calculate the CV that the reviewers suggested be made, as well as the suggestion that an "importance filter" be developed to prioritize coverage levels and account for situations where the magnitude of the discards are inconsequential relative to the level of observer coverage that would be necessary to achieve the performance standard.

All technical changes suggested by the SSC reviewers have now been made to the analyses described in the SBRM Amendment, and the amendment now includes provisions implementing the suggested "importance filter" process (see chapters 5 and 6 of the amendment for more discussion on these items).

Comment 7. Several commenters concluded that the amendment fails to meet the legal requirements of the Magnuson-Stevens Act, the National Environmental Policy Act (NEPA), and relevant Court orders. One commenter called for the SBRM Amendment to be withdrawn and for the Secretary of Commerce to implement emergency regulations to establish adequate levels of observer coverage until a "legally-compliant SBRM" is developed.

Response: The Councils disagree with the assertion that the amendment fails to meet the legal requirements of the Magnuson-Stevens Act, NEPA, and the relevant Court orders. The Councils were advised of the legal obligations under the applicable laws at each step in the development of this amendment. The Councils assert that this amendment fully complies with all applicable legal standards under the MagnusonStevens Act, NEPA, and other applicable laws (see chapter 8), and that the amendment fully complies with the relevant Court orders stemming from the Amendment 10 and Amendment 13 lawsuits.

There are no grounds on which to withdraw this amendment from development, nor any need or legal authority to promulgate emergency regulations regarding observer coverage levels at this time.

Comment 8. A commenter described the draft amendment as fatally flawed because it fails to incorporate the necessary requirements relating to "how" the bycatch data are to be collected; i.e., whether by observers and if so, the nature of the observer coverage. The SBRM should also specify, the commenter continued, how the data are to be analyzed and reported in support of management decisions.

Response: As a result of this comment, the amendment has been clarified to stipulate that, under the preferred alternatives, discard data are to be collected by at-sea fishery observers operating under the aegis of the NEFOP. For a detailed explanation of how the appropriate data are obtained by at-sea observers, refer to the Fisheries Observer Program Manual (NEFOP 2006a) and the Biological Sampling Manual (NEFOP 2006b). Chapter 5 and Appendix A explain, in detail, how the data are analyzed, and chapter 6 describes the SBRM reporting procedures proposed in this amendment.

Comment 9. Several commenters stated that NMFS will be fiscally unable to fulfill the requirements for observer coverage specified in the SBRM Amendment. The
commenters expressed concern that failure to fulfill the precision or observer level targets may result in litigation affecting the agency's ability to manage fisheries and perhaps bearing on the conduct of the fisheries.

Response: Based on the results of the analysis supporting this amendment, it is expected that observer coverage levels will need to increase in some fisheries from recent levels. It may be possible to decrease observer coverage in other fisheries, and this decrease may offset some of the increase needed, but not necessarily all. The Councils do not feel that the SBRM established by this amendment should be constrained to current or past levels of observer coverage, and acknowledge that observer coverage levels may need to increase overall to meet the SBRM performance standard. The purpose of this SBRM, as required by the MagnusonStevens Act and the Court orders, is to establish a methodology for assessing bycatch that is independent of the means available to fund the process. The SBRM Amendment recognizes that the agency's budget available to fund observer coverage is subject to change according to the appropriations authorized by Congress and the President, but it would not be appropriate to modify the SBRM based on expected funding levels that cannot be predicted. There may be years in which the available budget is insufficient to fully fund the observer coverage levels that result from the SBRM. The SBRM Amendment outlines a process for prioritizing available funding (see section 6.6).

Comment 10. A commenter noted that forms used for the reporting of bycatch should be standardized.

Response: The forms used by at-sea fisheries observers to report discards are standardized and are described in the Fisheries Observer Program Manual (NEFOP 2006a) and Biological Sampling Manual (NEFOP 2006b).

Comment 11. Several commenters were concerned about how the SBRM can be adapted to support the bycatch information needs of each FMP and how the SBRM will be updated to respond to (or in anticipation of) changes in the fishery. These commenters suggested the SBRM should contemplate the changing dynamics of each fishery by gear type and species and be integrated into each FMP.

Response: By definition, this omnibus amendment fully and adequately integrates the resulting SBRM into each FMP amended by this action. The Councils shared the concern raised by the commenter, so the SBRM Amendment includes provisions to allow changes to be made to elements of the SBRM through framework adjustments and/or specifications (see section 6.5). This is intended to preserve the ability of the Councils to make changes to the SBRM as needed to adapt to changes in the management programs of the various FMPs.

Comment 12. Commenters said that to ensure the SBRM can provide adequate information to support existing and future management needs, the amendment document should include a discussion of each fishery, its gear types, management scheme, and bycatch species.

Response: Chapter 2 of the SBRM Amendment provides a description of each FMP subject to the amendment that includes identifying the primary gear types used, the management scheme in place, the history and context for the FMP, the value of the fishery, and the primary ports of landing. Chapter 3 provides an overview of each fishing mode affected by one or more of the subject FMPs, including the major species caught, primary ports, and primary areas fished. The tables provided in Appendix C of the amendment identify the primary discard species for each fishing mode in 2004. These sections of the amendment address all items suggested in the comment.

Comment 13. The same commenters also suggested there should be a mechanism in place to update the allocation analysis annually or more frequently, in order to address changes in each fishery; i.e., gear innovations, changes in the total allowable catch, and other management changes.

Response: The Councils agree that the allocation analysis should be updated annually. The process established by this amendment includes an annual update to the analysis used to generate observer coverage levels and allocations. As a result of this amendment, the Councils would have the ability to change, through the framework adjustment process, certain aspects of the SBRM in order to address changes in each fishery.

Comment 14. One commenter suggested that the SBRM Amendment provide for future FMP-specific changes to be made by annual specifications, framework adjustment, regulatory action alone, or FMP amendment.

Response: The Councils agree and changes to the SBRM Amendment have been made to incorporate this flexibility (see section 6.5).

Comment 15. A commenter suggested that each FMP include a set of diagnostics, perhaps simply the coefficient of variation (CV) for bycatch estimate by mode, to gauge whether the FMP-specific SBRM is providing sufficiently precise information for management purposes.

Response: One of the primary outcomes of the SBRM Amendment is to establish a performance standard (a CV of no more than 30 percent) to function both as a mechanism to determine the level of observer coverage required in each fishing mode and as a diagnostic tool after the fact to evaluate whether the observer coverage provided data of the desired precision. This is described in detail in chapters 5 and 6 of the amendment, including a detailed discussion of the proposed SBRM reporting process intended to provide a periodic evaluation of the effectiveness of the SBRM at achieving its objectives. This evaluation would include determining the degree to which the observer coverage levels have been adequate to provide data of sufficient precision to achieve the CV-based performance standard (see section 6.4.2).

Comment 16. Several commenters stated that, despite observer allocation measures identified in the SBRM, the actual allocation of observers in any year will ultimately
depend on available funding. They noted that while the amendment document acknowledges the potential for funding shortfalls, it does not explain how the fundingdelimited allocation will occur and what standards will be used to set minimum levels of observer coverage. One commenter suggested the SBRM Amendment include a set of non-discretionary priorities for allocation of observer resources and that whatever approach was used, it take into account the available resources.

Response: The commenters are correct that in any given year, the costs to fully implement the observer coverage levels calculated through the SBRM proposed in this amendment may exceed available funding provided by Congress. However, the amendment proposes to address this contingency through a prioritization process to be set by the Councils (see section 6.6). It would be premature to establish nondiscretionary priorities in this amendment, as management and scientific needs can and do change with time. There already exist, through some of the FMPs addressed by this amendment, prescribed observer coverage levels for certain programs (e.g., Northeast multispecies fishery SAPs and the B-Regular DAS program). Nothing in this amendment alters any current prescribed levels of observer coverage.

## Comments on the Amendment and the Court Order

Comment 17. Several commenters expressed the opinion that the SBRM would not satisfy the remand orders. The Court ruling, they said, requires NMFS to specify the level and allocation of observer coverage in each fishery, and the actual level of observer coverage may not be left to the agency's discretion. Commenters opined that the SBRM establishes only a target performance standard (observer sea days sufficient to achieve a $\mathrm{CV} \leq 30$ percent for bycatch estimates), leaving the actual level of observer coverage as a matter of agency discretion, and therefore, the SBRM Amendment does not satisfy the Court's order.

Response: With respect to establishing an SBRM, the Court's orders only require that NMFS establish an SBRM that is non-discretionary, which the proposed SBRM does. The Councils disagree that the SBRM leaves the allocation of observer coverage to the discretion of the agency. The methodology established by and described in the SBRM Amendment dictates the level of observer coverage necessary in each fishing mode to meet the performance standard. Once established, the analyses that comprise the SBRM remove discretion from the process to determine observer coverage levels and allocations across fishing modes. In cases where there are insufficient resources (i.e., the agency budget cannot support) to fully allocate the levels of observer coverage required, the agency and the Councils will determine the appropriate prioritization of available observer coverage given the most pressing scientific and management needs (see section 6.6). The performance standard is not proposed to serve as a mere target, but is an objective measure of the level of observer coverage necessary to achieve the level of precision specified in the amendment. Moreover, the Court's order in Oceana v. Evans (II) explicitly rejected the need for specific percentage levels of coverage in footnote 38 of its opinion:

> Contrary to plaintiff's interpretation (see, e.g., Mot. at 29), Oceana I did not require that an FMP mandate a specific level of observer coverage. Rather, the Court held that an FMP may not delegate the development of a standardized bycatch reporting methodology to the Regional Administrator.

Comment 18. Another of the commenters, noting the Court's reference to the bycatch monitoring plan in the Pacific Highly Migratory Species FMP as an example of a legally compliant SBRM, suggested that a similarly compliant SBRM will have to contemplate the dynamics of each fishery and be integrated into each FMP. The writer noted that the SBRM Amendment, as written, will not anticipate and adapt to future fishery conditions and management needs.

Response: This amendment already contemplates the dynamics of each fishery and will be integrated into each FMP. Chapters 2 and 3 provide information specific to each FMP and fishing mode subject to the SBRM. Chapter 4 contemplates discard reporting mechanisms (both those currently used and potential additional methods) and in the context of the various fisheries in the Northeast Region. By developing an omnibus amendment, the Councils and NMFS are integrating this SBRM into all 13 Northeast Region FMPs. The provisions in the SBRM Amendment that make changes to certain elements of the SBRM through annual specifications or framework adjustments to the individual FMPs provide a mechanism to allow the Councils to adapt the SBRM on an FMP-by-FMP basis, as needed, to future fishery conditions and management needs in a relatively time-effective manner without the need to go through the full amendment process.

Comment 19. A commenter asserted that the draft SBRM Amendment exceeds the requirements laid out by the Court and is far more comprehensive than the example bycatch monitoring plans cited by the Court. The writer agreed that the rulings require the SBRM's implementation to be non-discretionary, but the commenter argued for flexibility in the new program, asserting that the Court did not mandate any particular approach or set of performance requirements.

Response: The Councils agree that the SBRM Amendment is more extensive and comprehensive than would be necessary to minimally satisfy the Court's concerns, but this is hardly a flaw and is certainly legal and appropriate under the MagnusonStevens Act and the Court opinions. While the Court did not mandate any particular approach or set of performance requirements, the approach and performance requirements proposed in the amendment are entirely consistent with the Court opinions and fulfill the requirements under the Magnuson-Stevens Act. By establishing the performance requirements described in this amendment, the resulting SBRM would be more robust than if the performance requirements did not exist.

Comment 20. The same commenter noted that by establishing a target CV for bycatch estimates in hundreds of various mode-species combinations, the SBRM Amendment would require specific application of a generally-derived standard. The writer urged NMFS to recast the omnibus amendment as a broader set of standards and methods, perhaps adopting a CV target for more broadly aggregated bycatch estimates, under
which PDTs would establish fishery specific observer coverage requirements and, thus, removing from the agency the discretion for establishing observer coverage levels. The commenter asserted that such flexibility would be consistent with both Court decisions.

Response: The CV-based methodology establishes the process by which observer coverage levels are determined and allocated across the wide variety of fisheries managed under the Northeast Region FMPs. Using a global standard (a CV of 30 percent) across all fisheries does not mean that all fisheries would be allocated the same level of observer coverage (as would occur under a process by which all fisheries were required to achieve, for example, 20 percent coverage), but recognizes inherently that some fisheries-those that have more highly variable catches-require higher levels of observer coverage than those with more consistent catches. In this way, the differences among fisheries that would affect observer coverage levels are accounted for while ensuring that the data collected by observers on discards in all fisheries achieve a consistent and standard level of precision.

Given that the expectations for the discard data obtained by at-sea fisheries observers should be consistent across all fisheries for which the data are used in similar ways (e.g., to obtain reasonably precise and accurate estimates of discards for use in stock assessments and to determine the stock-level implications of discarding), it stands to reason that a generally-derived performance standard is appropriate, particularly given the overlap and inter-relationships among fisheries and species caught (see chapter 3). When the discard data are used for different purposes in certain specific fisheries (e.g., for real-time area-based quota monitoring), it may be that the generally-derived performance standard may need to be supplemented to more appropriately reflect the needs of the specific application. Nothing in this amendment precludes either Council from modifying the SBRM process established through this amendment to accomplish such a change on an FMP-by-FMP basis as management needs dictate. In fact, the SBRM Amendment has been designed to ensure such flexibility remains with the Councils (see section 6.5). The ability of the Councils to develop changes to the SBRM through the framework adjustment and/or annual specifications process preserves the flexibility suggested by the commenter.

Comment 21. Several commenters stated that the Court decision requires the SBRM to clearly establish that an observer program will be developed and made mandatory in each fishery.

Response: The Councils disagree that the Court decision requires that an observer program be developed; the Northeast Fisheries Observer Program is well established and has proven to be a successful observer program for over 15 years. Observer coverage is currently mandatory in all Northeast Region FMPs subject to this amendment (i.e., vessels with Federal permits are required to carry an observer any time they are requested to do so). This amendment will formalize the SBRM in place in the Northeast Region and reinforce the importance and necessity of at-sea fisheries observers for collecting data on discards.

## Comments on the Amendment and NEPA

Comment 22. Several commenters stated that the Omnibus SBRM Amendment should be subjected to the scoping and development process of an Environmental Impact Statement (EIS). They argued that the environmental impacts of the SBRM Amendment are likely to be significant, since the SBRM ultimately would affect widespread marine life, as data collected under the SBRM would influence fisheries management decisions throughout the region for years to come.

Response: The Councils disagree that an EIS is necessary for this action. Section 7.2 of the amendment analyzes the direct, indirect, and cumulative impacts expected to result from the implementation of this amendment and section 8.9 .2 supports the conclusion that no significant impacts to the human environment are expected. While data collected under the SBRM may influence fisheries management decisions throughout the region for years to come, each of those future management decisions would be the subject of its own environmental review under NEPA. This separate environmental review would be based on the specific management measures under consideration for the specific stock(s) and fishery(ies) for which the action has been deemed necessary.

The purpose of this action is not to directly or even indirectly alter fishing practices or levels of fishing effort. This action is specifically designed to establish the methodology to be used to obtain, analyze, and report information regarding discards occurring in Northeast Region fisheries. It does not directly or indirectly affect the physical environment and, therefore, an EIS is not necessary. Nevertheless, the process for developing this amendment involves extensive public input and involvement by the two Councils.

Comment 23. The same commenters stated that the SBRM Amendment document contemplates too few and too narrow a range of alternatives to satisfy NEPA. They suggested that additional alternatives should have been considered with respect to the importance filters, bycatch reporting and monitoring mechanisms, the performance standard, and bycatch program review and reporting.

Response: The Councils disagree that the SBRM Amendment contemplates too few and too narrow a range of alternatives to satisfy NEPA. NEPA does not require a minimum number of alternatives be analyzed, other than the proposed action relative to taking no action, and the breadth of what is considered a reasonable range is dependent on the nature of the action. This amendment provides a range of possible outcomes as alternative courses of action, but is organized for the sake of clarity such that for each of seven relatively independent decision points the status quo is compared to between one and three additional alternatives (some alternatives include an additional one to three options). Given the structure of the SBRM Amendment in categorizing the actions under consideration, there are actually 1,464 distinct outcomes possible for the SBRM to be adopted by the Councils, ignoring sub-options within some of the alternatives. Accounting for the sub-options, the number of different possible outcomes climbs to 2,160 .

Comment 24. One commenter indicated that the lack of an EIS limited the opportunities for public participation and stymied involvement by the Councils in the development of the amendment.

Response: The Councils disagree that the preparation of an EA has in any way limited the opportunities for the public to participate in the process to develop the SBRM Amendment. NMFS and the Councils have endeavored to provide the public with numerous opportunities to participate in the process to develop this amendment, through a variety of fora and media. In addition to 13 Council meetings, 7 oversight committee meetings, and 1 meeting of members of the Councils' SSCs at which the SBRM Amendment was discussed in a public forum with opportunities for members of the public to provide input into the process, there were two formal public hearings held on the draft amendment for which the sole purpose was to solicit and obtain input from the public on the SBRM Amendment. The public hearings were held during a 59-day comment period that followed publication in the Federal Register of a notice soliciting input from the public on the draft amendment. Copies of the draft amendment, and a companion summary document, were distributed at Council meetings and the public hearings, were available by mail to anyone requesting a copy, and were posted on the Internet with instructions for how to provide comments.

In addition to these opportunities, upon submission by the Councils to the Secretary of Commerce for review, a notice of availability will be published in the Federal Register with a comment period prior to any decision by the agency to approve or disapprove the amendment. Publication of a proposed rule will provide yet another opportunity for the public to review and comment on the proposed regulations designed to implement the SBRM Amendment. These public meetings and review/comment periods meet or exceed the requirements of all applicable laws, including the Magnuson-Stevens Act, NEPA, and the Administrative Procedure Act.

Comment 25. Several commenters insisted that alternative threshold levels for the importance filter mechanism should be identified and analyzed in the NEPA document, as should a range of alternative CV levels, as the performance standard for the SBRM.

Response: The SBRM Amendment, at section 6.3.2, identifies ranges of alternative threshold levels considered to apply to the proposed importance filters. Although considered during the early development of the amendment, a range of alternative CV levels was not formally proposed (see section 6.8.4) due to the lack of a scientific basis for any CV other than the 20-30 percent encouraged in NMFS (2004). The Councils contend that the decision to adopt a performance standard of 30 percent is explained adequately in section 6.3.2. The only potential outcome of selecting a different threshold level for the importance filter (higher or lower) or selecting a different CV level for the performance standard (higher or lower) would be to change the resulting observer coverage levels necessary to comply with the SBRM (more or fewer days observed), which would, as explained in section 7.2.3, have no direct, indirect, or cumulative effect on the environment.

Comment 26. One commenter suggested that the purpose, need, and scope of the document are too vague. This commenter also suggested that the entire document, particularly the analytical sections, needs to be easily accessible to the public, stakeholders, and decision makers.

Response: As stated in section 1.4 of the amendment, the purpose and need of the document are to ensure that all Northeast Region FMPs comply with the SBRM requirements of the Magnuson-Stevens Act and to address the concerns raised by the Court in the Oceana v. Evans I and II decisions. The scope of the amendment is similarly explained in section 1.4 and Table 1, which identifies the 13 FMPs and 39 fishery species to which this amendment applies.

The Councils and NMFS intend for this document be easily accessible to the public, stakeholders, and decision makers. As noted in the response to comment 24, the document has been widely available in different media and through different means in order to ensure that all those interested in the SBRM Amendment would have access to it. The document is written in plain language (to the extent that issues of such a technical nature allow) so as to be understood by non-experts.

Comment 27. The same commenter argued that the environmental assessment (EA) ignores the indirect and cumulative environmental effects of the SBRM Amendment, and that attention should be paid to the relationship of precision of bycatch estimates to the risks to the environment.

Response: The Councils disagree that the EA "ignores" the indirect and cumulative environmental effects of the SBRM Amendment. Sections 7.2 and 7.3 of the amendment specifically analyze the potential direct, indirect, and cumulative effects of the action on the environment, as required under NEPA. Section 8.9.2 concludes that no significant direct, indirect, or cumulative impacts to the environment are expected to occur, as required for an EA under NEPA.

Comment 28. Also, the commenter suggested that through an EIS, NMFS should discuss the effect of the SBRM Amendment on the drafting and issuance of Incidental Take Statements and Biological Opinions under the Endangered Species Act.

Response: It is not necessary under NEPA to include a discussion of the effect of the amendment on the drafting and issuance of Incidental Take Statements and Biological Opinions under the ESA. An SBRM is a requirement of the Magnuson-Stevens Act, not the ESA, and an approved SBRM is not a prerequisite of preparing or implementing Incidental Take Statements or Biological Opinions.

## Comments on the Species Addressed by the Amendment

Comment 29. Several commenters addressed the range of species that would be considered under the SBRM, asserting that without a method to assess and report bycatch of all species, the SBRM is incomplete. Commenters claimed the Magnuson-Stevens

Act's definition of bycatch includes more species than those contemplated in the amendment, and includes non-commercial and unregulated fish species (especially those considered at risk, such as wolfish, cusk, and corals), as well as highly migratory species and fish managed by the Atlantic States Marine Fisheries Commission.

Response: The Councils agree that without a method to assess and report bycatch of all species encountered by a fishing vessel, the SBRM would be incomplete.
However, as explained in section 4.5 and section 6.8.1, the NEFOP currently recognizes and accounts for all species encountered by a fishing vessel, whether or not the species is managed under a Council FMP. The intent of the amendment is to establish an SBRM that accounts for all species encountered by a fishing vessel, by requiring that data on all species are obtained and recorded by at-sea observers and other data collections tools utilized under the SBRM, while ensuring that the data utilized by stock assessment biologists and the Councils to develop FMPs under the Magnuson-Stevens Act are of sufficient precision and accuracy.

Comment 30. The same commenters argued endangered species and marine mammals should also be addressed, and there should be a discussion of the bycatch of corals and sponges as indicators of impacts on marine habitat, particularly in those areas designated as essential fish habitat.

Response: Data on all species brought onto the deck of a fishing vessel are reported by at-sea fisheries observers, as explained in section 4.5 and section 6.8 .1 of this amendment and in the Observer Program Manual (NEFOP 2006a) and Biological Sampling Manual (NEFOP 2006b). These include endangered species, marine mammals, sponges, and corals. However, marine mammals are not considered bycatch under the Magnuson-Stevens Act and are, therefore, not directly relevant to the design of the SBRM, as required by the Magnuson-Stevens Act. Also, although data on discards of sponges and corals are collected by observers and are available for use by scientists, managers, and others, assessing the implications of corals and sponges as indicators of impacts on marine habitat is outside the scope of this amendment.

Comment 31. One of the letters expressed concern for the "chronic imprecision and inaccuracy" of estimates of bycatch of sea turtles and other protected species.

Response: The Councils disagree with the contention that there exists "chronic imprecision and inaccuracy" of bycatch estimates for sea turtles and other protected species. The commenter provided no evidence to support their contention. The analysis conducted in support of the amendment indicates that the precision of the discard data collected by at-sea observers varied, but overall was relatively strong (of the non-gray cells in Table 44 for which there was observer coverage in 2004, 54 cells had no bycatch, 82 cells had CVs of 30 percent or less, 40 had CVs between 30 percent and 50 percent, and 56 had CVs in excess of 50 percent). While there is certainly room for improvement in many fisheries, the evidence appears to contradict the commenter's assertion of "chronic" imprecision. As to the accuracy, section 5.6.2 of the amendment summarizes the accuracy analyses performed to date, and these
conclude that there is no evidence of systematic or significant bias in the observer program.

## Comments on the Observer Coverage Levels

Comment 32. One commenter stated their opinion that the amendment does not establish an allocation of observer coverage and does not explain how one would be established. This commenter also expressed concern over whether there was an automatic mechanism to update the allocation analysis every year.


#### Abstract

Response: The Councils disagree with the contention that the amendment does not establish an allocation of observer coverage. The primary purpose of the amendment is to establish just such a methodology by which observer coverage allocations are made. Chapter 5 describes, in detail, the methodology by which discard data are obtained and analyzed to, in turn, determine the necessary observer coverage allocations in each fishery. Chapter 6 describes, in detail, the proposed actions of the Councils to adopt this methodology as the basis to allocate observer coverage for all the FMPs. The intent of this methodology is to provide the mechanism to determine the observer coverage allocations on an annual basis, each year using the most recent complete year of observer data as an input into the process. The SBRM Amendment, in setting up a methodology for determining observer coverage allocations, rather than absolute coverage levels, used data from 2004 as an example dataset input into the proposed methodology.


## Comments on the Level of Precision of Bycatch Estimates

Comment 33. One commenter asked to what units or level of aggregation would the CV target be applied; that is, would the 30 percent CV be an overall bycatch estimate for all species aggregated, or would it apply by fishing mode, species, or species group?

Response: The stratification used in the proposed methodology would be applied at the level of species or species group for each fishing mode (a gear- and area-based delineation of fisheries at the appropriate level for assigning observer coverage). This is described and explained in detail in chapter 5.

Comment 34. Another commenter stated that the performance standard must be mandatory, rather than a target, and that the SBRM must clearly establish how the standard is going to be applied for fishery, gear type/sector, and/or species.

Response: The Councils agree that the performance standard should be mandatory, and the SBRM Amendment proposes a mandatory performance standard (achieving a CV of 30 percent or less). However, while the performance standard is used to determine the level of observer coverage expected to achieve the standard, whether this standard is actually met can only be determined after fishing is concluded for the
year. The CV is a measure of the variability in the data obtained in the sampling program. There are many factors that affect the variability of the discard data obtained by at-sea observers (e.g., changes in stock distribution) and many of these factors remain outside the control of NMFS or the Councils. Thus, meeting the appropriate observer coverage levels is not a guarantee that the CV will be 30 percent or less. As noted in the preceding comment, the stratification used in the proposed methodology to apply the performance standard is described and explained in detail in chapter 5.

Comment 35. Several commenters stated that the target CV does too little to limit the Agency's discretion in determining whether and how to allocate observers. They argued that the SBRM Amendment should require specific levels of observers in each fishery.

Response: The Councils disagree that the use of the CV-based performance standard leaves to the agency the discretion to decide whether and how to allocate observers. The CV level is the minimum standard necessary to estimate bycatch with the desired level of precision, and as long as the minimum level is attained, the SBRM meets the Magnuson-Stevens Act requirements. Any discretion used by NMFS to attain lower CVs only enhances the results derived from the SBRM, which is entirely consistent with the Magnuson-Stevens Act. The purpose of the CV-based performance standard and the methodology proposed in this amendment is to stipulate the specific analytical process by which the observer coverage levels required in each fishery would be determined. Nothing in this methodology would substitute agency discretion for achieving the minimum CV level as described in chapters 5 and 6. As noted, there may be years in which the budget available to the agency with which to fund at-sea observers is insufficient to meet the resulting observer coverage levels; however, the amendment includes a process by which the agency would consult with the Councils in order to develop priorities for how to apply the available funding.

Comment 36. Another commenter argued that the application of the same precision standard ( $\mathrm{CV} \leq 30$ percent) to all mode-species combinations is impracticable and ignores the issues and objectives of each individual FMP. The commenter also stated that it runs counter to NMFS's own technical guidance calling for more general application of the CV standard across all bycatch species.

Response: While the proposed application of the performance standard at the species or species complex level for each fishing mode may exceed the minimum standard suggested in the NMFS technical guidance on this issue (NMFS 2004), the Councils assert there is nothing wrong with exceeding this minimum level for application of the performance standard. The rationale for proposing a CV of 30 percent is described in section 6.3 and section 6.9.3. It is the intent of this amendment to establish a rigorous methodology to ensure that the discard data obtained by at-sea observers are of the highest possible quality, with high levels of precision and accuracy to meet the needs of the scientists and managers that utilize the data.

The Councils disagree that application of the same performance standard to all modespecies combinations is impracticable. The analysis presented in the SBRM

Amendment utilizes this performance standard in its application of the proposed methodology. The proposed methodology successfully determined observer coverage levels that would be expected to achieve this level of precision, confirming that this approach is reasonable and practicable.

The Councils also disagree with the commenter's contention that this approach ignores the issues and objectives of each FMP. One of the reasons the CV-based performance standard is the preferred basis for determining observer coverage levels is that it implicitly accounts for the variability associated with each fishery by requiring higher levels of coverage in fisheries for which there is relatively higher bycatch variability and lower levels of coverage in fisheries with less variability. In contrast, the non-preferred alternative would require a specific level of observer coverage (e.g., 20 percent of all trips) in all fisheries. The non-preferred approach would not account for the inherent differences among fisheries and would likely result in over-sampling some fisheries while under-sampling others. By establishing a global CV-standard, the proposed methodology accepts that there is a certain objective minimum level of precision that is desirable across all fisheries, but that the actual level of observer coverage necessary to achieve that standard will vary according to the unique parameters of each fishery. In addition, this amendment would enable the Councils to modify certain aspects of the SBRM on a fishery-byfishery basis though the use of framework adjustments to the FMPs. In this way, should a Council determine that a higher level of precision is needed in certain circumstances (for example, for adequate real-time monitoring of a quota in some fisheries), the performance standard could be changed to accommodate these situations with relative ease (see section 6.5).

Comment 37. The same commenter suggested that days-at-sea estimates to meet the target CV for all mode-species combinations would be likely to exceed current levels of observer coverage, and worried that the SBRM may oblige the agency to observer days-at-sea levels that cannot be met, perhaps resulting in litigation.

Response: Based on the results of the analysis supporting this amendment, it is expected that observer coverage levels will need to increase in some fisheries. It may be possible to decrease observer coverage in other fisheries, and this decrease may offset some of the increase needed, but not necessarily all. The Councils do not intend for the SBRM established by this amendment to be constrained to current or past levels of observer coverage, and acknowledge that observer coverage levels may need to increase overall to meet the SBRM performance standard. The SBRM Amendment merely establishes the methodology for assessing bycatch but does not establish funding or operational mandates for meeting SBRM objectives. Neither the Magnuson-Stevens Act nor the Court orders require that the SBRM resolve all potential funding and/or operational problems (e.g., an insufficient number of certified observers) that may arise in implementing the SBRM. If problems arise in implementing the SBRM due to funding or operational issues, the prioritization process described in section 6.6 would be utilized.

Comment 38. One commenter, in calling for the Secretary of Commerce to establish observer requirements through an emergency rule, stated that NMFS should establish observers on at least 20 percent of all days fished, except in cases wherein analysis of the best available science indicates otherwise.

Response: The Court order in Oceana v. Evans II explicitly rejected the need for specific percentage levels of observer coverage (see response to comment 17). Nevertheless, this approach was considered in the SBRM Amendment, but is not preferred for the reasons explained in section 6.9.2. Also, the Councils disagree with the assertion that regulations establishing an SBRM should be implemented through an emergency rule. As noted above in response to other comments, there is no basis to assume the Secretary would or should disapprove this amendment, which fully complies with all SBRM-provisions of the Magnuson-Stevens Act and, therefore, there is no need or justification for emergency regulations.

## Comments on the Importance Filters

Comment 39. In general, commenters supported the use of importance filters as a means of removing from consideration, for determining target observer sea day allocations, those mode-species combinations that are unlikely to occur or likely to be of minimal consequence, but urged caution in their refinement and use. One commenter characterized the use of importance filters for observer resource allocation as reasoned, practicable, and consistent with the law.

Response: The Councils agree with the comment and continue to propose the use of importance filters as part of the process to determine observer coverage levels.

Comment 40. One commenter stated that the filtering mechanisms need to be clarified and expanded to ensure all of the criteria used as filters are fully identified.

Response: The Councils agree and the final version of the SBRM Amendment clarifies and expands the discussion of the importance filters, including specifying the criteria to be used in implementing the filters (see sections 6.2 and 6.9.2).

Comment 41. Three commenters expressed concern that the importance filters rely on poor existing observer data as the foundation for calculation of the allocations. They suggested that a baseline level of observer coverage be established for a period of years to support future appropriate use of statistical filters.

Response: The Councils disagree with the commenters' assertion that the importance filters rely on "poor" data as the foundation for calculating the observer coverage allocations. The commenters provide no evidence to support this claim. The measure of the CV, as described in chapter 5, is an unbiased indicator of the precision of the data. As noted above in response to comment 31, less than 25 percent of the non-gray cells for which there was observer coverage in 2004 had CVs in excess of 50 percent. The majority ( 58 percent) of cells had either no discards or CVs of 30 percent or less.

By definition, those cells that had either no discards or CVs less than 30 percent were of sufficient quality to meet the performance standard proposed to be implemented through this amendment. The remainder of cells ( 18 percent) had CVs between 30 percent and 50 percent. The Councils and NMFS agree, in principle, with the suggestion to establish a "baseline" level of observer coverage for a period of years in order to provide data for more comprehensive analysis. Section 5.3.3.2 of the amendment describes the concept of "pilot" coverage that would address this suggestion for cells for which there was no observer coverage available.

Comment 42. Commenters generally supported the first tier gray-box filter, but several insisted that each decision to gray out a mode-species combination be explained in the amendment document. Also, the same commenters said that the gray-box filter should not be applied to any mode-species combination, wherein the species is a "protected species," or a species considered "at risk." They suggested that only after a robust observer program is in place can it be determined that an interaction between a mode and protected species is unlikely to occur.

Response: The Councils support the use of the gray-cell filter approach as a reasonable way to focus on particular combinations of fishing modes and species that occur in nature with sufficient frequency as to warrant inclusion in the SBRM. The need for this filter is particularly evident due to the approach, taken for ease and consistency of presenting the data, to use a matrix (species across the top; fishing modes along the side) as the basic model for the SBRM. This approach results in all species appearing as cells for all fishing modes, even if the species is never encountered in the fishing mode. The gray-cell filter is a recognition that many species are either never encountered by a fishing mode, or are encountered so rarely as to be de minimus. The process used to determine which cells should be included is explained in section 5.3.3.1. This section addresses both fish species and protected species.

The Councils reject the commenters' characterization that the current NEFOP is not "robust." The NEFOP is a well-established at-sea fishery observer program that has been in place for over 15 years. While the level of observer coverage has varied during this time in response to changing Federal budgets, and the program's objectives have evolved, the program itself has grown and developed in response to the needs of management and the scientists. The NEFOP observer program manual, biological sampling manual, training manuals, data handling procedures, and formal training facility and training program serve as a model for other observer programs around the country and around the world.

Comment 43. Several commenters claimed that the third level filter could be used to mask the real effects of bycatch in high volume fishery modes; i.e., when the discard rate for a species is small relative to a high volume fishery, but still of significant environmental consequence. The commenters asked for the third level filter to be removed from the amendment.

Response: Upon further consideration, the Councils have revised the third level filter to eliminate the potential that it could inadvertently mask the real effects of bycatch in high volume fishing modes. Section 6.2.3.2 of the amendment explains what changes were made to the filter and how these changes address this concern.

Comment 44. The same commenters expressed concern that the third and fourth level filters rely on threshold values (ratios) which are not specifically identified and analyzed in the amendment document. They stated that the SBRM Amendment must develop and address the specific fixed threshold alternatives through an EIS process before the public can properly assess the usefulness of the SBRM.

Response: The draft amendment included a range of potential threshold values from 0.5 percent to 3 percent, and the analysis in the document demonstrated the effects of these potential thresholds on observer coverage levels across the fishing modes. However, based on comments, the Councils have revised the importance filters to address concerns such as this comment. Section 6.2.3.2 explains the revisions made to the importance filters, and how the proposed threshold values were determined. Regarding the need for an EIS, see responses to earlier comments on this issue. The Councils are not preparing an EIS, but the revised EA that incorporates the changes made to the importance filters will be made available to the public for review prior to implementation.

Comment 45. A commenter suggested that the Councils consider adding an importance filter for any mode of fishing whose overall contribution to total landings falls below some threshold and, accordingly, for which the contribution to total discards can be considered de minimus. The commenter also suggested that the SBRM Amendment provide a means for the reduction of target observer sea days when gear improvements have reduced or eliminated the potential for bycatch.

Response: Regarding the first part of the comment, this is, in effect, the intent of the fourth level filter, which functions by comparing the total estimated discards of a species within a fishing mode with the total fishing mortality (commercial and recreational landings, plus discards) of that species among all fishing modes. In this way, species for which the total discards in a fishing mode is a de minimus amount of the total mortality of that species would not be used to determine the appropriate level of observer coverage needed in that fishing mode.

Regarding the second part of the comment, there are three ways in which changes in bycatch rates due to gear improvements could be accounted for under the proposed SBRM. First, the CV-based performance standard implicitly accounts for the variability associated with each fishery, by requiring higher coverage levels in fisheries for which there is relatively higher bycatch variability and lower coverage levels in fisheries with less variability. Thus, as conditions in a fishery change, whether as a result of gear improvements or not, and the variability of bycatch is reduced, the level of observer coverage necessary to achieve the performance standard would automatically decrease. However, the magnitude and the variability of bycatch are not necessarily directly related, as the magnitude relates to the overall
amount of bycatch occurring in a fishery, and the variability tracks the relative amounts of bycatch on trips within a fishery. It is possible that as the overall magnitude of bycatch decreases as a result of a gear modification or other change in the fishery, the variability among trips could actually increase. This could be particularly true as the magnitude approaches zero, where even relatively small amounts of bycatch could appear as substantially different than zero. This concern could be addressed by the fourth-level filter, which is intended to control for de minimus amounts of bycatch, as explained above.

The third way in which the proposed SBRM could address this issue is in the graycell filter process. As explained in section 5.3.3, this filter accounts for infrequent or infeasible interactions (combinations of species and gear types), by filtering these cells. The initial allocation to the gray-cell filter was based on a technical review of 16 years worth of NEFOP data, but the intention is that the gray-cell filter would be updated as new information becomes available that may change the initial distribution. A rationale for expanding the gray-cell filter would include such things as changes in regulations that effectively reduce potential bycatch interactions to the level of being highly infrequent or infeasible.

## Comments on the Analysis of Accuracy and Precision

Comment 46. One commenter stated that the amendment document sufficiently addresses the issue of accuracy, and its inclusion of the Rago et al. analysis of observer program accuracy rectifies previous Court-identified deficiencies.

Response: The Councils agree with the comment.
Comment 47. Another commenter stated that the treatment of accuracy in the document is limited to a dismissal of current science and suggested that the amendment document consider methods to retrospectively assess the accuracy of bycatch in periodic bycatch reports.

Response: The Councils disagree with the commenter's assertion that the treatment of accuracy in the document is limited to a dismissal of current science. A discussion of accuracy as it relates to precision is provided in section 5.2, and a summary of the analyses of accuracy conducted in support of the amendment is provided in section 5.6.2 and in Appendix A. The Court order in Oceana v. Evans I stipulated that the agency consider the information presented in Babcock et al. (2003), and this paper is discussed in Appendix A and in section 6.9.2. The commenter also suggests consideration of methods to periodically retrospectively assess the accuracy (bias) associated with the bycatch data collection program. This is an appropriate element of the proposed periodic SBRM Report, and the proposed contents of this report have been updated to include updating the accuracy analyses conducted in support of this amendment to evaluate the sources and magnitude of bias in the observer program data (see section 6.4.2).

Comment 48. A commenter, arguing for FMP-specific bycatch monitoring programs developed under a more general omnibus SBRM structure, suggested the amendment mandate that sampling designs minimize bias to the greatest extent practicable.

Response: The Councils agree that the development and implementation of sampling designs to minimize bias to the extent practicable is a valid objective for the SBRM, and the document has been clarified to identify this as an objective of the SBRM implemented under this amendment (see section 1.4).

Comment 49. The same commenter warned that the SBRM should not result in an undue fiscal burden on the public or the industry, and that precision and accuracy are matters of policy that should be left for the Councils to determine on an FMP basis. The commenter stated that the document should consider not only a scientific perspective on precision and accuracy, but should also include a discussion of the benefits and costs associated with varying levels of precision and accuracy.

Response: The Councils disagree with the commenter's assertion that precision and accuracy are matters of policy to be determined on an FMP-by-FMP basis. As discussed in the responses to comment 20 and comment 36, the proposed methodology is based on the premise that there is a certain objective minimum level of precision that is desirable across all fisheries, but that the actual level of observer coverage necessary to achieve that standard will vary according to the unique parameters of each fishery. As noted in chapter 5, accuracy is a measure of the bias associated with the sampling design. Improving the sampling design to minimize bias is not a policy issue but is a matter of science and is critical to the development of a reliable statistically-based biological sampling program. Likewise, while there are real costs associated with increased levels of precision, the precision associated with bycatch data has implications for the science conducted in support of fishery management decisions. The lower the precision of the data used, the less reliable are the results of stock assessments and the greater the risk to the resource (and the fishing industry) that results from management decisions. While uncertainty and risk are unavoidable in fisheries science and management, it is the position of the Councils that these can be minimized and balanced by improving the precision and accuracy of the data used in the process.

The costs and benefits associated with varying levels of precision are an important consideration, and can best be illustrated through an examination of the relationship of expected CVs over a range of observer coverage levels. Figure E-1 is excerpted from the Rago et al. (2004) paper as an example of this analysis. It demonstrates that at low levels of coverage, there is most often a substantial benefit (as indicated by decreasing CVs) from a small increase in observer coverage. However, as observer coverage levels increase, the returns (improvements in precision) diminish rapidly. Thus, in Figure E-1, there is an initial rapid improvement in precision up to approximately 100 observed trips, then the improvements taper off to the point that quadrupling the observer coverage up to 400 trips only improves the precision by 10 percent. Understanding this relationship and the diminishing returns that are expected as coverage levels increase are important considerations in evaluating the costs and
benefits associated with varying levels of precision. There is not similar relationship in regards to varying levels of accuracy, as the accuracy of the data is a direct result of the amount of bias in the sampling program (see sections 5.2 and 5.6 for a complete discussion of accuracy, bias, and precision).


Figure E-1. The 2003/2004 point estimates of the coefficient of variation (CV) of the discard to kept ( $\mathrm{d} / \mathrm{k}$ ) ratio for New England groundfish caught with otter trawl gear, and the expected coefficient of variation of the discard to kept ratio over a range of sample sizes (number of trips) (from Rago et al. 2004).

The commenter appears to suggest that observer coverage levels should be derived from target precision levels that are set by the Councils as an outcome of policy choices regarding the costs associated. The Councils disagree with this approach, but consider the SBRM to be a process that determines the observer coverage levels necessary to achieve the minimum precision level performance standard in order to provide the most robust discard data possible, without regard to the annual budgets available to fund such levels of observer coverage. The SBRM Amendment merely establishes the methodology for assessing bycatch but does not establish funding or operational mandates for meeting SBRM objectives (see response to comment 37). Once the available budgets are known, additional consideration of management priorities may be necessary by the Councils if the budget is insufficient to provide the full level of coverage desired.

Comment 50. A commenter stated that NMFS's bycatch mortality estimates are perceived by industry as inequitable from mode to mode and the document should better explain how discard mortality estimates are determined.

Response: The SBRM Amendment does not address discard mortality estimates. These estimates are derived on a stock-by-stock basis and utilized in stock assessments to determine total fishing-related mortality. The discard mortality estimates used in stock assessments are often based on a variety of sources, and are subject to the stock assessment peer-review process prior to being accepted as the basis for making determinations about fishing-related mortality. These estimates change over time as new information is utilized in the stock assessment process and as new assessment models are developed and refined. It would not be appropriate or practicable for the SBRM Amendment to address the issue of discard mortality estimates.

Comment 51. One commenter, providing a technical review on behalf of several fishing industry organizations, suggested that a typical assumption in the calculation of CVs based on observer coverage is that every tow is independent, but the truth is that sequential tows are clearly correlated and should not treated as statistically independent.

Response: While it is correct that sequential tows could be correlated and should not be treated as statistically independent, the proposed methodology is structured in recognition that the information content of tows is reduced by the inter-correlation; therefore, the tow was not used as the sampling unit. Instead, the SBRM analysis uses the fishing trip as the sampling unit. For a more detailed explanation, see chapter 5 and Appendix A.

Comment 52. This same commenter indicated that the "observer effect," the degree to which vessel operators behave differently when an observer is aboard, needs to be accounted for in the calculation of the CV.

Response: An analysis of the "observer effect" was conducted to explicitly evaluate the effect of bias, including the spatial patterns of fishing locations, the average trip length, and the average landings (kept pounds) of observed and unobserved fishing trips. These analyses indicated that the effect of observer bias is expected to be small and, therefore, the "observer effect" is not expected to contribute to the variance in the observer data. For a more detailed explanation, see chapter 5 and Appendix A.

Comment 53. This commenter also suggested that the CV calculation should account for observer downtime, those periods of fishing operations when the embarked observer is off duty.

Response: The bycatch ratio is based on the sum of the discarded pounds divided by the sum of the kept pounds of observed hauls and is, therefore, not influenced by the unobserved hauls. The bycatch ratio based on discarded pounds divided by days absent accounts for all hauls (observed and unobserved) by expanding the discarded
pounds by the ratio of the number of total hauls to the number of observed hauls. For more information on this issue, see chapter 5.

Comment 54. This same commenter suggested that the method of calculating the CV is, to some extent, fishery/stratum dependent. For example, different methods should be applied to day boat fisheries versus longer trip oriented fisheries.

Response: A finer-scale stratification could improve the estimation; however, tradeoffs have been made throughout the stratification scheme to accommodate the diversity of fleets and species groups. The heterogeneity in the relationship between the discard pounds to kept pounds may be evidence of this. Post-stratification is possible and a finer-scale division between day trips and multi-day trips is, in fact, made for observer deployment within otter trawl fleets.

## Comments on Electronic Monitoring

Comment 55. A commenter who works in the field of video monitoring agreed with the amendment document's rather high estimates of the costs associated with fishery video monitoring program. He attributed the high costs to the market dominance of a single contractor and he suggested that costs would likely come down should video monitoring requirements become more widespread and more contractors enter the field.

Response: The Councils agree with the commenter that the costs associated with electronic video monitoring would be expected to decrease as more contractors enter the marketplace. The costs provided in the document are based on the most widely available cost data. While this cost information may not be reflective of the costs that would be expected in a market environment in which there are many participants competing for customers, it is considered a valid indicator of the likely initial costs to the industry in the Northeast under current market conditions.

Comment 56. Another commenter agreed with the document's discussion of analytical difficulties that would be involved in video monitoring, and expressed support for the finding that use of such systems be deferred, pending further development.

Response: The Councils agree with the comment.

## Comments on the SBRM Reporting Process

Comment 57. Two commenters stated that the maximum report period should be annual, and the report should present the bycatch data by fishery, gear type, sector, area fished, species, and any other variable, as determined by the Councils.

Response: The Councils agree with the commenter that the frequency, format, and content of the SBRM Review Reports should be determined by the Councils for their

FMPs. Both Councils considered requiring SBRM Review Reports on an annual basis, every 3 years, every 5 years, or in conjunction with other required reports (such as SAFE reports or monitoring committee reports), but ultimately directed the SBRM Review Reports to be provided every 3 years (see section 6.4.2).

Comment 58. One commenter argued that various reporting content, format, and frequency alternatives should be described and analyzed in an EIS. Also, the commenter expressed disappointment at the examples provided in the appendices, suggesting that the Councils require "estimates of overall bycatch and bycatch mortality by species/stock within a fishery and/or fishery mode or gear sector in a particular area."

Response: Although the Councils are not preparing an EIS for this action, the SBRM Amendment complies with the commenter's request that options for the content, format, and frequency of the SBRM Review Reports be described and analyzed in the document. The example SBRM Review Report provided in Appendix F is an example of the type of information that would be available to the Councils in an SBRM Review Report for a specific FMP. It is not intended to represent the only possible format or content for the SBRM Review Report. As explained in section 6.4.2, the Councils are free to determine the type of information, format, and content they require. However, the example report does provide much of the information suggested by the commenter, such as the observed monkfish discards in each fishing mode, the ratio of monkfish discards to total discards of all species, estimates of total monkfish discards in each fishing mode, the percent of total monkfish discards associated with each fishing mode, and the CVs of the estimates of total discards in each fishing mode.

Comment 59. This commenter also expressed concern that the amendment did not require reporting on the SBRM, but provided only for the Councils to request a query of the appropriate databases.

Response: The Councils disagree with the commenter's assertion that the SBRM Amendment does not require reporting on the SBRM. The Councils developed and considered several alternatives regarding a formal SBRM Review Report, all of the which but the no action alternative would require a periodic SBRM Review Report to be prepared by NMFS. The document does, however, stipulate that regardless of the decisions of the Councils regarding the specific content, format, and frequency of the SBRM Review Report, they are always free to request any additional queries of NMFS' databases that they consider appropriate and necessary.

## Miscellaneous

Comment 60. A commenter insisted the SBRM must address how data will be collected on sea turtle impacts in the scallop dredge fishery, noting that turtle-chains prevent sea turtles from being captured and hauled on deck in the dredge, and there is no mechanism for observing sea turtle interactions with the gear underwater.

Response: The Councils disagree with the comment. There is an important distinction between what is defined as a "take" under the Endangered Species Act (ESA) and what is defined as "bycatch" under the Magnuson-Stevens Act. Under the ESA, the definition of "take" is to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S.C. 1532(19)). This is a much broader definition than that of bycatch in the MagnusonStevens Act, which is defined as "fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards [emphasis added]." The distinction hinges upon the term "harvested," which, while it is not defined in the Magnuson-Stevens Act, is accepted to mean an animal that is brought on board the vessel or otherwise removed from the ocean in the act of fishing. The activity described by the commenter regarding potential interactions between sea turtles and scallop dredge gear underwater that does not result in the turtles being captured and hauled on deck in the dredge could be considered a take under the ESA, but does not qualify as bycatch under the Magnuson-Stevens Act. Because the SBRM required to be established under the Magnuson-Stevens Act only pertains to the monitoring of bycatch, non-bycatch takes of sea turtles are outside the scope and purview of the SBRM. However, NMFS is obligated to monitor and address takes if required by the ESA or any applicable biological opinions associated with the FMPs amended by this omnibus amendment. Thus, while NMFS takes seriously the need to monitor interactions of fishing activity with sea turtles, such interactions that do not result in bycatch, as defined by the Magnuson-Stevens Act, are not explicitly addressed by the SBRM proposed in this amendment.

Comment 61. A commenter, arguing for greater FMP orientation of the SBRM, suggested that the amendment authorize and encourage a variety of cooperative research aimed at reducing bycatch and improving bycatch data quality.

Response: Including provisions to authorize and encourage cooperative research is outside the scope and purpose of the SBRM and this amendment. Nevertheless, the Councils support a wide variety of cooperative research programs, including many projects aimed at reducing bycatch. Bycatch reduction is frequently a priority research area of the Northeast Consortium, Cooperative Research Partners Program, and the various research set-aside programs. The Councils intend to continue to provide support for such projects, as resources allow.

Comment 62. A commenter stated that NMFS needs, as practical matter, to ensure the observer program is affordable and effective and enjoys stable funding and workforce.

Response: The NEFOP strives to maintain an effective and cost-efficient at-sea fishery observer program, including a stable, well-trained workforce. Funding levels vary and are dependent upon the annual Federal budget developed by the U.S. Congress and signed by the President.

Comment 63. A commenter suggested that NMFS should make use of industry and government resource surveys to estimate bycatch. The commenter noted that prior to
opening an area to scallop fishing, the area is surveyed by observed commercial vessels and that the pre-opening surveys may support sufficient discard estimates and provide for reduced observer coverage in the fishery.

Response: All available information is considered and used, as appropriate, in stock assessments and management decisions. While the focus of this amendment is development of a standardized methodology for obtaining and utilizing discard data in a programmatic way across all Northeast Region fisheries, nothing in this amendment would preclude the use of additional data as they become available.

Comment 64. The same commenter expressed concern that the SBRM's reliance on gear and area fished to identify modes may result in an unmanageable number of separate modes for scallop vessels under the SBRM.

Response: A detailed explanation of the purpose and procedures for stratifying the fisheries according to gear type, port, and fishery program is provided in section 5.3. While the number of strata may change as conditions in the management system change, the stratification is an important component of the SBRM used to differentiate fishing modes so that the variability inherent in most fisheries can be minimized to the extent practicable, thus reducing potential sources of bias and improving the precision of the resulting data collected in the fishing mode.

Comment 65. A commenter stated that the amendment document does too little to standardize how observers conduct themselves and their data collection aboard fishing vessels.

Response: While this comment addresses two very important aspects of any successful at-sea fishery observer program, these issues are well addressed by the NEFOP in the Observer Program Manual (NMFS 2006a), the Biological Sampling Manual (NMFS 2006b), and the Observer Training Program, and are beyond the scope and purpose of this amendment.

Comment 66. Another commenter wondered if NMFS had the resources to support the analysis obligations made by the SBRM Amendment.

Response: The Councils expect that NMFS will complete all analyses required under the SBRM proposed in this amendment, to the extent that resources will allow.

Comment 67. One commenter suggested that law enforcement be increased "to 10 percent, not less than 1 percent."

Response: Enforcement of fishing regulations is not within the scope or purview of this amendment. The Councils expect that the commenter may have misunderstood the discussion of at-sea observer coverage levels to relate to fisheries enforcement. At-sea fisheries enforcement is conducted by the U.S. Coast Guard, as one of several important missions. The ability of the Coast Guard to provide an on-the-water presence and to engage in fisheries enforcement is dependent upon annual budgets
and competing priorities such as drug interdiction, search and rescue, and homeland security.

# Public Hearing Summary 

Gloucester, MA
November 14, 2006

| Chair: | Dana Rice |
| :--- | :--- |
| Council Staff: | Chris Kellogg |
| NMFS Staff: | Michael Pentony |
| Council Members: | Phil Ruhle |
| Attendance: | $32(8$ signed in $)$ |

## Introduction:

Mr. Rice welcomed those in attendance and introduced the purpose and structure of the SBRM Amendment public hearing. Mr. Pentony provided a short presentation on the purpose of the hearing, a summary of the SBRM Amendment and the Councils' preferred alternatives, and a review of the process to comment on the draft amendment, which are accepted at the hearing, or at the second of two public hearings on December 13, 2006, in New York, NY. Mr. Pentony announced that written comments would be accepted through December 29, 2006, via mail, fax, or email.

Five individuals provided comments on the draft amendment. The following represents a summary of the testimony of each commenter and is not intended to be a complete transcript.

## Comments:

1. Gib Brogan, Oceana: Mr. Brogan relayed Oceana's concerns regarding the draft SBRM Amendment. Mr. Brogan asserted that the SBRM Amendment, as proposed, does not satisfy the Court's remand order regarding Amendment 13 to the Northeast Multispecies Fishery Management Plan (FMP). During his testimony, Mr. Brogan identified the following concerns with the document:

- The proposed SBRM continues to leave the level of observer coverage at the discretion of the Regional Administrator (RA). The SBRM Amendment should require a minimum level of observer coverage for each fishery and, therefore, does not meet the court order.
- The Purpose and Need in the first section of the document is not sufficiently clear. It should better state what is in the document and what it sets out to do; that is, how it will move the SBRM issue forward.
- An omnibus FMP amendment effects changes to all the region's FMPs. The document does not, but should, discuss how the amendment will affect each individual FMP.
- The possibility of future management implications is not spelled out in the document.
- The document should also clarify the annual process to update the observer allocations.
- An SBRM needs to establish an allocation of observer days and this document does not do that.
- The range of alternatives considered in the document is inadequate to comply with the National Environmental Policy Act (NEPA), and more viable alternatives should be considered. The performance standard of a CV equal to or less than $30 \%$ is accepted in the document as a gold standard without consideration of other CV levels.
- The document should specify what is to be included in the SBRM Report. The alternatives for requiring reports on the SBRM should be expanded.
- The idea of accuracy is not explored in the amendment document.
- The SBRM Amendment is very complex and technical and relies on NMFS science. The amendment should be peer reviewed to ensure the science and reasoning are robust.
- The concept of importance filters is too vague in the document. Sample threshold levels (used in several of the filters) and the effects of their range ( $0.5 \%-3.0 \%$ ) on the outcomes of data quality are not discussed. It appears that the threshold level can be manipulated. Threshold values should be fixed and established in the SBRM Amendment document. The importance filters should not be a mechanism merely for justifying status quo observer levels.
- Oceana has issues with specific fisheries. For sea scallop trawls, NMFS and the Councils should consider the use of underwater video monitoring to capture interactions of the fishing gear with marine life. There is no discussion of underwater video monitoring in the amendment document.
- Appendix E is an example of what a required SBRM Report might look like. The information provided in Appendix E is insufficient and does not satisfy the requests of the NEFMC regarding SBRM reporting. The example does not include any time/area data or analyses of bycatch patterns. Mr. Brogan expressed concern that if such information is not specified as required, it will not be collected.
- The SBRM Amendment has come a long way since the review of the Rago et al (2005) paper in September 2005, but more needs to be done to move the region's bycatch monitoring into modern management. Oceana will submit written comments.

2. David Frulla, Fisheries Survival Fund: Commenting on behalf of the Fisheries Survival Fund, Mr. Frulla expressed concern that some of the approaches proposed in the SBRM Amendment are too open to litigation. Mr. Frulla stated that the Fisheries Survival Fund will be submitting written comments and, perhaps, technical papers on specific issues. During his testimony, Mr. Frulla identified the following issues:

- Levels of precision and accuracy are matters of policy that should be left to the Councils. Whatever monitoring methods are decided upon, they should not unduly burden the public or bankrupt the industry.
- The document should explain the costs and benefits of achieving varying levels precision and accuracy.
- Mr. Frulla expressed support for the concept of importance filters and notes that under the example threshold levels the required number of observer days still more than doubles the highest levels ever achieved.
- Mr. Frulla concurs with the document's finding that video monitoring of discards is still a ways off. The method is not robust, as the boat deck is not a production line that is easily videotaped. Also, vis a vis underwater video monitoring, sea turtles that are deflected by a scallop dredge's turtle chains are not bycatch. A white paper by the Fisheries Survival Fund will address this issue.
- Mr. Frulla expressed support for the "gray cell" importance filter that removes from consideration (for observer day allocation) improbable bycatch gear/species combinations. Bycatch problems that have been addressed, such as sea turtles scallop dredges, might also be considered as gray cells in the importance filters.
- Add consideration of reducing needed observer coverage levels for fisheries that have implemented successful bycatch reduction devices.
- The detailed discussion of accuracy in the SBRM Amendment document and Rago et al (2005) should satisfy the Court's remand order. NMFS has done a good job addressing accuracy and bias in a principled way.
- The SBRM Amendment would set a performance standard of a CV less than or equal to $30 \%$ for each mode/species combination. Case law has provided more room for flexibility in this matter. The level of detail - down to mode/species combinations - is one reason the tally of observer days is so high. Mr. Frulla expressed concern that this approach may lead to a court order that requires observer coverage to meet a CV target of $30 \%$ for each mode/species combination.
- There's more flexibility in the court orders than Oceana suggests. Methodology has not been specified by the courts. The Pacific groundfish SBRM has been held up by the court as an acceptable example, but even it does not go into the level of detail of the Northeast SBRM Amendment.

3. Cindy Smith, Maine Department of Marine Resources (DMR): Speaking on behalf of the Maine DMR, Ms. Smith identified an issue related to the estimated discard mortalities. NMFS's mortality estimates by mode, derived from observed discards, are perceived by constituents in Maine as inequitable from mode to mode. The SBRM Oversight Committee should explain the discard estimates in the document. She explained that Maine DMR will be submitting written comments.
4. Jeff Kaelin, Ocean Spray Partnership/Ocean Frost Seafood: During his testimony, Mr. Kaelin identified the following issues:

- Mr. Kaelin supports the Council's decision not to adopt an electronic monitoring alternative. Electronic monitoring methods are not yet practical.
- Mr. Kaelin expressed concern regarding the Council's decision not to set minimum percentages of observer coverage.
- Mr. Kaelin also expressed concern regarding how a CV standard may leave NMFS open to litigation and that setting such a standard would handcuff the SBRM to artificial and unrealistic expectations. NMFS should not be in the position of getting sued due to lack of resources to meet CV and observer coverage targets. Can other parties at the table pitch in funds to support additional observer coverage?
- The use of importance filters in the determination of observer day determinations makes good sense. Mr. Kaelin expressed concern about the extrapolation of observed discards to derive total discard estimates. He will be submitting written comments.

5. Ron Smolowitz, Fisheries Survival Fund: During his testimony, Mr. Smolowitz identified the following issues:

- One component of monitoring that could be expanded is the use of industry and NMFS surveys to estimate bycatch. Prior to opening an area to fishing, the area gets surveyed by commercial vessels. The pre-opening surveys and the bycatch rates from VMS reporting could be expanded. Mr. Smolowitz believes that preopening surveys in which bycatch rates are determined may support discard estimates, even with a lower level of observer coverage in the fishery.
- The SBRM Amendment document should include a retrospective analysis of the Georges Bank sea scallop opening to determine whether the target CV was met using the pre- and post-opening surveys.
- Sea turtle interactions with scallop dredges are not bycatch. Turtle chains prevent the turtles from being caught. The interactions are "takes" (under the Endangered Species Act) and should be addressed elsewhere. This distinction should be clarified in the document.
- In areas without a TAC-driven closure, the Council and NMFS should consider requiring an exploratory level of observer coverage and develop methodology for such pilot coverage.
- The reliance in the SBRM Amendment on fishing gear/area modes is a concern for the scallop industry. Each new access area in the fishery is likely to result in a separate mode under the SBRM. This concern may be alleviated if pre-opening surveys are used to reduce the observer burden on the industry.


## Conclusion:

No one else requested to speak, and the hearing was adjourned at 6:30 p.m.

# Public Hearing Summary 

New York, NY
December 13, 2006

Chair: Laurie Nolan<br>Council Staff: Jim Armstrong<br>NMFS Staff: Michael Pentony<br>Council Members: Pat Augustine, Paul Scarlett, Ed Goldman, Fran Puskas, Gene Kray, and Jeff Deem<br>Attendance: $\quad 16$ (10 signed in)

## Introduction:

Ms. Nolan welcomed those in attendance and introduced the purpose and structure of the SBRM Amendment public hearing. Mr. Pentony provided a short presentation on the purpose of the hearing, a summary of the SBRM Amendment and the Councils' preferred alternatives, and a review of the process to comment on the draft amendment. Mr. Pentony announced that written comments would be accepted through December 29, 2006, via mail, fax, or email.

After a short question-and-answer period to clarify several specific points about the amendment, four members of the public provided comments on the draft amendment. The following represents a summary of the testimony of each commenter and is not intended to be a complete transcript.

## Comments:

1. Shaun Gehan, Fisheries Survival Fund: Speaking on behalf of the Fisheries Survival Fund, Mr. Gehan reiterated many of the comments made at the first hearing. In particular, Mr. Gehan identified the following issues:

- The draft SBRM Amendment does a good job of addressing the issue of accuracy that was identified by the Court as an area of concern.
- Overall, the importance filters are a good thing. In particular, they help focus limited resources where they would be the most meaningful.
- Some concern that the plan far exceeds the National guidance for bycatch monitoring, which suggests achieving a CV of 20-30 percent across fisheries, not at the species-by-species level as the SBRM Amendment proposes.
- Concerned over the potential for litigation if the amendment creates high expectations which are then not met. In order to remedy this, Mr. Gehan suggested expanding the importance filters and focusing them to further refine the resulting observer coverage levels.
- Concerned that the document does not go far enough in requiring an observer program; the Court said this was not optional. At a minimum, the document should stipulate that the use of observers is mandatory.

2. Greg DiDomenico, Garden State Seafood Association: Mr. DiDomenico expressed mixed emotions regarding this type of action, but stressed he hopes NMFS can get good information on bycatch occurring in the fisheries. He expressed concern that if the Agency cannot meet the requirements for fisheries observer coverage, then the amendment could serve as a tool for litigation. His primary concerns are that, if litigation occurs, either a fishery would be shut down due to incomplete observer coverage or the industry would be forced to pay for the observers.
3. Sima Freierman, Montauk Inlet Seafood: Ms. Freierman expressed concern that the SBRM Amendment does not address problems with the fisheries observer program, such as faulty data, anomalous tows, and putting observers on smaller vessels. She reported being particularly concerned about standardizing observer practices. Ms. Freierman would like the amendment to shift away from focusing on how the data are collected and to look at what goes on on the fishing vessels.
4. Peter Moore, American Pelagics Association: Mr. Moore indicated he would be submitting written comments, but expressed particular concern over the potential for unintended consequences of the amendment if the Agency cannot achieve the observer coverage levels stipulated in the amendment. He is concerned that fisheries may be shut down if there is insufficient funding to meet the expectations.

## Conclusion:

There was some discussion among the attending Council members and staff, but no other members of the public requested to speak, and the hearing was adjourned at 8:15 p.m.

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Subject: PUBLIC COMMENT ON FEDERAL REGISTER OF 11/16/06 VOL 71 PG 66748
Date: Thu, 16 Nov 2006 07:33:23 -0800 (PST)
From: jean public [jeanpublic@yahoo.com](mailto:jeanpublic@yahoo.com)
To: SBRMcomment@noaa.gov, COMMENTS@WHITEHOUSE.GOV, VICEPRESIDENT@WHITEHOUSE.GOV

```
FED REG DOC E6 19398 ID 102006a
HEARING IN NYC - 50 CFR 648
MEETING ON DECEMBER 13 AT 7 PM
OF COURSE THERE SHOULD BE STANDARDIZED FORMS WHICH ARE
USED ALL OVER THE U.S. BY THESE COUNCILS.
HOWEVER, THE FORMS USED ISNT THE ISSUE, THE LIES TOLD
BY COMMERCIAL FISH PROFITEERS WHO OVERCATCH IS THE
ISSUE. LAW ENFORCEMENT NEEDS TO BE STEPPED UP TO TEN
PERCENT, NOT LESS THAN ONE PERCENT.
WE NEED TO JAIL THESE OVER QUOTA COMMERCIAL FISH
PROFITEERS, FINE THEM WITH FINES STARTING AT ONE
MILLION DOLLARS AND GOING UP AND SEIZE THEIR VESSELS.
IT IS CLEAR THERE IS FAR TOO MUCH OVERFISHING GOING ON
AND SPECIES AFTER SPECIES AFTER SPECIES ARE VANISHING
FROM THIS EARTH. OUR CHILDREN'S HERITAGE IS BEING LOST
BY NOAA AND ITS FAILURE TO PROTECT ALL AMERICANS FROM
RAPACIOUS SMALL PROFITEERING CLIQUES.
B SACHAU
15 ELM ST
FLORHAM PARK NJ 07932
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Www2.nextag.com
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December 22, 2006
Patricia Kurkul
Northeast Regional Administrator
National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA 01930
Via email to: SBRMcomment@noaa.gov
Re: Comments of Oceana Concerning the Omnibus Standardized Bycatch Reporting Methodology Fishery Management Plan Amendment for the New England and Mid-Atlantic Regions

## Dear Ms. Kurkul:

We would like to take this opportunity to comment on the development and approval of the Standardized Bycatch Reporting Methodology (SBRM). Catch data is the fundamental basis of any fishery management system. Without an adequate bycatch reporting system, the sustainable management of New England and Mid-Atlantic fisheries will be impossible. Developing a robust program to collect, analyze, and report bycatch data - that is available and useful for fisheries managers, stakeholders, and the public -- is a critical step in improving the sustainability of these fisheries and the efficacy of the many rebuilding programs that are under way in these regions.

Oceana would like to commend the staff of the Fisheries Service for their work in developing a draft SBRM document that provides meaningful guidance for the Council and the Agency. The draft SBRM makes important conclusions about the need for increased use of at-sea observers to collect information about bycatch, including the findings of the National Working Group on Bycatch. This information and analysis will undoubtedly improve the way the regions' fisheries are managed.

However, the SBRM draft is the product of a remand order, and it must satisfy the requirements of the law and of the Court's order. As it stands now, the draft document fails to meet those requirements. This SBRM amendment will be a precedent-setting management action that will influence how fisheries are monitored and managed across the country. Oceana understands that it may require additional time and effort to fully address the requirements of the Court's order and controlling statutes, but emphasizes again that the document must be legal and complete. We are happy to work with the agency as the process moves forward, but intend on using every option to ensure that this document fulfills its requirements.

In order to meet the legal requirements of the Magnuson-Stevens Act, National Environmental Policy Act ("NEPA") and the Court order, the SBRM must incorporate significant changes, including:

- The SBRM must mandate how data is collected by mandating the level and allocation of observer coverage
- The SBRM must mandate how data is reported
- The agency must take a hard look at the environmental impacts of the SBRM in an Environmental Impact Statement ("EIS").

Below is more detail on these required changes.

## DETAILED COMMENTS

## I. THE SBRM MUST MANDATE HOW DATA IS COLLECTED BY MANDATING THE LEVEL AND ALLOCATION OF OBSERVER COVERAGE

As you know, Oceana brought lawsuits against the Fisheries Service concerning both Groundfish Amendment 13 and Atlantic Sea Scallop Amendment 10, because neither amendment contained an adequate SBRM. In these cases, the Court ruled that the amendments violated the SBRM requirement of the Magnuson-Stevens Act.

Most importantly, the Court held that Amendment 13 failed to "establish" an SBRM, because, while it set forth an intention to achieve $5 \%$ observer coverage, it left the actual level of observer coverage completely in the discretion of the agency. Oceana v. Evans, No. 04-0811, 2005 WL 555146 at *42 (D.D.C. Mar. 9, 2005) (hereinafter "Oceana I "). The Court found Scallop Amendment 10 to be unlawful, because it too failed to "establish" an SBRM, instead leaving the actual allocation of observers up to the Regional Administrator. Oceana v. Evans, 384 F. Supp.2d 203, 232 (D.D.C. 2005) (hereinafter "Oceana II").

The draft SBRM appears to have exactly the same flaw as Groundfish Amendment 13 and Scallop Amendment 10; it appears to establish performance targets while leaving the actual level and allocation of observer coverage entirely up to the agency.

What is more, the SBRM draft does not establish an allocation of observer coverage and does not explain how one would be established. The analysis in the document appears to be based upon a certain level of days-at-sea, but it is not clear whether there is an automatic mechanism to update the allocation analysis every year, which would be needed as fishing effort changes as the result of changes in total allowable catch levels ("TACs") and other measures controlling fishing effort. The draft also makes clear, at p. 184, that the actual allocation of observers would be further reduced based on funding, but the SBRM neither

Ms. Patricia Kurkul
December 22, 2006
Page 3 of 8
gives a minimum number of observers nor any way to determine how observer allocation would be reduced.

The hard work of the SBRM team should not be in vain. The Council and the agency must take the final step required by the law and establish the SBRM with binding requirements for observer allocation in affected fisheries.

## II. THE SBRM MUST MANDATE HOW DATA ARE REPORTED

As an omnibus amendment to individual fishery management plans, the SBRM amendment must develop a standardized bycatch reporting methodology that addresses the management and data needs of each fishery. The reporting methodology should be an integral part of each plan and effectively contribute to improving fishery management. The current document does not consider current or future management needs or discuss how the information provided by the SBRM could improve or change the management of a given fishery. The final document should include a discussion of the management scheme for each affected fishery and the possible bycatch data needs of the current and future management of these fisheries. The amendment should take affirmative steps to address these needs.

For example, the SBRM as drafted merely states that the Council can request information and it will be provided through a 'query' of the bycatch database and related analyses. This non-binding and vague promise does not establish a reporting methodology - it leaves reporting solely at the discretion of the agency. Instead, the SBRM should specify data to be collected, reporting formats, and reporting frequencies to address the needs of specific fisheries.

## III. THE SBRM MUST CONSIDER BYCATCH OF SPECIES THAT ARE NOT TARGETED UNDER FISHERY MANAGEMENT PLANS

The Magnuson-Stevens Act definition of bycatch and fish encompasses a much broader range of bycatch species than the SBRM document considers in its analyses. Species that are not targeted under fisheries managed by the New England or Mid-Atlantic Councils, such as those managed by the Atlantic States Marine Fisheries Commission (i.e. striped bass, shad, etc) or the National Marine Fisheries Service directly (Highly Migratory Species), must be considered in the Standardized Bycatch Reporting Methodology. Without a method to assess and report bycatch of all species, the SBRM is incomplete. Additionally, the SBRM must consider the management needs of the Councils in its analysis and include a discussion of bycatch of corals and sponges as possible indicators of impacts on marine habitat, especially essential fish habitat ("EFH").

## IV. THE SBRM DRAFT DOES NOT SATISFY NEPA

A. An Environmental Assessment ("EA") Is Insufficient for This Action

The information and analysis in the SBRM document will have a significant impact on thirteen fisheries from the Canadian border to North Carolina. The information, analysis, and technical guidance contained in a complete SBRM will affect how these fisheries are managed, their stock assessments, and ultimately the management approaches used to reach management goals. Therefore, the Omnibus SBRM amendment is a major federal action significantly affecting the quality of the human environment. Accordingly, the agency must take a hard look at the environmental impacts of the preferred alternative as well as other alternatives, in a full Environmental Impact Statement.

With a wide range of stakeholders that could be affected by the findings of this process, the agency must engage in a complete scoping process to educate and engage the public about the issue and seek concerns and ideas to be investigated and developed as part of the document. Instead of an open public process, the agency chose to develop this document using the internal Fishery Management Action Team ("FMAT") process which removed interested parties from the development process with the exception of periodic updates to the Councils.

## B. The SBRM Document Must Discuss the Purpose, Need, and Scope of the Amendment

In it current form, the SBRM document is vague and fails to clearly state the goals or issues to be addressed. The SBRM EIS must be presented in a format that is accessible to the public, affected stakeholders, and decision makers. The SBRM development process suffered because of a lack of public participation and the failure to engage the New England and Mid-Atlantic Councils apart from cursory presentations at council meetings. Putting the analysis in a more accessible format will yield a more complete and functional document.

## C. The EIS Must Consider a Range of Feasible Alternatives

Instead of examining real alternatives for each decision point, the EA only presents the options of status quo, preferred alternative and impossible straw man. This is blatantly in violation of NEPA and quite similar to the EAs that were thrown out in the original EFH case. See AOC v. Daley, 183 F. Supp.2d 1, 19 (D.D.C. 2000) (EAs overturned where most considered only status quo and preferred alternative).

For the important choices the EIS must consider real alternatives. For example:

## 1. Performance standard

The document fails to define to which units of measurement the performance standard will be applied. For example, would the bycatch estimate that would have a $30 \%$ CV be an
overall bycatch estimate for all species aggregated; an estimate for all species aggregated, but broken out by time and area; an estimate by "fishing mode;" an estimate for each individual species; or an estimates for various species groups?

For the SBRM to be effective, it needs to include a performance standard. This standard needs to be a requirement, not a target. Oceana believes that the SBRM can and should mandate compliance with relevant performance standards to ensure high quality bycatch data is used in fisheries management.

## 2. Reporting

The EIS should consider different reporting formats and frequencies and the option of a mandatory periodic report on bycatch in respective fisheries. The draft EA considers different frequencies of the SBRM review process, but does not discuss what should be in the report, or whether different reports should be required under the SBRM.

## 3. Accuracy

Precision and accuracy are equally important metrics by which the quality of data can be assessed. The treatment of accuracy in the SBRM is limited to a dismissal of current science (Babcock, et al). Although accuracy may be considerably more difficult to proactively plan for in sampling design, the EIS should consider alternative methods to retrospectively assess the accuracy of bycatch data in periodic bycatch reports.

## D. The EIS Must Consider Cumulative Environmental Impacts

The EA erroneously ignores the indirect and cumulative effects of the SBRM on the environment. As a broad reaching amendment to 13 management plans, the SBRM will indirectly affect the level of fishing and the level of mortality of targeted, bycatch, and protected species in the many fisheries and will directly affect the quality of the data used to complete stock assessments and set mortality limits. Particularly salient is that the less frequent the reporting and the less precise the methodology, the greater the risk to the environment. The EIS must fully discuss these issues and the importance of a robust SBRM or risk marginalizing the document and its important work.

## E. The EIS Must Address Protected Resources

Bycatch of protected species is a recently documented problem in some of the fisheries affected by this SBRM document. More attention must be given to the problem of protected resources and the chronic imprecision and inaccuracy of, e.g., sea turtle bycatch, estimates in these fisheries. Furthermore, the SBRM must address how data will be collected on sea turtle impacts in the scallop dredge fishery, which currently has no adequate monitoring mechanism since turtle chains render it impossible for at-sea observers to monitor interactions. Additionally, the EIS must fully discuss the impacts of the SBRM on the drafting and issuance of Incidental Take Statements and Biological Opinions for these fisheries.

## F. The EIS Must Address Importance Filters

The various alternatives for filters must be laid out in an EIS that explains the implications of the filters and proposes levels at which the filters could be set. See section VI below for additional information.

## V. Peer Review

The Omnibus SBRM Amendment is a significant action that will affect a wide range of fisheries. The National Marine Fisheries Service should ensure that the document receives a full external peer review by a body such as the Center for Independent Experts (CIE). Although the SBRM received a short review by a limited number of members of the joint Council Scientific and Statistical Committee, the review was limited to very technical issues, and was done while the SBRM was still very incomplete. Experts from the CIE should be given the opportunity to comment on the technical issues but also issues related to management and the integration of the SBRM into stock assessments.

## VI. IMPORTANCE FILTER

## A. Development of Filters

The preferred alternative would reduce the initial observer allocation by means of applying a series of "importance filters" to remove fishery mode/species combinations from the list of observer needs based on different criteria including the current database of fishery mode/species interactions. This approach is fundamentally flawed because it uses the scant observer data from past years as the foundation for the calculation of interaction percentages. Instead, the SBRM should mandate a baseline level of observer coverage and use the information from this coverage as the foundation for the future application of statistical filters.

Oceana also has serious concerns about the development and use of filters 3 and 4. These filters create a loophole through which the agency can support any level of observer coverage by manipulating the threshold values for these filters. If the SBRM does not specify the thresholds, the public has no way of knowing how useful the SBRM will be. Because the threshold values will constitute a significant part of the SBRM if the importance filter is adopted, the amendment must go out for further public comment on specific alternatives for the threshold values, including a proposed preferred alternative.

The draft document states that: "The third-level filter would eliminate species when the discards of that species in a mode are less than a certain minimum percentage of the total discards for that mode." Thus, the filter can be used to mask the real effects of a bycatch problem. For example, an unselective gear that catches a high volume of fish, like trawl gear, might catch a significant percentage of a particular species, but the percentage of that species in the total catch of the gear might not be high. Thus the third-level filter might fail to properly address bycatch of species like cod or haddock in gear like herring trawls.

Oceana recommends that filter 3 be removed from the SBRM and that the options for the percentage level for filter 4 be developed through an EIS.

## B. Protected Species

Oceana agrees that applying the first level 'graying out' filter is appropriate for those species which are geographically limited or physically unable to be taken with a given fishery mode but recommends that criteria or discussion be provided for all combinations removed through 'graying out'. This importance filter, however, is inappropriate for removing any fishery mode/protected species combination. Interactions with protected species are rarer than interactions with fish species. Interaction combinations should not be excluded based on frequency of the interactions until a robust observer program is in place which indicates that an interaction is unlikely.

## VII. COMMENTS ON DRAFT REPORT OF BYCATCH

Throughout the SBRM development process, FMAT members assured those involved at Committee and Council discussions that data would be available from the SBRM which would provide estimates of bycatch broken down by time, area, gear, and species/stock.

Instead of real examples of the usable data that the SBRM could produce, the Council and the public were provided with disappointing reproductions of past uses of bycatch data in fisheries management.

The New England Council is moving forward with a new management action to meet the mortality and rebuilding goals of the Multispecies Fishery. The Council should require that the following information should be included in any report from a 'query':

Estimates of overall bycatch and bycatch mortality by species/stock within a fishery and/or fishery mode or gear sector in a particular area (e.g. Bycatch of George's Bank Cod in the small vessel gillnet fishery)

Without evidence of the capability to assess bycatch in this kind of detail, the Council should require the FMAT to resume development of the document until such time as this level of detail is available.

## CONCLUSION

Oceana appreciates the work that has gone into the development of the SBRM document and its analyses. The work will advance the management of the region's fisheries and will bring the region closer to real fisheries accountability. Oceana is concerned that the process has gone most of the way toward completing its obligations but fails to take the final step to finish the job. We hope that the issues raised above can be amended before the SBRM is approved and implemented.

Ms. Patricia Kurkul
December 22, 2006
Page 8 of 8

Thank you for your consideration.
Sincerely,


Michael F. Hirshfield, Ph.D.
Senior Vice President and Chief Scientist
cc: Members
New England Fishery Management Council
Paul J. Howard
Executive Director
New England Fishery Management Council
William Hogarth
Assistant Administrator
National Marine Fisheries Service

Patricia A. Kurkul
Regional Administrator
National Marine Fisheries Service
Gene Martin
Regional Counsel
National Marine Fisheries Service

Subject: Comments on Section 7.2.1.3.2. Alternative 1.2 - Implement Electronic Monitoring
Date: Wed, 27 Dec 2006 08:02:29 -0900
From: Mark K. Buckley [mkbuckley@alaska.com](mailto:mkbuckley@alaska.com)
To: SBRMcomment@noaa.gov

My comments are related to the concluding paragraph of the above-referenced section of the SBRM:
"Comparatively, the costs associated with the electronic monitoring alternative appear much greater than the status quo alternative that is proposed as the preferred alternative at this time. Future consideration of electronic monitoring programs would need to weigh the benefits of such a program against the substantial costs to both the fishing industry and the Federal government, although as technologies improve, costs may decrease."

The facts in support of this statement are found in the previous paragraphs of that section. They reflect the cost structure associated with one contractor, who has has thus far been involved with the vast majority of video monitoring deployments in the commercial fisheries of North America. This contractor provides excellent service, and my comments are in no way meant to disparage the quality or thoroughness of its products. Nonetheless the contractor enjoys a virtual monopoly in the video monitoring field on this continent. This market dominance and scarcity of competition, I believe, have led to higher prices for video monitoring services.

A case in point is a video monitoring RFP issued in 2006 by the Alaska Fisheries Science Center. In this example there was a competitive field, with my Alaskabased company bidding against the market leader. My company's bid was $\$ 101,000$ and the market leader's bid was \$151,000.

This $33 \%$ cost difference, I believe, was due to my company's lower overhead and its local-hire business model. I am confident that if there were more competition to provide electronic observer services in places such as the New England Region, the prices would come down considerably.

Mark Buckley
Kodiak, Alaska

Mark K. Buckley
President
Digital Observer, Inc.
Kodiak, Alaska USA
Vox: 9074864684
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Fax: 907 486-1540

December 29, 2006
Patricia A. Kurkul
Regional Administrator
Northeast Regional Office
National Marine Fisheries Service
One Blackburn Drive
Gloucester, Massachusetts 01930-2298
Re: Comments on Draft SBRM Amendment
Dear Ms. Kurkul:
On behalf of the Natural Resources Defense Council (NRDC), I submit the following comments regarding the National Marine Fisheries Service (NMFS)' Northeast Region Standardized Bycatch Reporting Methodology, an Omnibus Amendment to the Fishery Management Plans of the Mid-Atlantic and New England Regional Fishery Management Councils ("Draft Bycatch Amendment" or "Draft Amendment").

NRDC's primary concern with the Draft Bycatch Amendment -- and it is a fundamental one -- is that the Draft Amendment fails to incorporate the necessary requirements relating to how the bycatch data is collected. Section 303 of the MagnusonStevens Act requires that each Fishery Management Plan ("FMP") and FMP amendment (hereinafter collectively "FMP") "shall ... establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery ...." See 16 U.S.C. § 1853(a)(11). It seems self-evident that, to "establish" such a standardized bycatch reporting methodology ("SBRM"), a FMP must "establish" both the manner in which the bycatch data is collected, e.g., whether by observers and if so the nature of the observer coverage, as well as "establish" how this data is then processed so as to provide an adequate basis for management decisions. Adequate data collection is obviously a necessary predicate to adequate analysis.

In three different decisions, one in 2001 and two in 2005, the federal district court for the District of Columbia recognized that the requirement to establish a SBRM includes a requirement to establish the bycatch data collection system itself. See Oceana v. Evans, No. 04-0811, 2005 WL 555146 (D.D.C. Mar. 9, 2005) (hereinafter "Oceana I"); Oceana v. Evans, 384 F. Supp. 2d 203 (D.D.C. 2005); CLF v. Evans, 209 F. Supp. 2d 1 (D.D.C. 2001). The federal court specifically concluded that a SBRM that only indicates an "intent" to implement,
rather than a mandate to implement, an adequate observer program fails to satisfy Section 303. See, e.g. Oceana I, 2005 WL at *34.

The Draft Bycatch Amendment does not satisfy the requirements of Section 303. In the portions of the Draft Amendment addressing data-gathering, NMFS simply states that its "preferred" approach is to continue to utilize the "status quo" data sources, most significantly the at-sea observer program. The Draft Amendment is fatally flawed because it does not propose to set any requirements relating to these data gathering programs, or to otherwise "establish" them. Most critically, the Draft Amendment does not set any requirements for level or allocation of observer coverage, or, for that matter, for any observers at all. The Amendment does propose the use of a $30 \%$ "Coefficient of Variation" ("C.V.") "standard" applied to "all applicable fishing modes for each species group." As an initial matter, we note that, because of the relatively general level at which NMFS proposes to apply the $30 \%$ C.V. "standard," it may not provide adequate precision. More significantly, like the $5 \%$ observer coverage level at issue in Oceana I, the 30\% C.V. "standard" appears to still be simply a target, not a requirement. While such a performance measure may well provide an enhanced understanding of the precision of various bycatch estimates, as well as facilitate the most costeffective use of observers, the $30 \%$ C.V. performance target proposal still falls short of what the law requires. As was already determined by the district court in Oceana I: it "merely suggests a hoped-for result, as opposed to 'establish[ing]' a particular standardized methodology, [and thus] does not measure up to the statute's requirements." See id.

In its comments dated December 22, 2006, Oceana addressed a number of other concerns with the Draft Amendment. NRDC shares these concerns and adopts Oceana's comments herein in their entirety. We want to draw the agency's attention in particular to the following concerns:

The Draft Bycatch Amendment proposes the use of "importance filters" for the purpose of reducing observer coverage to only what it considers to be significant fishery mode/species interactions. As set out in the Draft Amendment, however, the "importance filters" threaten to ensnare the agency in a self-perpetuating data-poor bycatch reporting methodology and to mask the shortcomings of this methodology from the public. First, it is critical - given that up-to-date data of adequate specificity, i.e., to the time/area/species/fishing mode level, is frequently lacking - that NMFS explain the limits of the existing data for each specific gear/species combination proposed to be "filtered out." Second, NMFS must identify, and allow the public to comment on, the "specific minimum percentage" thresholds that it intends to apply in the case of importance filters 3 and 4.

- The Draft Bycatch Amendment needs significantly more detail concerning how the bycatch information needs of each specific FMP will be addressed on an ongoing basis. For example, it is not at all clear that the proposed bycatch reporting methodology will be able to generate analyses, reports, and other forms of information that adequately address specific bycatch problems in specific fisheries, i.e.,
provide adequate information to make a management response possible. It is also important that managers be able to propose changes in the SBRM and supplemental monitoring in order to focus on a particular bycatch problem and enable development of a management response.
- For reasons set forth by Oceana, the Draft Bycatch Amendment requires an EIS. In this regard, we want to note that the Draft Amendment is, as NMFS almost certainly recognizes, a very important regulatory proposal. It addresses a significant fisheries management problem and proposes to do so by amending thirteen different FMPs, which cover dozens of managed stocks and affect a much larger number of marine species. The Draft Amendment is also of course a response to a judicial remand in two separate federal court actions.

In closing, NRDC does recognize that the Draft Bycatch Amendment is the product of considerable work and represents a step forward in certain respects, such as by recognizing the importance of observers and the need to increase observer coverage. However, as already noted, the Draft Amendment still falls substantially short of what the statute requires. We strongly urge NMFS to address the concerns we have highlighted above, as well as those identified by Oceana. Thank you for consideration of our comments.

Respectfully yours,


Brad Sewell
Senior Attorney
Natural Resources Defense Council

## KELLEY DRYE

VIA ELECTRONIC MAIL
Ms. Patricia A. Kurkul
Regional Administrator
National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA 01930

## RE: FISHERIES SURVIVAL FUND COMMENTS ON SBRM AMENDMENT

Dear Ms. Kurkul:
We represent the Fisheries Survival Fund, an association whose participants include the bulk of the Atlantic scallop full-time limited access permit holders. We submit this letter on behalf of the FSF, as well as North Carolina Fisheries Association, the Garden State Seafood Association, Montauk Inlet Seafood, Inc., the American Pelagic Association, and Associated Fisheries of Maine, and we expect other groups may associate themselves with these comments. Collectively, these organizations represent thousands, of participants in nearly every, if not every, fishery managed by the New England and Mid-Atlantic Fishery Management Councils. We appreciate this opportunity to provide comments, including technical comments prepared by a respected fisheries scientist, Mr. Paul Starr, who has years of experience in designing and implementing bycatch estimation programs, ${ }^{1}$, on the proposed omnibus Standardized Bycatch Reporting Methodology ("SBRM") Amendment, under consideration by both these councils.

## INTRODUCTION

Development of an omnibus SBRM amendment represents an ambitious project, albeit one that has not garnered attention and scrutiny commensurate with its significance. The Public Hearing Document is technical, but if it is implemented in the preferred form, it will have major practical ramifications for New England and Mid-Atlantic fisheries. It appears, moreover, that neither the fishing communities nor the New England and Mid-Atlantic Fishery Management Council members yet understand these ramifications. In contrast, and judging by the attendance at the two public hearings on the SBRM Amendment, environmental organizations, including those whose lawsuits in the groundfish and scallop cases resulted in the court decisions to which the SBRM Amendment responds, are paying close attention to this process. If the past is prologue, these groups will not hesitate either to renew such challenges if they perceive any weakness in the amendment or bring suit to enforce any mandate seen as resulting from the action the Councils take on this amendment.

1 These comments are included, along with Mr. Starr's curriculum vitae, as Attachments 1 and 2 to this letter.

Indeed, whatever standardized bycatch reporting methodology the Councils decide to implement, they should recognize that they are creating standards for a program that might be able to be enforced in court. In discussing a case involving invalidation of the Pacific Groundfish FMP for lacking an adequate SBRM, the federal court that invalidated the Scallop Amendment 10 SBRM, explained:

The failing in PMCC was that NMFS had determined that a live observer program was necessary for accurate reporting, but it had nonetheless neglected to establish any type of observer program.

Oceana v. Evans, 384 F. Supp. 2d 203, 234 n. 38 (D.D.C. 2005) ("Oceana Ir"), citing Pacific Marine Conservation Council, Inc. v. Evans, 200 F. Supp. 2d 1194, 1200 (N.D. Cal 2002).

In summary, the SBRM Amendment is currently not on a feasible or productive track. While considerable rigorous work has gone into this draft omnibus amendment, it does not strike an adequate balance between specificity and generality. It is overly specific when it stratifies the bycatch reporting regime into tens of hundreds of strata and then prescribes a uniform coefficient of variation ("CV") for each. Such fine gradations of the units of analysis are not necessary to meet the requirements for an SBRM requested by the court in the scallop and groundfish cases. (The undersigned participated on the government's side in the challenges to the SBRM in these cases and have a detailed understanding of these decisions.) Even more fundamentally, as explained herein, such an approach is not consistent with nationwide NMFS technical guidance.

Such a uniform CV approach across these many strata is likewise too general. Bycatch reporting objectives will and should vary with the particular management needs and problems specific to each fishery. NMFS explained in its nationwide technical guidance for establishing such monitoring systems that, "The development of a sampling strategy for the estimation of bycatch based on an at-sea observer program entails first clearly defining the objectives of the sampling program and selecting a sampling strategy designed to meet these objectives. . . . An explicit statement of the objectives is a critical step in devising effective sampling procedures., ${ }^{2}$

In contrast to this considered nationwide guidance, the omnibus amendment puts the metaphorical cart before the horse (as the court found in the prior cases) by establishing blanket standards of precision across a myriad of fisheries "modes" sub-divided by bycatch species, rather than considering the needs and requirements of individual fisheries. In this regard, the amendment appears to share the failures that the court found to exist in the scallop and groundfish amendments.

2 National Marine Fisheries Service, Evaluating Bycatch: A National Approach to Standardized Bycatch Monitoring Programs, NOAA Technical Memorandum NMFS-S/SPO-66, at 48 (Oct. 2004) (hereafter "Evaluating Bycatch"); see also Comments of Mr. Paul Starr, at 1-2 (attached) ("Starr Comments").

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This omnibus amendment would be more constructive if it provided the Councils and NMFS with a process and some ground rules they could employ to develop and implement fisheries-specific monitoring systems in plan-specific contexts. Such an approach could provide information that is actually useful to management. The amendment could also establish general rules for NMFS to use in administering observer programs. As we explain, we would expect, and the omnibus amendment could prescribe, that observer programs represent a core component of fishery-specific programs.

Finally, and perhaps equally importantly, such an approach could take into account available resources. As explained above, the Public Hearing Draft would prescribe that managers seek to achieve a $30 \% \mathrm{CV}$ for tens of hundreds of different strata. While it is not clear whether the Public Hearing Document plans to treat this $30 \%$ CV goal as mandatory for each stratum, it is quite possible (and perhaps even likely) that a court would find this requirement to be enforceable, particularly if attainment of $30 \% \mathrm{CV}$ represents the centerpiece requirement of the amendment. As the Councils can well understand, the resources do not and will not exist to achieve such a mammoth undertaking. However, failure to achieve these CVs could result in chronic and disabling litigation, each time a target CV is not met.

Fortunately, it is not necessary to begin the process from square one. With the adjustments suggested herein, which are based on the Evaluating Bycatch report, applicable law, consultation with experts in sampling design, and the decisions in the groundfish and scallop cases, the Omnibus SBRM Amendment can fully meet legal requirements and assist the Councils in their statutory responsibilities to evaluate and minimize bycatch. The following proposal provides a more practical - and practicable - way forward to create a workable program that not only actually can be implemented, but is also more consistent with legal requirements and the Councils' management needs. After setting forth our proposal, we will conclude by discussing the general legal framework applicable to this action and the specific issues raised in the SBRM Public Hearing Document.

## RECOMMENDED DIRECTION FOR THE SBRM AMENDMENT

The key task identified by NMFS in its Evaluating Bycatch report is to define the objectives of any SBRM program. (Typically, an SBRM program would not be designed for an entire NMFS Region's worth of fisheries at once, but the principle remains the same.) As we explain below, the draft Public Hearing Document has not been able to define the objectives for the SBRM program, either as a whole or for each specific fishery. It is simply not sufficient to prescribe a blanket CV requirement and term this an objective.

Properly conceived bycatch and reporting methodology objectives will vary by fishery, depending on such factors as whether protected species issues are involved, the gear types employed, and the baseline amount of information on the types and amount of bycatch. As noted in Evaluating Bycatch, different fisheries have differing needs in terms of sampling design and other elements of an SBRM. The report explains:

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[A]n at-sea observer program designed with the objective of estimating fishery discards may be quite different from one designed to assess incidental takes of protected species, particularly if the latter represents rare events. When there are multiple objectives for an observer program, the program design often will need to address competing objectives and the optimal design cannot be determined unless weights have been assigned to the various objectives. Basically, when there are multiple objectives, it becomes much more difficult to clearly define the objective (including the weights to be used), to identify the appropriate sample design, and to identify the desired level of precision for each estimate.

Evaluating Bycatch, at 48-49; see also Starr Comments, at 1 ("There is no substitute for dealing with each fishery unit (or grouping) individually and tailoring the monitoring to fit the situation.").

Accordingly, the omnibus should instead focus on the development of a broad program and methodology for developing fishery specific bycatch reporting regimes - with the details left to development in the context of individual fishery management plans. Such an approach represents a constructive enterprise. There is a value in and of itself for the Northeast Region to have a consistent set of standards for developing fishery-specific bycatch reporting programs.

Furthermore, the applicable case law does not require NMFS to develop fishery-specific programs to have a legally adequate and useful omnibus amendment. Oceana II explained that:

A methodology need not necessarily be detailed, but it must at the very least provide decision makers and the public with a program of what actually will be done to improve bycatch reporting, and why these measures will be sufficient based on the best available science.

384 F. Supp. 2d at 234. Realistically, given the nature of this omnibus amendment process, the elements of this amendment must be somewhat general.

Whether general or specific, the key element for an appropriate SBRM is that it sets requirements for NMFS to follow in deploying observer coverage and undertaking other fishery monitoring programs. Oceana II explained:

The Court concluded that the Secretary's mere "intention" to maintain a fivepercent observer coverage level, while delegating the actual level of observer coverage and methodology to the Regional Administrator, did not constitute establishment of a "bycatch reporting methodology."

Oceana II, 384 F. Supp. 2d at 232 (citing Oceana I, 2005 U.S. Dist. Lexis 3959, 2005 WL 555416, at *40). Our proposal's strength is that it would allow the Councils to develop these requirements, based on the recommendations of those with fishery-specific expertise.

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Accordingly, this SBRM omnibus amendment would meet all legal requirements so long as it: (1) establishes a process and broad programmatic outline that will guide the development of FMP-specific programs; and (2) directs the agency to focus resources according to certain criteria based on urgency for coverage determined from an examination of existing bycatch information, including reliable anecdotal information.

Regarding process, the omnibus amendment should authorize the Councils to develop and implement more detailed methodologies, specific to each fishery, through framework adjustments, regulatory amendments, or full plan amendments, as they see fit. To allow for initiation of such a subsequent FMP-specific process, the omnibus amendment should amend each fishery management plan to allow for the adoption of a bycatch estimation program by abbreviated rulemaking processes, such as through a framework action. ${ }^{3}$ Individual plan development teams, perhaps supplemented by working groups (as explained by Mr. Starr at page 3), would have the specific knowledge of the fishery in question to develop practical and practicable approaches. Moreover, the process should allow managers to adjust these fishery specific requirements, perhaps through annual or biannual specification setting processes, as conservation and management requirements for the fishery change over time. This approach would allow each Council to tailor bycatch monitoring and reporting to the specific needs of each fishery as they evolve.

Regarding more substantive requirements, the amendment will most likely have to mandate a live observer program in each fishery, in conjunction with other data collection systems. Evaluating Bycatch and other studies have found observers to be important to achieve precise and accurate estimates. Courts have also recognized the importance of live observers. ${ }^{4}$

Additional substantive requirements can be more general in nature. To that end, we would suggest that the SBRM:

- Mandate that each fishery management plan establish observer coverage levels in that fishery based on considerations specific to that fishery. Such levels can be particular to an individual species or a species grouping, as well as to each specific gear type, and can be changed through framework adjustment or specification

3 As an omnibus amendment, the SBRM Amendment can provide overarching analyses that can be incorporated into streamlined rulemaking documents under each FMP. This is perfectly consistent with legal requirements under the National Environmental Policy Act.
4 See, e.g., Oceana II, 384 F. Supp. 2d at 233-34 ("'Because the observer program is optional under Amendment 13, NMFS in theory could decide not to implement an observer program for the ground fishery, and nothing in Amendment 13 would prohibit the agency from making that decision."") (quoting Pac. Marine Conservation Council, Inc. v. Evans, 200 F. Supp. 2d 1194, 1200 (N.D. Cal. 2002)).

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setting processes, as conservation and management needs changes in the fishery and across fisheries ${ }^{5}$;

- Provide that each FMP should establish a set of diagnostics, perhaps using a target CV or CVs for each fishery or fishery mode, to gauge whether the program is providing sufficiently precise information for management purposes. This is consistent with NMFS' guidance, ${ }^{6}$ and far more realistic than attempting to achieve such a level for several hundred fishery modes sub-divided by bycatch species;
- Create a general set of priorities for deployment of limited observer resources that is non-discretionary for NMFS. For example, that resources be dedicated first to fisheries or sectors within a fishery that have taken protected species or that have material bycatches of overfished species;
- Mandate that sampling designs developed for each fishery minimize bias (thus promoting accuracy in assessments) to the greatest extent practicable;
- Authorize and encourage cooperative research to undertake such activities as, for example, development of gear that minimizes bycatch, identification of times/areas/gear with unusually high or levels of bycatch, testing of sampling designs, and getting basic information for fisheries for which the extent of bycatch information is not well understood. See Evaluating Bycatch, at 35 (also suggesting cooperative research projects focus on discard mortality and identifying means of minimizing the so-called "observer effect");
- Explain, expand upon, and authorize the use of "importance filters" by Councils as they develop fishery-specific observer plans, in order to insure that resources are focused on the highest priority areas.

These suggestions are not exclusive, but provide some flavor of the type of guidance the Omnibus SBRM Amendment should provide, and most of these elements are already contained in the document. A combination of mandatory elements, such as the observer program, priorities, and general guidance will together provide the necessary structure and guidance for the operation of fishery-specific monitoring programs that do not leave all the discretion with NMFS. As explained above, this is a key element of the court decision in the groundfish and scallop cases. See Oceana II, 384 F. Supp. 2d at 234 n .41 ("[T]he Court is not suggesting that the FMP should mandate the precise areas where observers must be concentrated for years to come; it only requires that the FMP establish some method for determining observer concentration instead of leaving all decisions to the Regional Administrator's discretion.").

5 In developing these fishery-specific programs, existing observer commitments (such as for higher levels of coverage in the Atlantic sea scallop area access and groundfish " B " day programs) will need to be considered as well.

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As noted, our proposal does not represent a major change from the direction that the current SBRM Amendment has taken. The Public Hearing Document contains many useful elements, such as its discussion of the various reporting methodologies, tools (such as logbooks, VMS, electronic monitoring systems, etc.). However, in its ambition, it far exceeds both legal requirements and what is feasible given current constraints, not to mention the national guidance from NMFS. As such, there is a very real danger that, if passed essentially as is, it could be found by courts to set a new standard that is neither feasible nor necessary. ${ }^{7}$

## GENERAL LEGAL ISSUES

Before turning to the specifics of the Public Hearing Document, there are general legal issues to consider. The Executive Summary of the Public Hearing Document explains:

Generally, an SBRM can be viewed as the combination of sampling design, data collection procedures, and analyses used to estimate bycatch in multiple fisheries. The SBRM provides a structured approach for evaluating the effectiveness of the allocation of fisheries observer effort across multiple fisheries to monitor a large number of species. Several specific analyses are conducted to calculate a measure of the variance associated with the data that have been collected by fisheries observers and to determine the most appropriate fisheries observer coverage levels and the optimal allocation of observer effort across the fisheries in order to minimize the variance to the degree practicable. Given the target level of data precision desired by fisheries scientists and managers, fisheries observer coverage levels can be calculated that would be expected to provide data of the desired precision [and accuracy].

Public Hearing Document, at iv.
The appropriate levels of precision and accuracy to be achieved from the SBRM contain a policy component under the Magnuson-Stevens Fishery Conservation and Management Act. The Public Hearing Document explains that the Magnuson-Stevens Act "addresses both the requirement to establish an SBRM for each FMP and the requirement to include conservation measures to minimize bycatch and bycatch mortality to the extent practicable . . . ." Public Hearing Document, at 6 (citing 16 U.S.C. § 1853(a)(11) (requiring these bycatch related measures in each FMP)). Notably, the Public Hearing Document proceeds to explain that it will deal with only the former element, and not address bycatch reduction as a conservation matter. $I d$. However, it does note that the goal is "to minimize the variance to the extent practicable." $I d$. at iv.

7 Parenthetically, the supervening changes in the Magnuson-Stevens Act, signed into law on December 27, 2006, and their applicability to amendments such as this now under consideration, mean that a slightly new course can be charted without any delay beyond that which will necessarily occur as guidance is developed and the SBRM Amendment reviewed for consistency with the newly-amended law.

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Accordingly, the Magnuson-Stevens Act's practicability standard applies to this exercise: In this instance, practicability entails two considerations: (1) the monitoring standards/observer requirements should not unduly burden the public fisc or bankrupt the fishing industry to implement; and (2) there needs to be a discussion of the benefits and costs of various levels of precision and accuracy, not just a purely scientific conclusion that a certain level is required. The court in the Oceana cases essentially made this point, and we are litigating it in another context.

A corollary to the first point, also, is that the SBRM should not be established as a set of aspirational goals that are not expected to be attained on a regular basis, given the expected resource constraints from a budgetary and observer manpower perspective. If the system is either aspirational, or so ambitious that it can only be expected to be aspirational, it will just become fodder for litigation from year to year when the standards are not met, with the threat of a court injunction on the fishery as a remedy for non-compliance.

As to the point regarding practicability, it must be noted that the requirement to establish an SBRM is an adjunct to the duty of the Council to minimize bycatch more generally. Indeed, the SBRM must be designed "to assess the amount and type of bycatch occurring in the fishery," and that bycatch must then be minimized to the extent practicable. 16 U.S.C. § 1853(11). In instances where a particular bycatch species is rarely encountered, and thus has been minimized, it is fully consonant with the legal requirement not to expend significant scarce resources in an attempt to develop extremely precise estimates. That is the essence of the practicability limitation, which applies with as much force to the SBRM as to the bycatch minimization objective itself.

In this regard, the FSF applauds the decision to include "importance filters" as a means of insuring that limited resources are directed to where they will be most effective. The Public Hearing Document, see e.g., id. at 167-71, does an admirable job of providing a reasoned explanation and justification for their use, and does so in legally relevant terms. For instance, it notes that achieving the essentially arbitrary target level of precision for estimates of red crab bycatch would cost more than three times the value of the entire red crab fishery. Id. at 170. Employment of these filters as a means of identifying the truly important bycatch species and fishing modes in which to focus limited observer resources represents a reasoned, practicable policy judgment that meets the requirements of the law.

Finally, it is worth noting that the SBRM well addresses one of the key issues in the court decisions in the Amendments 10 and 13 cases, specifically, the issue of accuracy. The failure in those amendments to address the findings in the Babcock, et al., study with respect to levels of observer coverage necessary to achieve precise and accurate estimates was one of the key omissions identified by the court. This shortcoming, however, has been rectified with the Rago, et al., study referenced in, and included with the amendment.

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## ELEMENTS OF SBRM AMENDMENT

Turning to the elements of the Public Hearing Document, it prescribes four choice points for the councils: (1) bycatch reporting and monitoring mechanisms; (2) analytical techniques and allocation of observers; (3) SBRM standard; and (4) SBRM review process. This memorandum will set forth the Councils' preferred alternative and some initial thoughts below.

The problem, however, is that the uncertainties of agency budgets and observer availability make it very difficult for NMFS to ensure implementation of a mandatory, highly ambitious level of observer coverage. Perhaps the most fundamental flaw in the Public Hearing Document is that it provides for an incredibly, in fact unduly, ambitious set of standards for observed trips, without any discussion or understanding of whether and how that level of observer coverage can be provided or paid for, or whether the agency can even make use of all the data it would collect under such a program (which has been a problem even in very targeted observer programs). See Starr Comments, at 2.

Oceana II makes clear that an SBRM standard may not be based, or back-calculated from, how much observer coverage can be funded. "While the logistics of paying for observers is a fair consideration in establishing a particular bycatch reporting methodology," the agency cannot put "the cart before the horse, predicting sampling frequency, observer distribution, and precision rates based on potentially available funding rather than establishing a methodology." Oceana II, 384 F. Supp.2d at 236.

Monitoring Mechanisms: Regarding element one, monitoring mechanisms: The Public Hearing Document essentially contains two options. The first involves using the sources of information that are currently available: fishery independent surveys, fishing vessel trip reports, dealer purchase reports, at-sea observers, commercial port sampling, recreational fishery sampling (MRFSS), and industry-based surveys. The document then addresses the strengths and limitations of each source of data from the perspective of identifying bycatch:

Observer-gathered discard information is generally considered the most accurate and objective in recording bycatch and discard information. Observer programs often collect detailed biological information on both catch and discards for all aspects of commercial catch . . .

Observer data are preferred over other data sources including FVTR data for a few reasons. Unlike fishermen, who may be performing or managing many fishing related tasks at once . . . observers are focused solely on data collection while deployed at sea. . . .
[However,] [m]anaging an observer program requires dealing with numerous practical and fiscal constraints. Observers must be carefully trained, work under sometimes hazardous conditions, and deal with a variety of circumstances that can arise while at sea on a fishing vessel. Logistical issues, such as having an adequate number of observers available to cover a wide geographic area,

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numerous ports, and a variety of fisheries; and getting the observers aboard vessels within relatively short windows of time before they intend to sail further add to the complexity and costs of observer programs.

Public Hearing Document, at 89. The document identifies only video sampling as an alternative to the current array of monitoring options, and explains that video does not currently provide the same types of detail as on-board observers. Id. at 98-101. The document correctly recognizes the analytical difficulties involved in transitioning to video monitoring and thus sensibly defers use of these systems, pending further development. Id. at 113.

Of course, this is not the end of the story. If the status quo is chosen, NMFS needs, as a practical matter, to get to an affordable and effective observer system, with a stable workforce and budgets. This is lacking right now for most Northeast Region fishing fleets.

Analytical Techniques and Allocation of Observers: In general, we support the preferred alternative, which would apply an "importance filter" to "aid in establishing target observer sea day allocations." Id. at 117. Recommended by the Scientific and Statistical Committee, the importance filter "is specifically designed to 'weed out' particular combinations of fishing gear and bycatch species where the infrequency and variable amounts of discards would result in very high observer sea day coverage levels, in spite of the fact that the actual magnitude and frequency of discards is very low and likely of no consequence to the discarded species." Id. "The importance filter focuses on the encounter rate (the proportion of trips in which the species was encountered and discarded), the relative proportion of discards of that particular species when compared to the discards of other species within the fishing mode, the magnitude of the observed discards, and the proportion of the discards of the species within the fishing mode to the total landings of the species among all fisheries." Id.

The importance filtering mechanisms need to be clarified and perhaps expanded to ensure that they have sufficiently identified the criteria to be used as filters. For instance, while an importance filter includes an encounter rate component, the Amendment should state that observer sea days can be reduced when gear improvements have reduced, if not eliminated, the potential for bycatch, viz. turtle chains ought to preclude intensive scallop fishery turtle monitoring. The Councils should also consider a filter for any mode of fishing whose overall contribution to total landings falls below some threshold or is so rarely used that it can be assumed that the contribution to total discards are likely de minimus. This would help to reduce the administrative complexity of the plan, as well as to preserve limited observer assets for areas of real concern.

SBRM Standard: The question presented in the Public Hearing Document is whether the SBRM Amendment would "specify a target CV as a performance measure or standard against which to judge the adequacy of the bycatch monitoring program described in the amendment." $I d$. at 121. The options are the $a d$ hoc approach that exists now, or application of a uniform $30 \%$ CV , subject to importance filtering. As explained above, we submit these decisions should be made in a more structured way than they currently are, but in FMP-specific contexts.

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The Public Hearing Document explains that the preferred alternative (uniform 30\% CV) would comprise the following:


#### Abstract

In addition to a set of bycatch reporting and monitoring mechanisms used to collect information on discards in a fishery, and a set of analytical techniques and procedures used to estimate discards, allocate at-sea fishery observer effort, and perform stock assessments, the preferred alternative would also establish a performance measure to ensure that the bycatch-related data collected under the SBRM and utilized in stock assessments and management is adequate for those tasks. In order to ensure that the SBRM is performing to the expected level, this preferred alternative would establish a process to periodically review the adequacy of the SBRM, with consideration of how and when changes to the SBRM should be made.


Id. at 121.
We submit that it will be important for the Amendment to establish some standards, to ensure fidelity to the Oceana decisions, but that: (1) there will need to be some flexibility in these standards; and (2) the Amendment should not be light years more ambitious than NMFS guidance in seeking to apply these standards. Our recommendations that seek to address these concerns are set forth above.

In terms of flexibility, such performance measures should represent diagnostic tools, and must not be read or be able to be characterized as immutable standards, such that failure to achieve them in any given year becomes an event for litigation. In this regard, as discussed below in regards to the second point, the ambitions of the SBRM as proposed in the Public Hearing Document may far exceed the ability of the agency to meet on a sustained basis, making it very important that the Councils utilize the importance filters, make clear that the CVs are aspirational, and state that program overall is sufficient to precisely characterize and assess bycatch across fisheries (as opposed to any particular mode).

Such flexibility is consistent with the decisions in the Oceana cases. The primary deficiency of Amendments 10 and 13 was the Council's failure to develop an reporting methodology coupled with what the judge saw as a grant of unfettered discretion to the Regional Administrator to determine when, where, and how much observer coverage to deploy. " $[\mathrm{A}] \mathrm{n}$ FMP that merely suggests a hoped-for result, as opposed to 'establishing' a particular standardized methodology, does not measure up to the statute's requirements." Oceana v. Evans ("Oceana P"), 2005 U.S. Dist. LEXIS 3959, at *136 (D.D.C., March 9, 2005) (citation omitted). "Instead of analyzing what type of program - whether a mandated level of coverage or some other mechanism - would succeed in producing the statistically reliable estimates of bycatch needed to better manage the fishery, the FMP essentially assigns this task to the Regional Administrator." Oceana II, 384 F. Supp. 2d at 233-34 (emphasis added).

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In the current instance, the methodology specified more than meets, and even exceeds, the requirements laid out by the court. ${ }^{8}$ In fact, the proposed amendment is far more comprehensive than what has been laid out in FMPs for other fisheries, such as the Pacific Groundfish and the Pacific Highly Migratory Species fisheries, the latter of which was cited by the environmental plaintiffs as a model and the former which was promulgated in response to a similarly successful SBRM challenge.

What the Oceana cases did not do, however, was to mandate any particular approach or set of performance requirements in order to meet the SBRM requirement. For instance, the judge explicitly noted that "Oceana $I$ did not require that an FMP mandate a specific level of observer coverage. Rather, the Court held that an FMP may not delegate the development of a standardized bycatch reporting methodology to the Regional Administrator." Oceana II at 384 F. Supp. 2d at 234 n. 38 . The court also noted that it "is not suggesting that the FMP should mandate the precise areas where observers must be concentrated for years to come; it only requires that the FMP establish some method for determining observer concentration instead of leaving all decisions to the Regional Administrator's discretion." Id. n.41. What the court did require, and this amendment actually overachieves relative to NMFS's guidelines, as noted below, is that mechanisms be developed that "would succeed in producing the statistically reliable estimates of bycatch needed to better manage the fishery." Id. In these terms, the task is to best utilize the government's resources to gain a precise estimate of the amount and composition of bycatch in the managed fisheries rather than designing a theoretically ideal system.

Even in instances where the importance filtering still requires some coverage, there may be a need for reduced levels of coverage designed to identify whether there is any bycatch issue when the data is too sparse to determine what level of observer coverage would be needed to achieve a pre-determined level of precision/accuracy. This may also need some statistical support as a basis for application either of an importance filter or some tolerance for a reduced level of precision/accuracy. These considerations are best addressed in context, as both Evaluating Bycatch and Mr. Starr explain. See Evaluating Bycatch, at 58-59; Starr Comments, at 1-2.

What would appear to be required, however, is a mandate that the agency create an observer program to implement the SBRM. See, e.g., Oceana II, at 135 ("'Because the observer program is optional under Amendment 13, NMFS in theory could decide not to implement an observer program for the ground fishery, and nothing in Amendment 13 would prohibit the agency from making that decision.'") (quoting Pac. Marine Conservation Council, Inc., 200 F. Supp. 2d at 1200). This is not the same as setting minimum levels of observer coverage, which,
$8 \quad$ See id. ("A methodology need not necessarily be detailed, but it must at the very least provide decision makers and the public with a program of what actually will be done to improve bycatch reporting, and why these measures will be sufficient based on the best available science.") (citation omitted)).

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it should be stressed, is not required under the law. ${ }^{9}$ Rather, it is a matter of including language similar to that in Pacific Groundfish Plan: "The Regional Administrator will implement an observer program through a Council-approved Federal regulatory framework." PFMC, Pacific Coast Groundfish FMP, at 71 (Sept. 2006). Such is necessary to avoid the same deficiency the court found in the Oceana cases.

The second, and significant, issue is that the Public Hearing Document goes far beyond NMFS guidance by recommending to apply this level of statistical precision to fishery modes, as opposed to the fishery for a species as a whole. It would also apply such a level of precision to each bycatch species rather than to bycatch in a fishery as a whole:

In total, the proposed SBRM would separately track and report the precision associated with the discard estimates of 36 individual fishery resources or species groups and 23 individual protected species or species groups across 39 separate fishing gear modes. In sum, this means that rather than trying to achieve a precision of 20-30 percent for a single estimate of total discards in each of the 16 major fisheries ( 16 separate estimates), under the proposed SBRM, the Councils and NOAA Fisheries Service will strive to achieve a precision of no more than 30 percent in up to 2,301 unique fishing gear mode and species combinations [less certain importance-filtered combinations].

Id. at 123. The Oceana decisions do not require this level of detail, as the quotes from the decisions above indicate.

Significantly, the Public Hearing Document's disaggregated approach countervails nationwide NMFS guidance. The SBRM Amendment explains:

Although the proposed 30-percent CV target is based on the recommendation [for CVs of $20-30 \%$ for SBRM programs] in NMFS (2004), the proposed application

9 While the court found fault with the fact that Amendments 10 and 13 did not set a mandatory level of observer coverage, those decisions were made in the context of two plans that contained "recommended" levels of observer coverage that could be changed or not implemented at all at the agency's sole discretion. See, e.g., Oceana I at 133 ("[T]he Secretary stated that he merely 'intends' to maintain a $5 \%$ coverage level. While he did state that a $5 \%$ level 'will resume in FY 05 and beyond,' in the context of the Secretary's overall response to criticisms of Amendment 13's bycatch reporting, it is clear that this figure is not mandatory and may be subject to change if the Secretary deems it proper.") (citations omitted). In other words, minimum levels of observer coverage were the primary means for collecting bycatch information under those two plans, and as such, the Court found that they must be mandatory and shown to be sufficient to collect precise and accurate data. By contrast, Councils could select a different mechanism, to wit, a methodology focused on gear types, sectors, and fisheries.

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of this standard differs in several important ways. First, the precision goal is recommended to apply to a "fishery," but in the proposed SBRM, the target CV would apply at the level of the fishing mode. [The Amendment then explains that this would require the six separate modes of the monkfish fishery to be examined separately.]

Another way in which the proposed application of the SBRM differs from the NMFS (2004) guidance is that while the guidance document indicates that the precision goal of 20-30 percent should apply to total discards "aggregated over all species [emphasis added], this proposed alternative proposes disaggregating all species to the level of individual species or groups of related species. Continuing the example of the monkfish fishery, among the gear types that catch monkfish, there are more than 29 other species caught in those gears (along with many other non-FMP species). The guidance in NMFS (2004), therefore, recommends that the precision of the estimate of total discards of all $30+$ species across all applicable fishing gears would be sufficient if the single estimate had a CV between 20 and 30 percent. The SBRM proposed under the preferred alternative would separately track the precision of the discard estimates for each individual species, except for a few limited cases where a species complex is more appropriate, managed under a Northeast Region FMP.

Id. at 122.
This is not an academic exercise. In practical effect, adopting the preferred alternative might require, based on estimates provided at the SSC, about 58,000 observer sea-days across the Northeast Region, compared to the 8,000 or so deployed, for example, in 2004. As explained above, the Oceana decisions suggest that if the Amendment appears to set certain standards for observer coverage, Councils will likely be held to those standards. It is, furthermore, unlikely that even with such coverage levels this standard could be attained for many of the various modes.

In this regard, Mr. Starr explains:
It is very unlikely that a single CV "performance standard" can be applied successfully to such a broad and diverse range of fisheries. While the application of such a standard may improve the existing situation, given that relatively little monitoring presently exists, I believe that it will also result in a large number of data collection programmes which will be poorly designed, badly applied and subsequently not properly analysed. Thus I believe that the overall goal of better monitoring and management of these fisheries will not be achieved, particularly in the short term.

Starr Comments, at 1. It is also Mr. Starr's conclusion, which coincides with the advice in the NMFS nationwide technical document, that " $[t]$ here is no substitute for dealing with each fishery

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unit (or grouping) individually and tailoring the monitoring to fit the situation." Starr Comments, at 1.

The divergence from NMFS guidance that would seek to prescribe a uniform level of precision of estimates for each bycatch species appears to present the biggest obstacle in practical implementation. ${ }^{10}$ Tellingly, Mr. Starr further explains that, in his experience, calculation of CVs for each cell is a detailed, individualized process. Starr Comments, at 2-4. It is hard to conceive how NMFS could administer this program, with the resource constraints it faces and its essential inflexibility as an institution. There is a reasonable concern that litigation could ensue again if NMFS were not able to achieve the stated degree of precision (plus accuracy) in each of these 2,000 or so individual situations, even if this approach is not consistent with NMFS guidance.

Figuring out how to address this issue will be very important for the fishing fleets in the Northeast Region. It may be that observer and management decisions could be based on an aggregated estimate, consistent with the NMFS nationwide guidance, and that the species by species information could be assembled as a diagnostic and evaluative tool. In either event, importance filtering will have an important role.

## CONCLUSION

The suggestions offered represent a workable and legally sufficient approach, that better meshes with available resources. It will also provide the Councils with the fishery-specific bycatch information they need in order to meet the conservation and management of the Magnuson-Stevens Act, especially as amended. This is an important issue, albeit one which is comparatively complicated. It bears taking the time necessary to produce a workable and realistio methodology.


David E. Frulla
Shaun M. Gehan
Counsel for Fisheries Survival Fund

10 There may be good reason, to seek to ensure consistent levels of coverage among fishing sectors, but there needs to be flexibility in terms of the levels of precision that are sought. See Evaluating Bycatch, at 59 ("Flexibility is needed when setting CV targets for specific fisheries and bycatch species.").

ATTACHMENT 1

# Paul Starr, Fisheries Stock Assessment Scientlst 61A Rhine Street, Island Bay, Wellington, New Zealand 

Patricia A. Kurkul<br>Regional Administrator<br>National Marine Fisherics Service<br>Onc Blackburn Drive<br>Gloucester, MA 01930

## RE: Submission on SBRM Amendment

Dear Ms. Kurkul:

## Introduction and qualifications

I have been asked by the Fisheries Survival Fund (FSF) to prepare an independent submission as an outside expert familiar with many of the issues being debated over the adoption of the Standardised Bycatch Reporting Mcthodology (SBRM) Amendment. I have had considerable expericice over the thirty years that I have becn a fisheries scientist in designing, implementing and analysing data gencrated from various programmes intended to measure quantities of intercst in a fishery. These programmes range from obscrver programmes such as those being discussed in relation to the SBRM to logbook programmes which are designed to be complcted by the fisherman.

I am not completely familiar with the details of how fisheries are managed on the eastem scaboard of the United States nor am I fully cogaisant of all the sensitivities which exist between the various sectors and stakeholders who participate in these fisheries. However, I feel that I am able to make some general comments on the nature of the "preferred alternatives" identified in the SBRM Public Hearing Document because such programmes tend to have strong similarities regardless of where they are implemented. I havc experienced this universality myself, having worked extensively in westem Canada as a salmon and groundfish scientist and also having worked in the New Zealand groundfish and shellfish fisheries.

## Summary

The following is a summary of the main points of this submission:

- It is very unlikely that a single CV "performance standard" can be applied successfully to such a broad and diverse range of fisheries. While the application of such a standard may improve the existing situation, given that relatively little monitoring presently exists, I believe that it will also xesult in a large number of data collection programmes which will be poorly designed, badly applied and subsequently not properly analysed. Thus I believe that the overall goal of better monitoring and management of these fisherics will not be achieved, particularly in the short term.
- There is no substitute for dealing with cach fishery unit (or grouping) individually and tailoring the monitoring to fit the situation. Thereforc, a more productive approach

would be to cstablish a process through which all stakeholders can participate in the establishment of the monitoring programme, including agreement on the overall management goals.
- Finally, my experience has shown that successfiul fishery monitoring programmes need the co-operation of the stakeholders being monitored. It is casy to mandate compuisory programmes, but they tend to be less successful (and more costly) than programmes that have been developed co-opcratively.


## General comments

The most relevant comment that I feel I can make is that collecting information from any fishery without clear objectives which arc tightly integrated into the management of that fishery is not a sensible course of action. This seems to me to be the most fundamental flaw in the SBRM Public Hearing Document where the "preferred alternative" is to specify a single region-wide performance standard, specifically the " $30 \% \mathrm{CV}$ " for mean catch estimates, without reference to the management objectives the coefficient of variation (CV) standard is to serve, including conservation issues applying to these fisheries. That is because specifying a CV without knowing how the data will be used in the management or the science is like putting the "cart before the horse". The precision required for an estimate should always be tied to the purpose to which the estimate is put. To do othcrwise is poor science and not good management practise.
I recognise that there is a lack of information to manage some aspects of these fisheries and the SBRM is an attempt to rectify important missing components needed for management. However, simply specifying a minimum level of observer coverage and/or specifying a target perfomance standard is probably not the best way to go about establishing the collection of data that can be used to manage these fisheries. My understanding is that the SBRM will apply to about 1,500 strata (where a stratum would be a species, fishery, time period cell) for which data would be collected. It is almost inconceivable that any agency would have the resources to go through a process of designing, implementing and finally analysing the data for such a large number of strata. Even 100 such strata would tax the capacity of any agency with which I am familiar. It is important to note that an observer on a vessel collecting information over a number of species will not achieve the $30 \%$ CV performance standard for each species collected. Instead, the $30 \%$ CV performance standard will require a separate sampling protocol for every species bccause each species is captured at different rates, even on the same vessel.
A frequent lapse in many observer progranmes is the failure to adequately analyse the resulting data. Captain Ron Smolowitz, an independent gear technologist and consultant to the $\operatorname{FSF}$, described to me the existence of obscrver bycatch information for a scallop dredge fishery in the Gcorges Bank Scallop Access Areas which takes yellowlail flounder as a bycatch. High levels of observer covcrage are used to manage this fishery and there exist at Icast four years of good quality data. However, I undcrstand that these data have not yet been analysed to see whether they have achieved a target CV performance slandard nor has the design of this observer programme becn adjusted based on the data collected. Given that resource constraints apply to all natural resource management regimes with which I am familiar, this example shows how difficult it is to achieve an adequate level of design, implementation and analysis for a single programme, let alone 1,500 cells.
Therefore, I believe that mandating a fixed CV performance standard on 1,500 strata and expecting that this will supply useful infomation that can bc used in managing these fisheries is a recipe for failure. It is inconceivable to me that there would be sufficient resources, either in terms of personnel or of money, that could successfully undertake the design of such a large programme, let alone implement and evaluatc thc outcome of each and every stratum. The SBRM, as I think it will progress over time, will most likely result in a pattern of putting
obscrvers on vessels without a great deal of thought collecting a large amount of data, some of which may be rclatively useless and then allowing the data to moulder in a computer without bcing properly analysed.

## An alternative approach

My experience has shown that this problem should be approached differently to achieve success. For instance, in New Zealand, the Ministry of Fishcrics uses "Working Groups" (which are organised around specific fisheries or species groupings) to help it to perforn the following tasks: a) sctting priorities for which fisheries are to be monitored (usually on the basis of perceived problems), b) arranging for the scicntific design of an observer programme to address the problems, c) critiquing and evaluating the design before implementation, d) overseeing the implementation of the design and e) arranging for an evaluation of the final product.
In New Zealand, Working Groups arc comprised of knowledgeable and interested people who represent all components of fishery "stakeholders": government and industry scientists, managers, representatives from NGOs, recreational fishery groups and aboriginal groups. The Working Groups tend to work on a consensus basis, primarily putting forward material on which there is agreement. Occasionally there is dissension and a minority report will also be filed. But there is usually strong agreement on issues which involve fishery observer coverage because these issues tend to be straightforward and usually do not cause much difference in opinion.
It appears to me that what is missing in the SBRM Public Hearing Document is the establishment of a process - the development of fishery-specific methodologies - that will achieve the collection of uscful information which can be used to manage bycatch in thesc fisheries without specifically mandating a fixed $30 \%$ CV for large number of separate strata. Such a process needs to be measured, thoughtful and directed towards where it will do the most good and will address the problems which require immediate attention. Resources are always limiting in natural resource management situations and they need to focussed on those problems which are perceived to be the cmost acute. This can be best done (in my cxpericnce) in a group setting where consensus can be reached. A motivated and well run Working Group will achieve a much better result than single individuals working in isolation, regardlcss of which agency or interest group they represent.

## Additional issues concerning the design of observer programmes

I have a few additional points to add to this submission, which are technical but which have implications for the SBRM decision:

1. Observer coverage CVs often are calculated as if every tow is independent. This is not true because observer coverage takes place in the context of a fishing trip, a series of tows conducted by the same skipper. Experience has shown that sequential tows by the same skipper are correlated, which means they are not statistically independent. This means that more tows need to be observed to achieve the statistical performance standard of a $30 \% \mathrm{CV}$ than would be required if all tows could be randomly selected. While this issuc is not strictly relevant to the specification of the $30 \% \mathrm{CV}$ performance standard, it is frequently overlooked and means that achieving the mandated performance standard is often much more difficult than envisioned.
2. There are also auxiliary issues associated with observer coverage. One of these is the "observer effect". That is, vessels perform differently when an observer is present. This effect is obviously most important when observer coverage is low, because there will be the greatest leverage. However, this effect may affect the calculation of the CVs and should be considered in the design of the programme.
3. Another issue is how to handle downtime while the observer is on board. NGO commentary often suggests that commercial vessels use this opportunity to subvert the coverage afforded by an independent observer, although this effect may be less pronounced in fishery systems that are managed by a trip limit or by the number of days fished. More importantly, observer downtime will affect the estimate of the CV and should be included in the estimation of this quantity. Again, this is frequently an aspect of observer coverage which tends to be overlooked with the more usual response being to assume that every tow on a vessel with an observer is actually observed.
4. The method of calculating the CV will also be, to some extent, fishery (or stratum) dependent. For instance, fisheries that consist mainly of day trips will have different issues for calculating the CV compared to fishexies that go out for a week or more. This dichotomy shows the weakness of relying on a universal standard to ensure adequate coverage for all fishery strata and indicates that specifying a single target CV performance standard will not address all the relevant issues.
I bring up these points not because they are directly relevant to the decision of whether to implement the SBRM, but because they affect the design of the programme which is needed to achieve the mandated $30 \% \mathrm{CV}$ and illustrate why specifying a single CV target is not adequate in itself. The calculation of the CV itself will be incorect unless all factors which affect the CV are incorporated, and these will vary across fisheries or even within the same fishery, as they will differ by spccics. With thesc factors contributing complications in calculating the CV estimates, there is a danger that the focus of the SBRM programme will move to determining whether the performance standard was achieved, rather than ascertaining whether the data needed to manage the fishery were obtained.

## Conclusion

My instinctive reaction to the SRBM proposal is that a single performance standard that applies to a range of objectives across a large number of fisheries is doomed to failure. Fisheries don't fit the "one size fits all" model. It is not sensible to expect that a single overarching performance standard, such as specifying a $30 \% \mathrm{CV}$, will automatically result in satisfactory outcomes across a number of differing situations. Fisheries are complex and managing them requires careful consideration of the components of cach situation individually. To do otherwise is a recipe for failure.

One final point: my experience has shown that observer programmes are much more successful when the participants support the project. Observers always are "extra" in that they interfere with the smooth operation of the vessel and potentially may affect the livelihoods of everyonc on board. Therefore, it makes a lot of sense to design the programme in such a way that the co-operation of those most affected is secured. Mandating unrealistic solutions that are probably not achievable is not the best way to proceed. Instead, if a process where fishermen are allowed to have a real and significant input at the design level of the programme is developed, then the overall goals of the programme are much more likely to be achieved.


ATTACHMENT 2

## CURRICULUM VITAE

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## Academic Qualifications:

1973 Master of Science
University of British Columbia
Thesis title: Population dynamics and colonisation of Sida crystallina in Marion Lake, British Columbia.

1968 Bachelor of Science
Yale University
Thesis topic: Distribution of aquatic invertebrate fauna in cave ecosystems

## Professional Positions Held:

2000 - present Consulting Fisheries Stock Assessment Scientist Major clients:

Canadian Groundfish Research and Conservation Society
New Zealand Rock Lobster Industry Council
New Zealand Seafood Industry Council

| $1997-2000$ | Chief Scientist |
| :--- | :--- |
|  | NZ Seafood Industry Council |

1991-1997 Fisheries Stock Assessment Scientist NZ Seafood Industry Council (previously New Zealand Fishing Industry Board)

1982-1991 Senior Stock Assessment Biologist (chinook salmon) Canadian Department of Fisheries and Oceans (DFO) Biological Sciences Branch

Program Planner
Canadian Department of Fisheries and Oceans Program Planning Branch

1980-1981 Management Biologist, Canadian Department of Fisheries and Oceans Fraser River Division
Fisheries Branch
1976-1980 Biological Technician
Canadian Department of Fisheries and Oceans
Fraser River Division
Fisheries Branch
1975-1976 Fisheries Biologist
Province of British Columbia
Fish and Wildlife Branch
1973-1975: Research Assistant
University of British Columbia
Institute of Animal Resource Ecology

## Present Research/Professional Speciality:

- Experience in stock assessment of a variety of marine species, including deepwater demersal species (orange roughy, oreo, hoki and other species), inshore demersal species (snapper), shellfish (including lobster) and salmon (chinook, coho, sockeye, chum and pink).
- Experience in designing marine fisheries research programmes, including biomass tagging surveys, sampling of commercial and recreational catches, and research trawl surveys.
- Specialisation includes designing self-monitoring programmes for the collection of scientifically useable information in commercial potting, long line and trawl fisheries.
- Experience in the presentation and interpretation of fisheries data for the purposes of fishery management, including extensive participation in peer review working groups in Canada, New Zealand and the United States.
- Experience in providing advice to the fishing industry, to government policy makers, and to government negotiators in international fishing treaties.
- Experience in the New Zealand ITQ system, particularly in its implementation of research planning for fisheries assessment research, the evaluation of the research output and its integration into eventual management decisions.
- Specialisation in the interpretation and presentation of scientific information to all parts of the NZ Fishing Industry to allow informed decision making on scientific issues.
- Supervision and training of graduate students in a practical fisheries assessment and management environment.


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## Processors:

Lund's Fisheries
Atlantic Capes Fisheries Cape May, NJ
NORPEL
New Bedford, MA
P/V Frost Fall River, MA Cape Seafoods, Inc. Gloucester, MA Atlantic Pelagic Seafoods, LLC Portland, ME

## Vessels:

Cape May, NJ:
F/V Enterprise F/V Gulf Stream F/V Flicka F/V Dyrsten F/V Retriever F/V White Dove

Newport, RI F/V Seabreeze

New Bedford, MA F/V Atlantic F/V Moragh K F/V Mary K F/V Nordic Explorer F/V Dona Martita F/V Eastern Hunter F/V Western Hunter F/V Crystal Sea F/V Luke and Sarah

Gloucester, MA F/V Osprey
F/V Western Venture F/V Endeavor F/V Challenger F/V Voyager

Portland, ME
F/V Harmony

## Associations:

American Pelagic Association

Garden State Seafood Association

NW Atlantic Small Pelagic Resource Oversight Group
4 Fish Island
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Jeff Reichle/Lund’s Fisheries, Cape May, NJ (609) 8847600

December 29, 2006

## VIA ELECTRONIC MAIL

Patricia A. Kurkul
Regional Administrator
National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA 01930

## RE: FISHERIES SURVIVAL FUND COMMENTS ON SBRM AMENDMENT

On behalf of the companies and vessels listed in our masthead, we are writing in support of the comments submitted to you today by Kelley Drye Collier Shannon (Shaun Gehan and David Frulla, on behalf of Fisheries Survival Fund) relative to the Standardized Bycatch Reporting Methodology Omnibus Amendment.

Their comments and suggestions reflect our needs, and will make the Omnibus Amendment workable for the Agency, the Councils and the affected industry.

As an industry, we advocate for sound fishery science and management. We believe the Omnibus Amendment, as currently written, could be very detrimental to your Agency's ability to manage the fisheries properly given the likelihood for litigation if and when the Agency is unable to fulfill the specific requirements of the Amendment as currently proposed.

Thank you,
/s/
Brady Schofield and Jeff Reichle

## Conservation Law Foundation

December 29, 2006
Patricia A. Kurkul
Regional Administrator
National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA 01930

Via electronic mail to: SBRMcomment@noaa.gov

Re: Comments on SBRM Amendment

Dear Ms. Kurkul,

The Conservation Law Foundation (CLF) submits the following comments on the omnibus Standardized Bycatch Reporting Methodology Amendment (Omnibus SBRM). We again acknowledge and thank the New England Fishery Management Council (NEFMC) and the National Marine Fishery Service (NMFS) for responding to our request in the fall of 2005 to decouple the draft SBRM, advanced by NMFS at that time from Groundfish Framework 42. The draft Omnibus SBRM amendment that will apply to all fisheries in New England is clearly a superior effort that has benefited from additional work. Developing and implementing a comprehensive SBRM based on the best available science is an important step toward achieving full compliance with the Magnuson-Stevens Act's bycatch requirements and addressing one of the most serious conservation and management issues facing fisheries management in New England.

While the proposed Omnibus SBRM demonstrates considerable effort by NMFS to develop a draft SBRM that would be a significant improvement over the existing patchwork of bycatch reporting measures, it simply continues to fail to meet the legal requirements of the Magnuson-Stevens Act (MSA), the National Environmental Policy Act (NEPA), and relevant court orders. CLF urged that these shortcomings be addressed throughout development of the Omnibus SBRM, thus it is unfortunate that at this time we must urge you to again withdraw the draft Omnibus SBRM in order to develop and analyze an appropriate range of alternatives addressing the legal shortcoming discussed below through a full Environmental Impact Statement (EIS). While we continue to seek expeditious implementation of SBRMs throughout New England’s fisheries, the fact is that this SBRM will establish precedent for future SBRM's across the nation. Thus, while we are disappointed that more time will be required to complete the amendment, it is more important that it be done right and that further litigation on this matter is avoided if at all possible.

## I. Bycatch Information is Critically Important to Effective Fisheries Management

The Northwest Atlantic ecosystem, the fish populations it supports, and fishing communities throughout New England continue to suffer due to depleted fish populations resulting from the failure of the existing groundfish management system to achieve its conservation and rebuilding goals. A

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## Conservation Law Foundation

significant contributing factor to the poor condition of N.E. stocks is the failure of New England fisheries managers to adequately implement measure to avoid and minimize bycatch.

As clearly set out in the Magnuson-Stevens Act, development of a SBRM to assess the amount and types of bycatch occurring in fisheries is a critical aspect of the Council's responsibility when writing fishery management plans, and it is the first step to fulfilling the Act's mandates to minimize bycatch and bycatch mortality. Without an accurate and precise assessment of bycatch, the Council and NMFS are simply hamstrung in their ability to develop management measures to account for the ecological and economic waste that is occurring in our fisheries. Without appropriate bycatch assessment and reporting, effective management is impossible.

## II. The Omnibus SBRM Fails to Meet the Requirements of the Court Order Regarding the Development of a Standardized Bycatch Reporting Methodology

As you are aware, the Conservation Law Foundation brought two separate federal court cases resulting in decisions holding that the bycatch measures developed by the Council and NMFS for inclusion in the Groundfish FMP failed to meet the legal requirements of the Magnuson-Stevens Act (MSA). ${ }^{1}$ While the proposed Omnibus SBRM Amendment is greatly improved over initial efforts, it is still inadequate and fails to meet the applicable legal requirements as set forth in the March 9, 2005 Order by the United States District Court for the District of Columbia. Specifically, the Federal Court ordered NMFS and the NEFMC to evaluate its bycatch reporting and assessment program, establish a standardized reporting methodology, specify observer coverage levels in their fishery management plans, and address other demonstrated shortcomings in their observer program. ${ }^{2}$ In reaching this conclusion, the Court emphasized the following points:

1. NMFS violated the MSA when it failed to require any observers in the New England groundfish fishery. ${ }^{3}$
2. NMFS violated the MSA and ignored the best available science when it failed to take account of the report on bycatch and observers submitted by Oceana to NMFS as part of the Amendment 13 administrative record. ${ }^{4}$
3. NMFS violated the MSA when it failed to assess the bycatch problem by sector, gear type, and species. ${ }^{5}$
4. NMFS violated the MSA when it relied upon discredited methodologies for monitoring and reductions in bycatch in the New England groundfish fishery. ${ }^{6}$
[^57]Upon entering these findings, the Court remanded the bycatch portion of Amendment 13 to NMFS with instructions to comply with the MSA. ${ }^{7}$

Given that NMFS has already delayed its compliance with the bycatch requirements of the MSA by over ten years, and now for more than five years following the ruling by Judge Kessler in December of 2001, we again request prompt compliance with the MSA and the March 9, 2005 Order. In order to do so, the following changes to the draft SBRM must be made.

## 1. Specify levels of Observer Coverage in the FMPs

The Court found that the groundfish FMP failed to specify a level of observer coverage in the fishery. Further, the Court rejected the argument by NFMS that is had met its SBRM obligations by stating an intention to achieve a certain level of observer coverage while retaining complete discretion for setting the actual level of observer coverage. ${ }^{8}$ The draft Omnibus SBRM appears to take the same approach rejected by the Court by establishing mere performance targets in the SBRM while leaving the actual level of observer coverage entirely up to NMFS's discretion.

Further, insofar as the SBRM appears to undertake an allocation analysis for observer coverage based upon a certain level of days fished, it is not clear whether there is a mechanism in place to update the allocation analysis annually (or more often) in order to address changes in the fishery. The draft also indicates that the actual allocation of observers would be reduced based on funding, but there is no way to determine how this will occur and no standards are set for minimum levels of coverage. The Omnibus SBRM must set the stage for the Council and NMFS to specify the levels of observer coverage in all fisheries by gear type, sector, and/or other appropriate criteria.
2. Adequately Assess the Bycatch Problem by Fishery, Gear Type, and Species.

In reaching its conclusion that the SBRM needed to address bycatch by sector, gear type, and species, the Court considered the bycatch plan utilized in the Pacific Highly Migratory Fisheries (FMP) as a reference point for what a legally compliant SBRM in New England would look like. ${ }^{9}$ As is evident by the Court's decision and a review of the Pacific FMP, to be useful in improving fisheries management the SBRM must specifically contemplate the changing dynamics of each fishery by gear type and species, and be integrated into each FMP. The draft Omnibus SBRM does not do this in a meaningful way, and therefore it is likely to fall well short of anticipating and adapting to future fishery conditions and management needs. As a starting point for addressing these shortfalls and making the SBRM a truly useful document, it should include a discussion of each fishery, gear type, and associated species interactions along with the fisheries management scheme. It should then consider and seek to anticipate the potential bycatch data needs in order to make appropriate recommendations for levels of observer coverage and other means for collecting bycatch data.

Further, the MSA's bycatch provisions contemplate that a broader range of species will be addressed than is covered by the Omnibus SBRM. Species not commercially targeted under fisheries managed by the New England or Mid-Atlantic Councils should be included. These

[^58]species should include those managed by the Atlantic States Marine Fisheries Commission, Highly Migratory Species, protected species (e.g., sea turtles), and species known to be at risk (e.g., wolfish, cusk, corals). Absent these species, the SBRM is incomplete and will fail to meet the MSA's intended goals.

## 3. Best Available Science Must be Applied in Establishing the SBRM

## Performance standard

To be effective, the Omnibus SBRM must set a mandatory performance standard; it cannot be a mere target standard. The standard must clearly indicate how it is to be applied, and it needs to be set for each fishery, gear type and/or sector, and species.

## Reporting

There should be, at a minimum, an annual report on bycatch for each fishery broken down by gear type, sector (as appropriate), area fished, species and other means as determined by the Council. All reports must be public.

## Filters

The Omnibus SBRM proposes to reduce the initial observer allocations by applying a series of "importance filters." These filters would remove fishery mode/species combinations from the list of observer needs based on different criteria including the current database of fishery mode/species interactions. This approach is fundamentally flawed because it uses the existing poor observer data as the foundation for the calculation of the allocation. A better approach would be to establish a baseline level of observer coverage for a period of years and to then use this observer data to establish the appropriate use of future of statistical filters. Further, until there is a robust data set providing a high degree of confidence in the use of filers, no protected species or species at risk should be eliminated as a result of data shoing a low frequency of interaction because, by definition, a low frequency is likely in many instances due to the low abundance of protected species.

CLF is also concerned that filter 3 could result in the inappropriate removal of a fishery mode/species because the species could show up as a low volume in a very high volume fishery, yet the environmental impact could be significant. Recent evidence of bycatch of haddock in the herring mid-water trawl fishery is one example though, because of the severely depleted status of cod, a cod/herring trawl interaction could be even more serious. Filter 3 should be eliminated from the SBRM. Filter 4 is also of concern because it fails to establish a threshold value, a matter that should be analyzed through an appropriate EIS alternatives analysis.

## III. Failure to Complete an Environmental Impact Statement or Meet Other Fundamental National Environmental Policy Act Requirements

## 1. The SBRM Will Have Significant Environmental Impacts Triggering the Need for an EIS

Contributing significantly to the shortfalls in the Omnibus SBRM is the failure to develop the Amendment through an EIS. Lack of an EIS limited the opportunities for public participation and stymied New England and Mid-Atlantic Council involvement, which in turn has significantly limited the range of alternatives considered and the substantive analysis of the issues.

As noted above, the first step to fulfilling the Act's mandates to minimize bycatch and bycatch mortality is the SBRM; if the SBRM fails to include an accurate and precise assessment of bycatch it is

## Conservation Law Foundation

impossible for the Council and NMFS to develop the management measures necessary to reduce the ecological and economic waste that is occurring in our fisheries. The decisions made as a result of the SBRM analysis will affect fisheries and other ocean life throughout the New England and Mid-Atlantic regions and will help form the basis for nearly all fundamental fisheries management tools including stock assessments and management measures to control fishing mortality and bycatch, itself. A poorly designed SBRM could result in significant environmental harm as bycatch issues are missed or their seriousness is not accurately assessed resulting in the severe depletion of a species.

It is difficult to imagine an action to be taken by NMFS with a greater potential to significantly affect the quality of the human environment, thus the agency must take a hard look at the environmental impacts of the Omnibus SBRM in a full EIS.

## 2. The SBRM Fails to Consider a Range of Alternatives

Fundamentally, the draft Omnibus SBRM only contains two alternatives for each decision point, one of which is the status quo, and fails to consider other reasonable alternatives. In some cases the identified alternative is so overly simplistic the result is in effect to have no alternative at all (e.g., whether to specify an SBRM review process). Development of a SBRM, like other major federal actions, requires consideration of an appropriate range of alternatives to comply with NEPA and the MSA. Additional alternatives should have been considered in many areas of the Omnibus SBRM, including for importance filters, bycatch reporting and monitoring mechanisms, performance standards, and bycatch review and reporting. The failure to consider a reasonable range of alternatives here at least partly stems from the decision early on not to undertake an EIS, thereby limiting public participation and the opportunity to develop additional alternatives.

## IV. NMFS Should Specify Observer Coverage via Emergency Rule

Because the fishery management plans for New England continue to unlawfully fail to require any level of observer coverage, NMFS must take action immediately by emergency rule to establish an adequate level of coverage during the period of time it takes to develop a legally compliant SBRM through an EIS. The observer coverage established through emergency rule must be based on the best available science. In instances where draft SBRM or other information does not represent the best available science for setting the level observer coverage necessary to assure accurate and precise estimates of bycatch for a given gear type or sector, NMFS should establish observers on at least 20 percent of all days fished (trips) consistent with the Oceana report on bycatch discussed in the March 9, 2005 federal court ruling (e.g., 20 percent). ${ }^{10}$

Thank you for considering these comments. The Conservation Law Foundation looks forward to working with NMFS, the NEFMC and other interested parties to address the concerns raised in these comments. Should you have questions regarding these comments or wish to discuss any of the issues further, please contact me at rfleming@clf.org or by telephone at 207.729.7733.

> Sincerely yours, $\frac{/ \mathrm{S} /}{\text { Roger Fleming }}$ Senior Attorney

[^59]cc: New England Fishery Management Council
Paul J. Howard
Executive Director
New England Fishery Management Council
William Hogarth
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50 Water Street, Mill \#2
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Richard Robins
Chairman
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800 North State Street, Suite 201
Dover, DE 19901

Submitted via email to: nmfs.ner.draftSBRM@noaa.gov.

## Re: Comments on Draft Standardized Bycatch Reporting Methodology Omnibus Amendment

## Dear Chairman Stockwell and Chairman Robins:

Oceana thanks you for the opportunity to submit these comments on the Northeast Region Omnibus Standardized Bycatch Reporting Amendment Draft document. ${ }^{1}$

For more than a decade Oceana has advocated and litigated to improve the quality of information available to support Northeast Region fisheries management under the guidance of the New England and the Mid-Atlantic Fishery Management Councils. Modern fisheries management is becoming more data-dependent every year, so access to high-quality, accurate, and precise catch data is essential. As the SBRM document itself explains, "( t )he primary purpose of bycatch reporting and monitoring is to collect information that can be used reliably as the basis for making sound fisheries management decisions." ${ }^{2}$

Oceana's longstanding goal for the SBRM is to establish a program across the Northeast region that collects accurate and precise information about bycatch in all fisheries and then timely reports this information in a useful form to Councils, fisheries scientists, the fishing industry, and other stakeholders. A robust data collection and reporting system will help identify bycatch interactions that need management attention, improve stock assessments, and support efforts to manage the region's fisheries.

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There is great potential for the Councils and the National Marine Fisheries Service (NMFS) to support these multiple functions. However, the Agency-led SBRM development process has not done the job. Moreover the Agency's revision of the SBRM irrationally ignores how the fisheries work, by using a data-set that is almost 10-years old, when the fishery had vastly different characteristics, and by failing to consider the management changes brought on by important events such as the introduction of Annual Catch Limit (ACLs) and Accountability Measures (AMs) in the fishery management plan amendments that implemented the 2006 reauthorization of the Magnuson Act (MSA) and the establishment of a catch shares fishery for New England groundfish.

Oceana repeats many of the comments that we raised in a May, 2013 letter to the Fishery Management Action Team (FMAT) chair highlighting deficiencies in the document at that time. ${ }^{3}$ Despite assurances to the Councils that revisions and modifications would be made prior to public comments ${ }^{4}$, it appears that the majority of the promised changes have not been made the document continues to suffer from deficiencies we identified 5 months ago. Oceana encourages the Councils to ensure that the document is complete before proceeding with approval and submission to the Agency.

For these reasons, despite the need to establish the SBRM as quickly as possible, we urge you to delay Council approval of the SBRM document. It is incomplete and inadequate to satisfy the goals and objectives of the amendment or satisfy the various mandates that guide this action. The SBRM simply does not provide the information needed to identify, recognize, describe, and respond to bycatch in the region or assess the effects of this action on the fisheries of the region. Approving a fundamentally flawed document in the name of speed is unacceptable. Oceana looks to you as chairs of your respective Councils to lead your Councils and disapprove the current SBRM document to allow further development and specific action to address the important shortcomings in the document which can then be approved at a later date.

Oceana encourages the Councils to convene an open Council-led process in the near future to publicly develop and refine the amendment to meet the needs of the fisheries of the region and provide the information that fisheries managers, scientists and stakeholders need to manage New England and Mid-Atlantic fisheries.

In the interim, Agency can move forward with an observer allocation process for 2014 regardless of Council action on the draft amendment. An interim plan of action that continues the status quo approach is not ideal but will serve the fisheries of the region until a new SBRM amendment can be completed: a short term solution that Oceana reluctantly accepts.

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## The SBRM is an incomplete response to the Court Order in Oceana v. Locke

The SBRM includes measures that specifically respond to the court opinion in Oceana v. Locke. ${ }^{5}$ As the SBRM document explains, the court found that the 2007 SBRM provided the Agency with undue discretion to determine whether there was insufficient funding and also provided the Agency undue discretion to address insufficient funding to support the goals of the SBRM.

The treatment of funding triggers in the draft document is wholly inadequate. The draft contains only one alternative to the status quo, and does not coherently explain what that alternative is or how it differs from the status quo. The Councils need to take a fresh look at this issue, considering what it really means to have insufficient resources within the context of how fisheries and budgets are actually managed.

The reallocation alternatives presented in the current document are fundamentally incomplete, because they address reallocation observer coverage without addressing reallocating buffers for uncertainty and otherwise modifying management measures to account for the reallocated observer coverage. The Amendment must address this fundamental aspect of the SBRM in order to be consistent with the conservation goals and objectives of the Magunuson Act.

## Funding Triggers

While Oceana supports developing a formulaic approach to determine when available funds are insufficient to support the needs of the SBRM observer allocation in order to remove Council and Agency discretion from this portion of the allocation process, the draft document fails to contain such an approach. The draft document purports to consider only one alternative to the status quo, but a review of the text intended to describe that alternative reveals that there is no substance to this approach.

The document starts out by claiming that the Amendment "would identify specific funding sources to be used to fund observer coverage under the SBRM each year." ${ }^{6}$ But the document never actually describes an alternative that would do that. The most specific it gets is the claim that "total available funds allocated to the Northeast Region from the Congressional appropriate funding lines listed in Table 66 would be used to support SBRM consistent with historic practice. ${ }^{77}$ But the draft document fails to explain why only these funding lines and not others would be considered, fails to explain the relevant aspects of the appropriations and Agency budgeting process, fails to explain whether other discretionary sources of money exist, fails to explain how new or different funding lines that might be applicable would be handled, and fails to explain exactly how much leeway the Agency gives itself in the phrase "consistent

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with historic practice." It appears to all intents and purposes that this alternative is the same as the status quo expressed in different words.

So the Councils must develop alternatives that really do confine Agency and Council discretion. In developing these alternatives, the Councils must consider all the relevant factors, not just federal funding from certain named funding lines. Among these factors to be considered would be other potentially applicable funding lines, discretionary money, existing industry-funding opportunities in the Northeast Region, and the possibility of developing industry-funding alternatives within the SBRM amendment.

## Prioritization Alternatives

## Prioritizing Buffers for Uncertainty in Conjunction with Changing Observer Levels

The SBRM Amendment's discussion of the prioritization process should start from the realization that the prioritization is related to the performance standard which is related to the management needs. These three elements can be balanced in more than one way. A reduction in observer coverage increases scientific and management uncertainty which then causes uncertainty in permissible catch levels. The Agency and Council have already begun to explore these tradeoffs between catch levels and uncertainty. In the 2004 SBRM guidance, the Agency described this basic situation:
'as the CV of the estimate increases, the limit on bycatch for the marine mammal species of interest decreases in a predictable manner. Therefore, managers can determine the costs and benefits associated with various levels of the CVs on both the abundance estimate and the bycatch estimate and allocate funding appropriately to improve either or both estimates. ${ }^{8,}$

The Agency then further discussed the effects of increased uncertainty:
'if bycatch mortality is not monitored adequately, it increases the uncertainty concerning total fishing-related mortality, which in turn makes it more difficult to assess the status of stocks of fish and other bycatch species, to set the appropriate optimum yields and overfishing levels for fish stocks, to determine acceptable levels of bycatch for other bycatch species, and to ensure that the optimum yields are attained, that overfishing does not occur and that the acceptable levels of bycatch for other species are not exceeded. ${ }^{9,}$

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More recently, the Council analyzed this type of reduction of quota to account for uncertainty in the discussion of monitoring in the Multispecies sector fishery. ${ }^{10}$ This work summarized the effect of various CV levels on different catch scenarios and suggested requiring catch reductions to account for scientific uncertainty and keep catch below set levels. This approach is a fundamental requirement of management under ACLs and AMs as advised by the National Standard One Guidance ${ }^{11}$

Any observer prioritization process must consider and rationally include the appropriate trade offs between uncertainty and buffers in catch limits to allow for scientific and management uncertainty. If uncertainty is increased as a result of the prioritization, there must be changes to account for this increased uncertainty. The Omnibus SBRM amendment is the appropriate place to develop and consider these necessary changes in every Fishery Management Plan. Without a full consideration of the effect of monitoring prioritization on catch management, the SBRM is incomplete.

What does this mean in terms of alternatives? The SBRM reallocation alternatives section must develop and consider alternatives for achieving the conservation goals and objectives of the Magnuson Act prior to considering alternatives for doing the best the Agency can if it cannot achieve those goals. Thus, the reallocation alternatives should result not in a simple reallocation of observers but also in a process for rebalancing buffers for uncertainty in the catch limits and management measures that will not receive full funding for their observer needs. It is irrational to completely ignore this vitally important component of the prioritization process.

## Reallocation Methodologies

To the extent that one component of reallocation will be reallocation of observers, Oceana offers comments on the incomplete alternatives put forward in the draft. Oceana sees merit in both the Proportional and Penultimate Approaches to prioritizing monitoring resources if funding does not match the needs described by the SBRM analysis. Both approaches are rational and methodical means to reallocate observer coverage - which is only a portion of what a reallocation alternative must do.

Oceana also notes that these prioritization approaches are untested. Without practical application of these tools, there may be unforeseen significant effects on the ability of the SBRM to accomplish its primary purpose to collect information to support management. Oceana suggests that the Councils revise the proportional and penultimate prioritization measures to guard against these shortcomings and improve the transparent oversight of catch

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monitoring in the region. The product of any prioritization must be subject to public review and comment.

## The Draft SBRM Does Not Provide Information Needed to Support Management of the Region's Fisheries

Since 1996, the MSA has required every FMP to 'establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery. ${ }^{12}$ Importantly, the Act also defines a fishery as '(A)(O)ne or more stocks of fish which can be treated as a unit for purposes of conservation and management and which are identified on the basis of geographical, scientific, technical, recreational, and economic characteristics; and (B) any fishing for such stocks. ${ }^{13}$

When developing an SBRM, the document advises that " $(t)$ he development of an SBRM must consider how, where, and when it is most appropriate to collect information on and monitor bycatch occurring in a fishery, and the most effective SBRM will be designed at the appropriate operational level1 ${ }^{14}$. "It then clarifies that an 'FMP is the operational unit used for managing a fishery (or collection of fisheries) that targets the species specifically addressed in the FMP. FMP is the operational unit for MSA compliance. ${ }^{15,}$

For these reasons, it is logical that the Councils would want an SBRM that collects and reports bycatch using the 'operational unit' for management of the region's fisheries: the FMP. All management actions are at the FMP level. MSA-mandated accountability is at the FMP level. ${ }^{16}$ If bycatch issues are taking place or arise, the response at the Council level will be through an FMP action.

However, instead of allowing the Councils to consider and select the appropriate operational level for the fisheries of the region relative the management needs of the fisheries, the Agency has forced the Councils to adopt a new concept, known as the 'fishery mode' as the operational unit of the SBRM with emphatic clarity: "While the FMP works very well as the operational unit for devising and implementing fishing regulations, it is not the most efficient or appropriate operational unit for devising and implementing an SBRM ${ }^{17 \prime}$ Unlike most other policy decisions, the Councils have not been given the opportunity to consider the effects of the mode approach on the administration of the fisheries of the region or the merits and tradeoffs of this approach. Since the beginning of the previous SBRM, the fishery mode has not been discussed.

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Instead the Agency simply opines that, "the fishing mode is a more appropriate operational unit than the FMP.... ${ }^{18}$

Oceana has commented in the past that the fishery mode is an ineffective approach to bycatch reporting that provides bycatch data that is of little use to be the 'basis for making sound fisheries management decisions. ${ }^{19,}$ Oceana continues to oppose the use of the fishery mode because this approach 1) does not report bycatch relative to FMPs, 2) does not collect or report bycatch in a spatially useful manner and 3) does not consider the data needed to manage the same species in different stock areas. These weaknesses present problems for the Councils as they try to manage fisheries and can be remedied by rejecting the fishery mode in favor of a Fishery Management Plan-level operational unit.

First the aggregation of FMPs or parts of FMPs under a single mode improperly aggregates catch and shields this bycatch from appropriate management scrutiny. Allowing the Agency to continue to aggregate bycatch by the mode stratification will continue to hamper the efforts of the Councils to identify bycatch problems, manage catch and meet the management objectives of each FMP.

Second continuing to collect and report bycatch information by species (e.g. cod) rather than species and stock area (e.g Georges Bank cod) does not provide useful information for assessment or management. The document even notes that "(s)tock areas will not be considered in the analyses, although retrospective data on observed discards would be available at this scale. ${ }^{20 \prime \prime}$

To illustrate the inefficiency of the fishery mode, a recent report from the Agency estimated that across the fisheries of the region, over $71,000 \mathrm{mt}$ ( $156,500,000$ pounds) of discards of the 14 species groups occurred during the July 2010 through June 2011 period ${ }^{21}$. Although the data was reported by species such as yellowtail flounder, the report was unable to parse bycatch by FMP or stock and instead reported it by the more general fishery mode. This lack of clarity does not indicate which stock was caught or which fishery should be held accountable. This lack of clarity leaves all stakeholders and managers unable to respond to this vast volume of discards. If this data were reported by stock and FMP level, the Councils could then consider appropriate management actions in response to ensure accountability.

The Councils' struggle to manage the catch of specific stocks in varying levels of abundance across the region. The Councils should take clear action to include options to define the

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operational unit for the SBRM to be the FMP level with stock area stratification to provide useful information support management.

The Councils must take this action before moving forward with approval of the SBRM.

## The SBRM Does Not Meet the Data Needs of Annual Catch Limits and Accountability Measures

Since the advent of Annual Catch Limits (ACLs) and Accountability Measures (AMs) in 2006, the need for robust catch information has become more critical to ensure that all catch, both landings and discards, are accounted for in the effort to end overfishing. Accurate, precise and timely catch information is essential for the Councils to ensure that ACLs are not exceeded. In the absence of robust data, managers are left to use assumptions about catch without any assurances about the quality of these important descriptors of the fisheries.

In the 2007 SBRM, the Agency declined to assess the bycatch reporting that ACLs and AMs would necessitate. Instead the Agency chose to ignore the mandate for ACLs and AMs, treating it as a future change that could be considered at a later date ${ }^{22}$. This responsibility cannot be avoided any longer. Managing the FMPs of the region under ACLs and AMs is now the status quo for every FMP. The Councils and Agency must ensure that the data collected and reported match the data needs of the respective FMPs to 'be used reliably as the basis for making sound fisheries management decisions ${ }^{23}$ including in-season closures, overage deductions and the 'off the top' Annual Catch Target (ACT) setting process that is used throughout the Mid-Atlantic. Remarkably this process is described in just two sentences in the document without any discussion of the role of data in the process: "The Council then sets corresponding annual catch targets (ACT) for each fishing sector. The commercial quota and recreational harvest limit are the amount of landings remaining after deducting discards from the respective ACTs. ${ }^{24 \prime}$

The SBRM must include an explicit discussion of the data needed to administer each fishery and its ACLs and AMs. Without this fishery-by-fishery discussion, the SBRM will not support the specification or administration of ACLs and AMs used in the region and cannot be shown to meet the mandates of the MSA.

## The Standardized Bycatch Reporting Methodology Must Consider Alternatives to Respond to Management and Scientific Uncertainty Created by the 30\% CV Performance Standard

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Uncertainty and assumptions are common and expected in fisheries management. However it is incumbent upon the Agency as part of both NEPA and MSA analysis to fully explore, discuss and account for the effects of this uncertainty on management and science. The document itself recognizes the effects of uncertainty as well, concluding that "(u)ncertainty related to the amount and mortality of discards increases the uncertainty associated with stock assessments, diminishing managers' ability to accurately set and achieve optimum yield from a fishery. ${ }^{251,}$

It is troubling then to see that the SBRM does not discuss the effect of CV-associated uncertainty on both management uncertainty ${ }^{26}$ and scientific uncertainty ${ }^{27}$ or the need to consider these factors when setting and administering ACLs and AMs. In fact, the SBRM offers just one reference to the stock assessment process as a footnote ${ }^{28}$ and generalizes the discussion of ACL specification in each fishery.

Oceana has submitted independent analysis of the effects of a $30 \%$ CV on bycatch estimates that show this uncertainty to be as much as $+/-100 \%$ of the true value ${ }^{29}$. This is a considerable amount of uncertainty that cannot be ignored. Uncertainty must be discussed in the context of each FMP, an approach that was suggested by the Agency in its 2004 guidance on developing SBRMs: "The appropriate precision standards for the estimates of bycatch depend on the management objectives, the management uses of the estimates, the precision of other information used with the bycatch estimates to make management decisions, and the cost of increasing the precision of the bycatch estimates. ${ }^{30 \text { " }}$

For these reasons, the SBRM should be rejected by your Councils to allow a full discussion and consideration of the effects of uncertainty associated with the 30\% CV Performance Standard and the ability of this information to support current management of each fishery. Further, as discussed above, if the CV standard cannot be met, the effects of this increased uncertainty must be discussed and accounted for in the SBRM.

## The Draft SBRM Does Not Use the Best Available Science in its Consideration of Bias and Precision

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Catch data that is collected and reported to support assessment and management must be both precise and accurate. Accuracy and precision will ensure that bycatch data is representative of the catch of the fishery as a whole and provide useful information to meet the goals and purpose of the respective FMPs and the SBRM. The Agency has advised that bias may present more significant problems for management than precision: '(i)n some instances decreasing bias (including that caused by the observer effect) will be more important than increasing precision. ${ }^{31}$ This necessity for accuracy as well as precision is aptly noted in the objectives of the SBRM: 'to establish, maintain, and utilize biological sampling programs designed to minimize bias to the extent practicable, thus promoting accuracy while maintaining sufficiently high levels of precision ${ }^{32}$.'

The current SBRM however continues the trend started by the 2007 SBRM by inappropriately focusing its design on achieving goals of precision and largely discounts bias. Bias in data is a serious issue that must be accounted for at the risk, in the words of one NEFMC member of being 'precisely wrong. ${ }^{33,}$

The SBRM does a poor job examining and exploring the issue of bias while attempting to justify a conclusion that "there are no bias issues evident ${ }^{34 "}$ in the monitoring of the region's fisheries. This conclusion advanced to justify the findings of the SBRM is not supported by the analysis and discussion in the document. Furthermore, the publication of external reports demonstrating bias in the region's fisheries questions this conclusion.

The discussion of bias in the document relies on an analysis of 2004 observer data to characterize the accuracy of observer data relative to Fishing Vessel Trip Report (FVTR) data. This analysis concludes that an examination of kept pounds 'compares favorably' and 'indicates no evidence of systematic bias." ${ }^{35}$ However, an exploration of other metrics indicates that bias may be present in this data. Trip length was 'different' between the observer and VTR data set with a consistently longer trips with observers ${ }^{36}$. Further when viewed spatially, the document advises that ' $(\mathrm{t})$ he null hypothesis of observer proportions equal to FVTR proportions was rejected ( $\mathrm{P}<0.05$ ) in 38 of the 86 comparisons, which suggests that there are some spatial differences in the observed data compared with the FVTR data. ${ }^{37,}$ Put a different way, bias exists in the spatial data in 44 percent of comparisons. This additional analysis suggests that a difference exists between observed and unobserved trips and observer data is not representative of the fishery.

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This weakness in the SBRM analysis of bias is further demonstrated with the analysis performed by Chad Demarest in 2012 to examine bias in the NE Multispecies sector fishery ${ }^{38}$. Demarest used a more comprehensive examination of eight metrics of fishing behavior ${ }^{39}$ and used a peer reviewed technique to examine for observer bias ${ }^{40}$. Demarest found that 'analyses point towards a highly variable but relatively consistent pattern of different fishing behaviors when an observer is on board and when one is not' and further concluded that 'fishing behavior across the eight metrics was variable, but that statistically significant differences in reporting were observed across all eight metrics and that the strength of the statistical signal varied depending on how the data were parsed. ${ }^{41,}$

The omission of the Demarest analysis comes after Oceana's specific comments describing its findings to the FMAT in May 2012. ${ }^{42}$ This omission raises questions of the intent of the Agency to reach predetermined conclusions relative to bias and whether the conclusions are arbitrary, capricious and an abuse of discretion.

It should also be noted that the Standardized Bycatch Reporting Methodology has improperly inserted 'to the extent practicable' language into the goals for accuracy where it is not warranted. The SBRM is required of all FMPs ${ }^{43}$, not where practicable. Conservation and management measures shall be based upon the best scientific information available ${ }^{44}$, not where practicable. And ACLs and AMs must be included in each Fishery Management Plan to prevent overfishing ${ }^{45}$, not where practicable. Accuracy is therefore necessary for each of these requirements and must be ensured.

The SBRM must be updated with a complete discussion of bias and include measures to assess and account for bias in bycatch monitoring.

## The Standardized Bycatch Reporting Methodology Omnibus Amendment Requires an Environmental Impact Statement

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In this comment letter, Oceana identifies a number of specific ways in which the SBRM Environmental Assessment (EA) does not satisfy NEPA, the MSA and the Administrative Procedure Act (APA) These flaws are symptoms of a systematic problem: a measure of such major significance and widespread impact requires that the Agency take a hard look at a full spectrum of alternatives through an Environmental Impact Statement (EIS).

As Oceana has explained in prior comment letters on this process and the previous SBRM iterations ${ }^{46}$, the information and analysis in the SBRM document will have a significant impact on thirteen fisheries from the Canadian border to North Carolina. The information, analysis, and technical guidance contained in a complete SBRM will affect how these fisheries are managed, their stock assessments, and ultimately the efficacy of the management approaches used to reach the goals of the FMPs through ACLs, AMs and other measures. The Omnibus SBRM amendment is a major federal action significantly affecting the quality of the human environment and cannot satisfy the requirements for a Finding of No Significant Impact, or FONSI.

In bringing the environmental analysis into compliance with NEPA, the Council and the Agency must also give proper consideration to the alternatives preemptively and irrationally rejected for consideration in the draft document before the Councils have even had the opportunity to rationally consider them. These alternatives include the important alternative of extending the bycatch reporting methodology to bycatch species rather than only to target species managed under a plan and alternatives to develop and employ alternative monitoring techniques where observer coverage would not be completely accurate. The scoping process that comes with an EIS should prove invaluable in this regard.

Accordingly, the Agency must disapprove the SBRM Amendment as inconsistent with NEPA and swiftly act to develop an EIS and a revised SBRM Amendment that will comply with the Court's order, NEPA, and the Magnuson-Stevens Act. With a wide range of stakeholders affected by the findings of this process, the Agency should engage in a complete scoping process to educate and engage the public about the issue and seek concerns and ideas to be investigated and developed as part of the document. This scoping should include the narrow range of issues that were vacated by the Court, the new challenges posed by the status quo ACLs and AMs requirements for the affected fisheries as well as other issues highlighted by stakeholders.

## Conclusion and Recommendations-

In conclusion, while it is disappointing that the Agency has not seized the opportunity to improve catch monitoring and reporting in the NE region with the current SBRM , it is not surprising. Since the beginning of the development of the previous SBRM, it has been clear that the intent of the Agency has been to elaborately codify the Agency's outdated approach to

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monitoring without ever answering the critically important question of how much observer coverage do the region's fisheries need to be effectively managed under the current management regime?

Oceana suggests that the Councils take the following actions when it reviews the Standardized Bycatch Reporting Methodology at their upcoming meetings:

1. Disapprove the Standardized Bycatch Reporting Methodology document. The document is not complete and many of the promises made to the Councils have not been fulfilled.
2. Initiate an Environmental Impact Statement process to identify and address issues related to the primary purpose of the SBRM, to collect information that can be used reliably as the basis for making sound fisheries management decisions.
3. Convene a joint ad hoc Council committee to explore the data needs of each fishery and how the SBRM can be structured provide the necessary information to support current management.
4. Task the FMAT with developing options in the SBRM that account for uncertainty associated with the CV30 performance standard in ACL specification processes. Additionally management options should be developed to respond when the CV standard cannot be met.
5. Include alternatives and analysis to ensure accuracy of bycatch data.
6. Require the Agency to publish the observer coverage needs that are associated with the assertion that 'NMFS requests funding for the Fisheries Observer Program that it has determined necessary to meet the needs of the fishery and to comply with statutory mandates ${ }^{47}$,

Oceana remains committed to ensuring that the fisheries of the NE region are managed with statistically robust data that is accurate, precise and timely to support sound fisheries management decisions.

We agree with the purpose of the SBRM and look forward to working with the Councils as you continue to develop an SBRM that meets these purposes.

Thank you for considering these comments,
Sincerely,


Gib Brogan
Oceana
Wayland, MA

[^72]Mr. John K. Bullard, Regional Administrator

NMFS, NERO

55 Great Republic Drive

Gloucester, MA 01930

December 18, 2013

Dear Mr. Bullard,

Please accept these comments on the draft SBRM. I work part time for Wallace and Associates, who represent numerous surfclam and ocean quahog fishing vessels and processors. Prior to joining Wallace and Associates I was the Senior Ecologist for the Mid-Atlantic Fishery Management Council (MAFMC) where I worked for 30 years. I was the senior clam staffer from the late 1980s until 2012. I wish to comment on the draft omnibus amendment to all the fishery management plans of the New England and Mid-Atlantic Councils that was noticed in the Federal Register on November 19, 2013.

The surfclam and ocean quahog fisheries are extremely clean, as evidenced by the NEFSC clam survey species listing in Table 34 of the MAFMC Amendment 13. Surfclams and ocean quahogs comprise well over $80 \%$ of the total catch from the survey with no fish caught by the survey dredge. Only sea scallops, representing other commercially desirable invertebrates were caught at around one-half of one percent by the survey dredge. Commercial clam operations are certainly even cleaner than the scientific surveys (which have liners in the dredges) as all animate and inanimate objects except for surfclams and ocean quahogs are discarded quickly before the clam resource in place in the cages. Processors want only clams and reduce their payments to the boats if "things" other than surfclams or ocean quahogs are in the cages.

Clam Amendment 13 also addressed interactions with marine mammals and sea turtles. Since the start of my interaction with the clam fishery in the early 1980s, I have never heard of an interaction between commercial clam operations and marine mammals or turtles. While marine mammals may occur near surfclam and ocean quahog beds, it is highly unlikely any significant conflict would exist. Commercial clam dredging vessels dredge at very slow speeds and healthy animals should have no difficulty avoiding these vessels. Additionally, surfclam and ocean quahogs are benthic organisms, while marine mammals and marine turtles are pelagic and spend nearly all of their time up in the water column or near the
surface. The realized reduction in the number of fishing vessels resulting from the implementation of the ITQ program reduced the potential for the interaction with endangered species from a minimal to a very minimal level.

This draft omnibus amendment is designed to prioritize the allocation of sampling effort. Only a small fraction (about 105 days based on 2012 sea days needed) of effort appears devoted to the clam fisheries. However, I wonder if with the projected very large shortfall in the number of days available, if it might warrant the exclusion of these two fisheries in order to develop more statistically valid data for other fisheries where bycatch and marine mammals and turtle interactions do occur.

Thank you for your consideration of these comments. Should there be any questions, I can readily be reached through this email address or by phone (215-536-3543).

Sincerely,

Thomas B. Hoff Ph.D.

David T. Goethel
23 Ridgeview Terrace
Hampton, NH 03842

December 10, 2013, 2013

Mr. John Bullard
Regional Administrator NMFS
Northeast Regional Office
55 Great Republic Drive
Gloucester, MA

Comments on the Draft Amendment to "The Standardized Bycatch Reporting Methodology (SBRM)
Amendment"

Dear Mr. Bullard,
Notwithstanding the provisions of 303(a)(11) to include provisions to assess the amount and type of bycatch, I believe this amendment should be withdrawn and reworked for the following reasons:

1. There is nothing standardized about bycatch reporting across fisheries.
2. The standard of precision chosen ( $30 \% \mathrm{cv}$ ) is the wrong standard. Accuracy is more important than precision.
3. The issue of cost is not sufficiently addressed.

In addition to the SBRM document I wish to have the National Marine Fisheries Service review and comment on SBRM in light of:

1. "Design, Implementation and Performance of an Observer Pre-Trip Notification System (PTNS) for the Northeast United States Groundfish Fishery," Michael C. Palmer,et.al., Northeast Fishery Science Center Reference Doc 13-21.
2. "Analysis of Landings/Discards-Proportional Allocation Scheme of the At-Sea Monitoring Program in New England", Jenny Sun, Gulf of Maine Research Institute. (See documents attached to the electronic submission)
These papers address many of the issues and short comings surrounding the current system which are detailed below.

First, about the issue of standardization, bycatch is unique to each fishery and should be scored on a fishery by fishery basis to form a prioritization matrix. This is how the Atlantic States Marine Fishery Commission handles the problem. Those fisheries receiving the highest scores get proportionally more of the limited funding available for bycatch observers. Using a standard measure of precision only insures that far more coverage of fisheries with limited bycatch is required than is actually necessary. This prioritization process should be done by a joint effort between the NMFS and the NEFMC.

Precision is the wrong metric for bycatch. Consider this example; two archers each fire six arrows at a target. One archer places all six arrows in a very tight grouping but completely outside the target circles. He is very precise but not accurate. The second archer places two arrows in the bull's-eye with the other four scattered across the concentric circles. He is accurate but not very precise. As a manager and a scientist, I am more interested in accuracy. The current system that is precision oriented causes under coverage of boats catching large amounts of fish and over covers small boats making numerous trips for small amount of fish. Furthermore it is rigid and inflexible and does not allow for placing coverage where large amounts of discards may occur. The alternative way, described in the Sun paper, would produce more accurate bycatch data and be more cost effective and yield more accurate
data for stock assessment. For example, the vast majority of fish caught in two New England fisheries are caught by a relatively small amount of vessels. In the herring fishery over ninety percent of the fish are caught by about twenty vessels, the remaining ten percent are caught by literally hundreds of vessel catching small amounts of fish. Similarly, in groundfish, approximately ten percent of the boats catch ninety percent of the fish. Accuracy would be greatly improved by high levels of coverage on these vessels in both groundfish and herring. The remaining vessels could be covered at the NEFOPS level of coverage of about five to seven percent to determine a baseline and detect any major changes in bycatch over time. Placing high levels of coverage on the boats that actually catch the majority of the fish would be both cost effective and greatly improve accuracy.

Finally, the issue of cost is not addressed sufficiently. I believe the cost of collecting bycatch data is a function of government and should be explicitly stated in the document. As such, it will always be subject to budget constraints and hence the need for prioritization mentioned above. I also believe the document should explicitly state that a census of bycatch is not necessary, useful or cost effective with a rationale. A section should be added to the document stating why a census is cost prohibitive and of little scientific value. I believe that the gains in precision and accuracy become negligible. This should be done specifically to avoid legal challenges by Environmental Non-Governmental Organizations trying to require $100 \%$ observer coverage.

Last, I would hope that all comments in this letter are fully addressed in detail in the Federal Register by NMFS, with sufficient rationale to ensure they have been seriously considered, analyzed and will hold up in a court of law.


David T. Goethel

Attachment 1

# The Design, Implementation and Performance of an Observer Pre-trip Notification System (PTNS) for the Northeast United States Groundfish Fishery 

by Michael C. Palmer, Patty Hersey, Heidi Marotta, Gina Reppucci Shield, and Sarah B. Cierpich

# The Design, Implementation and Performance of an Observer Pre-trip Notification System (PTNS) for the Northeast United States Groundfish Fishery 

by Michael C. Palmer*, Patty Hersey, Heidi Marotta, Gina Reppucci Shield, and Sarah B. Cierpich

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U.S. DEPARTMENT OF COMMERCE<br>National Oceanic and Atmospheric Administration<br>National Marine Fisheries Service<br>Northeast Fisheries Science Center<br>Woods Hole, Massachusetts

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Information Quality Act Compliance: In accordance with section 515 of Public Law 106554, the Northeast Fisheries Science Center completed both technical and policy reviews for this report. These predissemination reviews are on file at the NEFSC Editorial Office.

This document may be cited as:
Palmer MC, Hersey P, Marotta H, Shield GR, Cierpich SB. 2013. The design, implementation and performance of an observer pre-trip notification system (PTNS) for the northeast United States groundfish fishery. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 13-21; 82 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/
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## LIST OF ACRONYMNS AND ABBREVIATIONS

ASM: At-Sea Monitor
CV: Coefficient of variation
DAS: Days-at-sea
FSB: Fisheries Sampling Branch
GUI: Graphical user interface
NEFOP: Northeast Fisheries Observer Program
NEFSC: Northeast Fisheries Science Center
NMFS: National Marine Fisheries Service
NOAA: National Oceanic and Atmospheric Administration
ODDS: Observer Declare and Deploy System
PHP: hypertext preprocessor
PIN: Personal identification number
PLSQL: Procedural Language/Structured Query Language
PTNS: Pre-Trip Notification System
SBRM: Standardized Bycatch Reporting Methodology
SMP: Special Management Program
U.S.: United States

VMS: Vessel Monitoring System


#### Abstract

Historically, a dock intercept process was used to deploy observers in the northeast United States multispecies (groundfish) fishery. In this process, fishing trips for observer coverage were manually selected using pre-defined specifications established by the National Marine Fisheries Service's Northeast Fisheries Science Center. Amendment 16 to the Northeast Multispecies Fisheries Management Plan implemented major changes in the groundfish fishery, which affected the magnitude and complexity of observer deployment. These changes included: (a) creation of an additional 15 active groundfish sectors; (b) an approximate four-fold increase in the level of observer coverage; (c) introduction of a new class of trained observers; (d) potential for industry-funded observer coverage to supplement government-funded coverage; and (e) the need for the observer deployment process to directly support in-season monitoring of fishery discards. The dock intercept process was insufficient to adequately address these new provisions, and an automated observer pre-trip notification system (PTNS) was implemented in the northeast groundfish fishery on 1 May 2010. The PTNS uses a self-adjusting probability-based, tiered selection process to randomly assign observer coverage across the groundfish fleet on a proportional basis for the purpose of monitoring discards. The PTNS also addresses other objectives, such as monitoring of special management programs and protected species bycatch. In this paper, we discuss the design, implementation, and performance of the PTNS over the past three years.


## INTRODUCTION

Historically, at-sea observers have been deployed in the large-mesh groundfish fishery occurring off the northeast United States using a dock intercept process. Observer service providers would manually select fishing trips for coverage using pre-defined specifications established by the National Marine Fisheries Service’s (NMFS) Northeast Fisheries Science Center (NEFSC). The pre-defined specifications were in the form of a prioritized sea day schedule established through the annual Standardized Bycatch Reporting Methodology (SBRM) process (Wigley et al. 2007). Sea day schedules support stratified random sampling designs by providing a list of observed sea days needed for coverage within a particular stratum. Observer service providers used the sea day schedules along with a randomized list of vessels likely to be active in the fishery to manually select trips for observer coverage based on knowledge of local fleet activity. There were exceptions to the dock intercept process; for example, observer deployment in some special management programs (SMPs, e.g., participation in the United States/Canada Resource Sharing Area on Georges Bank) was accomplished using a pre-trip call-in system. However, for the majority of observer coverage, particularly in the groundfish fishery, observer deployment was accomplished using a manual dock intercept process.

Amendment 16 to the Northeast Multispecies Fisheries Management Plan (NEFMC 2010) brought about major changes to the northeast groundfish fishery, including some which affected the degree and complexity of observer coverage. Most notably, Amendment 16 implemented a new management regime in the northeast groundfish fishery colloquially referred to as 'sector management.' One of the more significant requirements under sector management was the need to estimate total sector catches in-season. To meet these requirements the breadth and complexity of the groundfish monitoring effort had to be expanded while at the same time continuing to meet the demands of existing monitoring programs. It was widely recognized that a dockintercept process would be insufficient to meet the increased demands. A more sophisticated and integrated observer deployment system would be needed prior to the start of sector management, which began at the start of the 2010 groundfish fishing year on May 1, 2010 ${ }^{1}$.

## Amendment 16 and sector management

## Increased observer coverage

Prior to sector management, observer coverage rates in the groundfish fishery averaged less than 8\% between 2000 and 2009 (Figure 1). Coverage rates were primarily controlled by the available funding; however, since 2008 the SBRM Omnibus Amendment (MAFMC/NEFMC 2007) required that coverage rates be sufficient to achieve a $30 \%$ coefficient of variation (CV) on estimates of fishery discards. Within the SBRM framework the $30 \%$ CV criteria was applied at

[^73]the fleet and species group level. SBRM species groupings were consistent with the scope of existing fishery management plans (e.g., large-mesh groundfish). SBRM fleets were broadly defined by their regional (New England, Mid-Atlantic) and gear (e.g., large mesh otter trawl) characteristics. Using the broad SBRM stratification scheme, the existing observer coverage levels were generally sufficient to achieve discard estimates with CVs below the $30 \%$ threshold for the groundfish complex (Wigley et al. 2011). Additionally, for most individual groundfish species, the $30 \%$ CV criteria were met when estimating discards at the level of stock management units (NEFSC 2008, 2012).

Amendment 16 specified that "minimum coverage levels must meet the coefficient of variation in the Standardized Bycatch Reporting Methodology. The required levels of coverage will be set by NMFS...and may consider factors other than the SBRM CV standard when determining appropriate levels" (NEFMC 2010). While Amendment 16 did not explicitly define the stratification levels to which the $30 \%$ CV would apply, it was generally interpreted that it would be applied at stratification levels identical to those used for the estimation of in-season groundfish discards which were stratified by sector, gear, and stock. There were expected to be 18 active sectors (including the common pool, which includes those vessels that did not join organized sectors), six gear types, and 16 stocks (including sub-stocks like the eastern Georges Bank cod, Gadus morhua, and haddock, Melanogrammus aeglefinus). The maximum number of possible discard strata combinations exceeded 1,700. It was known that observer coverage levels much higher than the approximate $8 \%$ that had been historically achieved would be needed to meet SBRM precision requirements under sector management (Northeast Fisheries Science Center Discard Peer Review, http://nefsc.noaa.gov/groundfish/discard/). In addition to the precision concerns, there were also practical considerations, such as funding availability and achieving a coverage level that would deter observer bias (e.g., Benoît and Allard 2009). Ultimately, NMFS determined that there would need to be approximately 22-30\% observer coverage of the groundfish fishery in addition to the approximate $8 \%$ coverage provided by existing monitoring efforts.

Sector vessels would be subject to the increased groundfish observer coverage levels whenever the vessel was sailing on a fishing trip designated as a 'groundfish' trip. A groundfish trip is defined as any trip where the vessel will be fishing under a Northeast Multispecies day-at-sea (DAS). While sector vessels were exempt from DAS requirements, the usage of DAS would continue to be monitored and used to determine the directed nature of the fishing trip. Based on these rules, in addition to trips targeting groundfish, groundfish trips may also include trips targeting monkfish (Lophius americanus), spiny dogfish (Squalus acanthias), and skates (Rajidae). Under Amendment 16, vessels intending to sail on a groundfish trip would be required to submit notification to NMFS of their intent to fish at least 48 hours in advance of sailing, in order to facilitate the deployment of fisheries observers.

## A new class of observer

Amendment 16 originally specified that, beginning with fishing year 2012 (May 2012), all sectors must fund NMFS-approved at-sea monitoring programs. In the interim (i.e., fishing years 2010 and 2011), NMFS agreed to fund observer coverage levels in excess of existing federally funded monitoring to meet the increased coverage demands. Observers certified through the Northeast Fisheries Observer Program (NEFOP) to provide baseline fishery coverage collect a suite of information on fishery operations that extends beyond the core information needed to support in-season monitoring of groundfish sectors. Anticipating a future shift from NMFSfunded to industry-funded observers, a lower-cost alternative to NEFOP observers was created that were termed 'at-sea monitors,' or ASMs. The data collection protocols for ASMs are restricted to collecting haul-by-haul catch estimates and length frequency information. ASMs do not perform any of the additional biological sampling or data collection required of the NEFOP observers, though they do collect minimal protected species bycatch information. In contrast to the single service provider contract awarded to provide NEFOP coverage, multiple service providers were contracted to provide ASM coverage. Additionally, sectors could contract with individual service providers to fund ASM coverage beyond the NMFS-funded levels (i.e., industry-funded ASM); to date, however, no sector has done so. All coverage types, regardless of funding source and program objective, would be used in support of groundfish discard estimation for both stock assessments and in-season quota monitoring.

## Complexity of proportional deployments

In a given fishing year, not all of the 1,700 possible discard strata would be expected to be active. For example, some sectors’ operations were likely to fish only certain gear types, in addition to being geographically restricted to one or two regions (Figure 2), which would preclude the harvesting of certain groundfish stocks. However, it was not known a priori which strata would be active. Given the large scale changes to the fishery as a result of sector management, the behavior of the groundfish fleet in prior years would likely be a poor predictor of expected behavior from May 1, 2010 and beyond. The efficient and effective support of finescale discard stratification would require the capacity to dynamically identify active strata and deploy observer coverage in these strata in a statistically unbiased manner. This was a marked departure from the sea day schedule approach, in which the stratification scheme was static and the behavior of the fleet was assumed to be similar from one year to the next. An additional aspect of the in-season discard estimation methods was that sectors would be subject to an assumed discard rate early in the fishing year, when there were insufficient in-season observations in strata from which a reliable estimate could be derived. Given this, it was desirable to achieve some level of 'front-loading' to get in-season information early in the fishing year in a way that would not introduce a temporal bias into the resulting discard estimates.

## Maintenance of existing coverage objectives

While Amendment 16 and sector management brought about many changes to the groundfish monitoring program, it did not reduce the obligation to continue ongoing monitoring efforts in support of other programmatic objectives. These included coverage of vessels participating in certain SMPs, such as the Georges Bank United States/Canada Resource Sharing Area and closed area access programs. In addition, NMFS is mandated to provide seasonal coverage of certain groundfish gear types to monitor the bycatch of protected species like marine mammals. Monitoring of protected species is also covered under the SBRM Omnibus Amendment. The sampling protocols employed on gillnet trips is limited with respect to fish sampling, and as such these trips are not applied against groundfish trip coverage requirements and excluded from the discard estimation process.

## Summary of needs

Amendment 16 and sector management introduced considerable complexity into the manner in which observers would need to be deployed in the groundfish fishery. To meet these demands, a sophisticated and integrated observer deployment system would be needed that was capable of automatically, and efficiently, allocating observer coverage across the range of monitoring programs. The highest priority of such a system would be to support the stratified random deployment of observers within the groundfish fishery in an unbiased manner. Given the range of possible observer programs (e.g., NEFOP, NMFS-funded ASM, industry-funded ASM) across the groundfish fishery, such a system would need to support multiple selection protocols as well as observer coverage rates. Coverage rates could vary from program-to-program, and potentially from sector-to-sector. Because some observer programs would utilize multiple service providers, there needed to be an efficient and equitable method for assigning trips to individual providers proportional to the relative capacity of each service provider (i.e., number of employed observers). Since multiple ASM service providers would exist, it was desirable to select multiple providers; this would improve the likelihood of a trip being covered in the event that the first provider selected did not have an observer available for deployment. Lastly, from the perspective of the fishing industry, the system would need to be simple and easy to use, and would allow for the trip and provider selection processes to be accomplished through a single action.

With these requirements in mind, the NMFS Northeast Fisheries Science Center (NEFSC) set out to design an observer pre-trip notification system (PTNS) beginning in late winter of 2010. While other similar systems have been developed and deployed in North America since 2010 (e.g., NMFS - Alaska Region developed and deployed their Observer Declare and Deploy System; USOFR 2012), to our knowledge the PTNS was a first-of-its-kind automated observer deployment system. Much of the design work could not begin until the details of Amendment 16 were finalized, which left only a few months to design, test, develop, and deploy a sophisticated next-generation observer deployment system. Given the short development time frames and new fishery management regime, it was inevitable that improvements in the initial design would be required. During the first year of deployment PTNS was incrementally improved, resulting in the
current system, which has been meeting a range of observer deployment requirements since May 1, 2011. In this paper we discuss the design, implementation, and performance of the PTNS over its three-year implementation in the groundfish fishery. Additionally, we identify areas of possible improvements that would benefit not only the PTNS, but the design of similar systems around the world.

## SYSTEM DESIGN

During the preliminary PTNS design phase, several critical system features were identified. We have attempted to describe the need and basic design of the PTNS with respect to these features, but it is not intended to be an exhaustive list of all of system features. The following descriptions capture the major PTNS features that are central to its successful operation.

## Hierarchal tiers

The most important design feature identified was the need to establish a hierarchy in the selection process. Because of the multiple coverage objectives that the PTNS would need to address, it was critical that the relative priorities of each of the objectives were established such that coverage was assigned in order of relative importance. Within the hierarchal structure, individual monitoring programs were assigned to priority levels, or tiers. Each tier had an associated type of observer coverage (e.g., NEFOP observer for NEFOP-level coverage) for which there may or may not have been multiple providers. The hierarchal design features of the PTNS are described below:

Sampling unit - The object that is being sampled from the population, or sampling frame. Within the PTNS, the fishing trip was identified as the sampling unit. The PTNS selection process would be trip-based, such that the target coverage rates would be evaluated with respect to the ratio of observed trips relative to total trips occurring within a defined stratum. While other sampling frames were considered, such as total fishing effort (e.g., days absent) and total groundfish landings, the difficulty in defining a sampling unit in these terms at the point of notification (i.e., prior to a trip sailing) precluded their use in the PTNS. Fundamentally, if the coverage deployment was unbiased, the proportionality of trip-based coverage would be equal to those of other metrics.

Selection tiers - Discrete hierarchal levels within the observer selection process. Many of the selection tiers would correspond to explicit monitoring programs such as NEFOP, protected species (limited fish sampling), and ASM monitoring (limited biological sampling). In general, the placement of the tiers within the hierarchy would be dictated by overall importance relative to resource monitoring. The more important tiers would be placed at the top of the selection process, and trips would move down through the selection process until the trip was selected at a given tier. Once a trip was selected at one selection tier, it would exit the selection process and could not re-enter. The selection of a
trip at a selection tier would not guarantee that an observer would be assigned to cover the trip, since the trip would still have to enter the provider assignment process postselection. There would be four different types of tiers: 'conditional,' 'list,' 'probabilitybased,' and 'sea day schedule'. Conditional tiers refer to those tiers where trips are issued waivers if they met certain defined conditions. List tiers refer to those tiers where a vessel was either on the 'list' or not on the 'list'. List tiers exist in two forms: automatic waiver and automatic selection. Probability-based tiers rely on a stratified random selection process to determine whether a trip is selected for coverage. Sea day schedule tiers rely on fixed sea day schedules; if a trip declared into a stratum for which there is still a positive balance on the sea day schedule, it would be selected for coverage. A full list of selection tiers and a general description of each are provided in Table 1.

Observer coverage types - The type of observer coverage deployed on a fishing trip. Each selection tier would have only a single coverage type. The possible coverage types would be: NEFOP coverage, NEFOP-limited (protected species), NMFS-funded ASM, and industry-funded ASM. The relationship between selection tiers and coverage types is shown in Table 1.

Observer providers - A company contracted to provide fishery observers. Each provider may be contracted to cover multiple selection tiers, and or, multiple coverage types. For coverage types where multiple providers exist, a weighted probability selection would be used to identify two service providers (provider 1, provider 2) for each trip. The probability of provider selection would be proportional to the number of certified observers each provider has at the time of the notification. Provider 1 would receive the right of first refusal, and if provider 1 declined the trip or failed to accept the trip in a specified amount of time, the trip would be offered to provider 2 . The details of this selection are described later in this paper.

The relationship between selection tiers and observer coverage types is shown in Table 1. Figure 3 provides a schematic of the progression of a fishing trip as it moves through the PTNS groundfish selection process. All of the selection tiers that would preclude a trip from being selected are placed at the beginning of the selection process to ensure that only those trips eligible for coverage reach the lower selection tiers where positive selection of a trip is possible. The ordering of the four initial list tiers (manual waiver, set-only gillnet, do not deploy - safety, do not deploy - coverage) is irrelevant, as trips must pass through all four in order to reach tiers capable of a positive selection.

Trips could be issued manual waivers by PTNS staff on a case-by-case basis. Manual waivers are most commonly issued when a vessel operator wants to sail less than 48 hours from the trip notification to avoid impending weather. In these situations a PTNS staff member would occasionally grant the vessel a temporary waiver of coverage if the vessel has a good record of compliance. Gillnet vessels may take what are referred to as 'set-only' trips, which are trips in
which gillnet gear is set, but not hauled. There is no harvesting of fish on these trips, so the deployment of an observer is unnecessary. These trips would be monitored for compliance external to the PTNS to ensure that they are truly set-only trips. The 'do not deploy' list tiers have two purposes. The first tier of this type is to protect the safety of observers. If a vessel has been identified as unsafe or constituting a hostile work environment for an observer, vessels will be temporarily placed on this list until the issues can be resolved. Many of these situations represent compliance problems and often require the intervention of NMFS Office of Law Enforcement. Once the issue has been addressed, the vessel is removed from the list. The second 'do not deploy' tier type is used to allow a temporary reprieve to vessels that have experienced unusually high coverage until their coverage rates are reduced below a specified level. Because the PTNS works to achieve coverage targets at the stratum level, not the individual vessel level, occasionally there can be a wide disparity of individual vessel coverage within a stratum, particularly when a stratum contains several non-compliant vessels or vessels attempting to avoid observer coverage. To achieve target coverage rates for a stratum, low coverage on a small number of vessels must be compensated by other vessels within the stratum receiving aboveaverage coverage. The PTNS tracks individual vessel coverage rates and automatically monitors for high- and low-coverage vessels. The details of this system monitoring will be described in a subsequent section. Vessels identified as high-coverage are placed in the 'do not deploy coverage' and vessels identified as low-coverage are placed in the 'keep active' tier, which will be described below.

The next selection tiers are the NEFOP-level coverage, SMP, and protected species tiers (Tiers 5 through 7; Table 1). These constitute the core monitoring programs in the region, independent of additional coverage needed to meet groundfish sector coverage demands. These were identified as the top monitoring priority for the groundfish fishery. The NEFOP and SMP are probabilitybased tiers; however, the protected species coverage is assigned using a sea day schedule. The difference in design was reflective of the desire of the end-user group that assigns protected species coverage to continue to use their existing sea day schedule method for observer selection. The sea day schedule selection specifies a set number of sea days of observer coverage by month, port, and gear-type. Any trip that reaches this tier will be evaluated to determine if it meets the criteria for which there is a positive balance on the sea day schedule. The sea day schedule is filled on a first-come, first-filled basis. If the trip does meet the criteria it will be selected for coverage. Trips not selected at the NEFOP, SMP, and protected species tiers will drop through to the ASM selection tiers. In the initial design discussions it was not known when, and if, there would ultimately be an industry-funded component to the system. For this reason, the NMFS-funded tier was placed higher in the selection process than the industry-funded component. The last tier is the 'keep active' tier. This tier is used to ensure coverage of vessels that have experienced below-average observer coverage despite automated system efforts to randomly deploy observers. Observer coverage for trips selected in the 'keep active' tier are assigned using the observer coverage associated with the next highest selection tier (e.g., if

NMFS-funded ASM coverage is the next highest tier turned on within the PTNS, 'keep active' trips will be assigned NMFS-funded ASMs).

Within each of the probability-based tiers (NEFOP, SMP, NMFS-funded ASM, and industryfunded ASM), a 'must deploy' sub-tier exists. These sub-tiers are used to address vessel compliance issues, specifically observer avoidance behavior. Before a vessel enters into the probability based selection for any of these tiers, the vessel is checked against a list to determine if it has been previously identified as 'non-compliant' based on prior PTNS usage patterns. The compliance aspect of the system will be described in depth in a subsequent section. Trips that enter the probability-based sub-tiers will be assigned coverage based on a stratified random selection algorithm. The details of the selection algorithm are covered in the next section.

## Methods to establish observer deployment probabilities

The primary objective of the PTNS is the stratified random deployment of observers within the groundfish fishery in support of in-season discard estimation. Specifically, the PTNS needs to be able to deploy observers in an unbiased manner within each stratum, contingent on a target coverage rate. The level of stratification applied within the PTNS was designed to be consistent with the in-season discard estimation methods which were based on sector, gear and mesh size (i.e., gear category), and fish stock. Since the specific species/fish stocks that would be caught on a particular trip were not known a priori, the PTNS used the intended fishing area as a proxy for fish stocks. The fishing areas were divided into three regions (Gulf of Maine, Georges Bank, and Southern New England/Mid-Atlantic; Figure 2) which generally corresponded with the management units used for the various groundfish stocks.

The target coverage rates are determined external to the PTNS based on considerations that include the desired precision of discard estimates, compliance monitoring needs (i.e., reduction of observer effects; Benoît and Allard 2009), and funding availability. Target coverage rates would likely require manual adjustment throughout the fishing year to compensate for changes in trip length, amount of fishing effort (number of trips), estimated effort remaining in the fishing year, number of observers available, and overall compliance with PTNS notification requirements.

With the exceptions noted above (e.g., do not deploy, set-only gillnet, must-deploy, protective species sea day, and keep-active tiers), the selection method for the majority of trips entering the PTNS should incorporate a probability-based sampling scheme utilizing random selection of fishing trips. There are numerous manners by which the trip selection probability could be determined ranging from the simple to the complex. From an initial design review, several desirable features of the selection method were identified:

1. Ability to achieve a target coverage rate.
2. Some level of 'front-loading' to get in-season information early in the fishing year to limit the influence of assumed discard rates in the calculation of discard estimates. While
the 'front-loading' aspect was desirable, it had to be accomplished in such a way as to limit the amount of temporal bias in the level of observer coverage.
3. Ideally, the selection criteria should have a self-adjusting capacity so that it can make fine-scale adjustments to the target coverage rates based on the actual realized coverage rates for the stratum, in the event that coverage rates are perturbed from the desired target rate.

With these criteria in mind, three different selection methods were considered and evaluated through simulation. The methods do not constitute an exhaustive list of possible methods; rather, they were selected because of their simplicity and ability to achieve a target level of observer coverage over time. Under all three methods, each trip is assigned a random number from 0.000 to $1.000\left(r_{\text {tier }}\right)$. The trip is selected if $r_{\text {tier }} \leq$ a tier's selection probability ( $p_{\text {tier }}$ ). The selection probability ( $p_{\text {tier }}$ ) is some function of either the target coverage rate ( $t_{\text {tier }}$ ) or stratum trip counts with the independent control variable, varying by method.

The three candidate methods were investigated and evaluated using simple, single-tier simulations. The simulations were programmed using SAS software, Version 9 (SAS Institute Inc., Cary, NC, USA). Simulations assumed that all trips entered into the system occurred (no cancellations), and that trips selected for coverage received coverage (providers could not decline trips). Trips were entered into the simulation one at a time, and each iteration was carried out to 100 trips. Each simulation was run for 500 iterations, and the performance of the method was evaluated based on the mean coverage rate and precision. While the simplistic nature of these simulations may not capture the nuances of a production system and the limited iterations may not characterize the true precision, the simulations were sufficient to evaluate the general characteristics of each the methods and offer an objective means with which to identify an optimal method. The three candidate methods are described below.

## Fixed method

The fixed method represented the simplest of the three methods explored, and addressed only the criteria to achieve a specified coverage rate. In the fixed method, every trip had a fixed probability of being selected for observer deployment that is equal to the target observer coverage (Equation 1, Figure 4).
[Equation 1] $p=c_{t}$
Where:
$p$ is the probability of trip being observed
$c_{t}$ is the target coverage level

## Incremental method

The incremental method attempted to address the probability of zero coverage early in the fishing year by applying some front-loading capacity. The incremental method starts with a
specified high fixed coverage rate (e.g., 1.0), with the coverage rate decreasing in fixed increments as each successive trip entered the stratum (Equation 2), until it reaches a defined target coverage rate (Equation 3, Figure 5). The method operates independent of the realized observer coverage rate; the probability of a trip being selected for observer coverage is dependent only on its order of occurrence in the stratum, not whether previous trips were selected for observer deployment. In this respect, the incremental method did not contain a selfadjusting mechanism.

$$
\text { [Equation 2] } p=1-t(i) \quad \text { unless } c_{t}>1-t(i) \text { then } p=c_{t}
$$

The number of trips that must exist in a stratum before the target observer coverage is reached is:

$$
\text { [Equation 3] } t=\left[\frac{1-t}{i}\right]+1 \quad \text { (integer) }
$$

Where:
$p$ is the probability of trip being observed
$c_{t}$ is the target coverage level
$t$ is the number of trips in a stratum when the pre-notification for a trip occurs
$i$ is the increment value

## Linear method

In addition to the ability to achieve a target coverage rate and front-loading capacity, the linear method also employed a self-adjusting capacity. The self-adjusting feature allowed the system to adjust the selection probabilities based on the realized coverage rates, thereby providing a correction mechanism if realized coverage rates deviated from the target coverage rates. In the linear method, a linear regression was fit between two control points: a specified maximum selection probability, and a target coverage rate (Equation 4, Figure 6). The control points represented the fixed behavior of any assignment of observer coverage levels; when no trips were observed within a stratum, observer coverage was assigned at the specified maximum selection probability (e.g., 1.0), and when the observer coverage within a stratum was equal to the target coverage level, any additional trips were assigned coverage at a probability equal to the target observer coverage rate. The probability of a trip being selected for coverage at all other points was determined using a simple linear regression. The trip selection probability could not drop below the specified minimum. A minimum level may be desirable for compliance reasons such that even when realized observer coverage levels are high, a vessel operator could expect that there is some probability that the trip will be observed.

$$
\text { [Equation 4] } \quad p=\left[\frac{c_{t}-1}{c_{t}}\right] c_{r}+c_{\max } \quad \text { unless } c_{\min }>\left[\frac{c_{t}-1}{c_{t}}\right] c_{r}+c_{\max } \text {, then } p=c_{\min }
$$

Where:
$p$ is the probability of trip being observed
$c_{t}$ is the target observer coverage level
$c_{r}$ is the realized (actual) coverage level when the pre-notification for a trip occurs
$c_{\text {max }}$ is the maximum selection probability
$c_{\text {min }}$ is the minimum selection probability
The compensatory nature of the linear method attempted to stabilize the realized coverage rate at the target coverage rate as quickly as possible. By setting the minimum coverage rate higher, it limited the ability of the method to compensate for high realized coverage rates.

## Method comparisons and preferred alternative

Both the linear and fixed methods have the tendency to reach the target coverage rate in fewer trips relative to the incremental method (Figure 7). The duration it takes for the linear method to reach the target coverage rate is positively related to the specified minimum coverage rate. The fixed method is susceptible to a large amount of variability when there are few trips within the stratum, but does tend to approach the target coverage rate over time. One drawback to the fixed method is the high probability of having no observer coverage for a stratum when trip counts are low (Figure 8). The lower the target observer coverage rate, the higher the probability of having zero observed trips. This quality may not be desirable, given the likelihood of small stratum sizes ( $<10$ trips) expected under sector management and the desire to move away from the assumed discard rate into an in-season discard rate. Both the fixed and incremental methods achieve approximately normal distribution of stratum coverage (Figures 9 and 10). The self-adjusting nature of the linear method works to reduce the overall variance in the stratum coverage, thereby achieving non-normal distributions.

Unlike the fixed method, both the incremental and linear method have zero theoretical probability of having no observer coverage. However, in practice, all methods have some probability of having no observer coverage. This can occur if the selected observer service provider(s) are unable to deploy an observer on the first trip in a stratum. One benefit of the linear approach is that the probability of selection is based on realized observer coverage, not the total number of trips taken in the stratum. In the event that the first trip within a stratum is not observed, the linear method will assign a probability of 1.0 to the next trip occurring within the stratum. The impacts of provider cancelation were not evaluated in this simulation.

Because of the front-loading aspect of the incremental method and its inability to set trip selection probabilities below the target coverage rate, the realized coverage tends to be biased high relative to the target rate. The effects of the incremental method's front-loading can never be mitigated. These impacts are greatest when there are a low number of trips within the stratum and increase with smaller increment values.

The linear selection method addressed the concerns identified with both the fixed and incremental methods; specifically, the probability of having zero trips within a stratum early on
in the fishing year and a prolonged coverage bias introduced from the front-loading. The lower the minimum coverage rate, the faster the front-loading biases were addressed. Additionally, the self-correcting aspect of the linear method worked to reduce the overall variance in the coverage rates relative to both the fixed and incremental methods. Based on these simple simulations, the linear selection method performed optimally and had all of the desirable properties outlined in the design phase.

## ‘Combined' versus 'separate’ tier relationships

Whenever a trip enters a PTNS selection tier it receives a random value, $r_{\text {tier }}$, ranging from 0 to 1.0. A tier selection probability, $p_{\text {tier }}$, is then estimated using the linear method, and when $r_{\text {tier }} \leq$ $p_{\text {tier }}$, the trip is selected for coverage. When a selection system has more than a single tier, there are two ways that tier selection probabilities can be designed: 'separate' or 'combined'. In a 'combined' system, each trip receives a single $r$ value and the individual tier selection probabilities are cumulative. For example, in a system with three tiers where the target coverage rates of the first, second, and third tiers are $0.08,0.30$, and 0.12 respectively, the target values $(p)$ used within the PTNS are cumulative, such that the first tier is assigned a 0.08 target probability, the second tier is assigned a 0.38 target $(0.08+0.30)$, and the third tier is assigned a 0.50 target $(0.08+0.30+0.12)$. The realized coverage rates necessary to estimate the $p$ value in the linear method are estimated by combining the coverage from all tiers, such that the PTNS only needs to track a single coverage rate for each stratum. The primary advantage of the 'combined' method is that it is relatively simple to implement, since the PTNS only needs to track realized coverage at the stratum level and not for each strata-tier combination. The major disadvantage of the 'combined' method is that in order for it to achieve the target coverage rates for each individual tier, the minimum coverage level specified within the linear method must be set equal to the target coverage rate for all but the last tier (Figure 11), thereby diminishing the compensatory nature of the linear method.

A 'separate' system treats the selection of each tier independently from the rest such that each trip receives an $r$ value for each tier it enters. The target coverage rates are set equal to the desired target and work independent of the coverage in all other tiers. To implement this design, the PTNS must track coverage rates for each strata-tier combination. In this sense, a 'separate' system is more complicated to implement; however, the major advantage of the 'separate' system is that the minimum coverage level can be set to any desired value to maximize the compensatory nature of the linear method (Figure 11).

The performance of the two system designs was evaluated using simple multi-tier simulations. These simulations were built on the initial single-tier simulation code. Simulations were done using both two- and three- tier systems, with the tier coverage rates for tiers one, two, and three set at $0.08,0.30$, and 0.12 respectively. The coverage rates were chosen based on anticipated target coverage rates for the NEFOP and NMFS-funded ASM in fishing year 2010, and an arbitrary value was chosen for industry-funded ASM coverage. Example runs from the
simulations are shown in Figure 12. In the 'combined' system, there is a notable high bias that persists in the lowest tier (tier 1) for several trips. This effect is similar to what was observed in the incremental selection method. Since the minimum coverage level must be set to the target coverage level, the 'combined' system is very much like the incremental method in the sense that it has no mechanism to compensate for the initial high coverage induced by the front-loading. The high bias in the lowest tier is offset by below-target coverage in tiers two and three. Additionally, because of the diminished ability of the 'combined' system to self-correct coverage in excess of the target coverage rate, the system is slow to respond to perturbations as occurred in tier 2 of the three-tier example. This perturbation negatively impacted the ability of the system to meet the coverage requirements of tier 3 . Conversely, the 'separate' system equilibrates to the target coverage rates for all tiers relatively quickly, and perturbations from the target are minimal. A 'separate' system allows the PTNS to take full advantage of the compensatory nature of the linear selection logic, and also ensures that perturbations affecting one tier are isolated and do not affect the other tiers.

When the PTNS was first implemented on May 1, 2010, it was based on the 'combined’ design. The choice in design was purely pragmatic, based on the short amount of time available to design, build, and implement the initial system. It was recognized from the beginning that a 'separate' system would be optimal, but it was believed that there was insufficient time to implement a system with that complexity in the initial design. During the first year, work began to revise the PTNS to incorporate the 'separate' design, with the revised system implemented at the start of the 2011fishing year.

## Observer avoidance and coverage equitability

When the PTNS was first implemented on May 1, 2010, it contained no mechanism to address the intentional avoidance of observer coverage by vessels. Shortly after implementation it became clear that some vessels were avoiding observer coverage by canceling trips scheduled for observer coverage at proportions higher than trips not scheduled for observer coverage. In August 2010, the PTNS was redesigned to fix this loophole. The redesign forced vessels that cancelled trips scheduled for observer coverage to be automatically selected for observer coverage on all subsequent trips until a trip had been covered by an observer. The design was intended to reduce the incentive to cancel trips scheduled for observer coverage and ensure more equitable coverage across all vessels. This solution created a new sub-tier within each of the probability based tiers which was termed 'must deploy.' This was a list tier such that anytime a vessel canceled a trip scheduled for coverage, it would be placed on the 'must deploy' list corresponding to the type of coverage that was canceled. For example, if a trip selected for NEFOP coverage was canceled, the vessel would be added to the NEFOP 'must deploy' sub-tier. The next time a trip from the vessel entered the NEFOP selection tier, it would be checked against the list prior to undergoing random selection. If the vessel was listed, the trip would automatically be selected for NEFOP coverage. Once a vessel successfully carried an observer following placement on the 'must deploy' list, it would be removed from the 'must deploy' list at
all levels. If a vessel canceled trips at multiple tiers prior to carrying an observer, it could be placed on the 'must deploy' list for multiple tiers. The PTNS would recognize a vessel as having carried an observer once a provider had indicated within the PTNS that an observer had been deployed on a vessel.

The redesign was effective at forcing vessels that were attempting to avoid coverage to carry observers. Unfortunately, the redesign negatively impacted compliant vessels that were not intentionally avoiding observer coverage, but rather legitimately attempting to fish around weather windows, crew availability, etc. These impacts were exacerbated during the winter fishing months, when 'day-boat' vessels (i.e., small vessels which typically take trips $\leq 48$ hours) were forced to cancel a higher proportion of declared trips due to inclement weather. As a result, active, compliant 'day-boat' vessels ended up experiencing observer coverage well in excess of the target coverage rates in fishing year 2010. A more effective means of addressing observer avoidance that did not penalize compliant vessels was needed.

Prior to the start of the 2011 fishing year, work began to develop improved methods of dealing with observer avoidance without negatively impacting compliant vessels. The need to delay notifying the vessel of the PTNS trip selection until 48 hours prior to the sail date was identified. Frequently, 'day-boat' vessel operators would make trip declarations in weekly batches and notify their intent to fish every day in the coming week, not knowing which days would offer favorable sea conditions and/or an available crew. Once the operator had a better understanding of sea conditions and crew availability, they would cancel notifications for trips on which they did not intend to sail, a process that was often done in advance of the 48 -hour notification requirement. In the initial PTNS design, vessel operators were informed immediately after declaration which trips were scheduled for coverage. This allowed the vessel operators to consider an additional piece of information when deciding which trips to take or cancel; this was particularly true of those vessels looking to avoid observer coverage. To address this, the PTNS was modified so that vessel operators were not informed of the selection status of a given trip until 48 hours prior to the trip sail date (the PTNS still made the selection at the time of entry, but notification was delayed). Any cancelations made prior to the 48 -hour period would be done without knowledge of the coverage status; therefore, trips canceled outside of the 48-hour window would not be subjected to subsequent 'must deploy' targeting.

For those vessels that canceled trips within the 48-hour window, the goal was to identify only vessels that were intentionally avoiding observer coverage; however, identifying these vessels proved difficult. Since PTNS operates at the stratum level and not at the individual vessel level, any vessel that has received below-target coverage must be offset by one or more vessels with above-target coverage within the same stratum. From a system operation perspective, it is irrelevant whether the low coverage was due to random chance or intentional avoidance of observer coverage through selective cancelation; both causes affect all other vessels within their stratum identically. Rather than attempting to identify vessels intentionally avoiding observer coverage, the solution envisioned would simply target all low-coverage vessels that cancelled
trips scheduled for observer coverage. This would require significant changes within the PTNS to enable it to track individual vessel coverage levels, and then be able to utilize this information to determine whether a vessel would be subject to 'must deploy' assignment following cancelation of a trip scheduled for observer coverage.

In an effort determine appropriate 'low coverage' threshold values, a modeled version of the PTNS was created to simulate its performance under varying levels of low-coverage thresholds. The modeled PTNS was more sophisticated than earlier PTNS simulation models, in that it accounted for provider cancelations and allowed for differential vessel cancelation rates. Additionally, it categorized vessels into two groups: 'compliant' and 'non-compliant.' Compliant vessels were those that canceled trips scheduled for observer coverage at the same rate they canceled trips receiving a waiver. Non-compliant vessels were identified as those with higher cancelation rates on trips scheduled to carry an observer compared to trips receiving a waiver. While both compliant and non-compliant vessels would be targeted for canceling observer coverage when their overall coverage rate was below the threshold value, the identification of the two groups assisted with understanding how the PTNS modifications would affect each group. The modeled PTNS lacked one important component compared to the actual PTNS: trips were entered individually and not in weekly blocks as is common among 'day-boat' vessels. Therefore, the graduated notification aspect of the proposed redesign was not considered in these simulations.

Simulation runs were performed using actual PTNS notifications from the 2010 groundfish fishing year. The simulated population was created from a real stratum (sector, gear, fishing region) containing several active 'day-boat' vessels. Only the first 1000 trips from the selected stratum were included in the simulations. Because the simulated set was constructed of actual PTNS notifications, the individual vessel behavior (cancelation rates, compliant vs. noncompliant, total trips declared, etc.) was self-determined from the data. Three separate simulations were performed using three different 'low-coverage' threshold values. In all simulations the provider decline rate was fixed at $10 \%$ (i.e., the selected provider decline $10 \%$ of the trips initially offered). The simulated PTNS included a single tier with a target coverage rate of $30 \%$ and a minimum selection rate of $1 \%$. Each simulation was run through 250 iterations. The selected low-threshold coverage levels were $0 \%, 30 \%$ (equal to the target), and $100 \%$. The $0 \%$ low-coverage threshold provides a simulation of the initial May 1, 2010 PTNS design, where vessels were not targeted following the cancellation of a trip scheduled for an observer. The $100 \%$ low-coverage threshold provides a simulation of the PTNS post August 2010, when vessels were targeted following the cancelation of a trip scheduled for observer coverage regardless of their current coverage rates or coverage status. Setting the low-coverage threshold equal to the target coverage (30\%) represents a compromise between the two systems.

The results from the simulations indicate that setting the low-coverage threshold equal to the target coverage (30\%) produced the least biased overall stratum coverage with respect to the interquartile range (Figure 13). Comparatively, the $0 \%$ threshold and $100 \%$ threshold tended to
produce biased low and high coverage, respectively. Under all three simulations, the distribution of stratum coverage tended to be above target until 10 to 25 trips had occurred in the stratum. These results are consistent with single-tier simulations of the linear method (Figure 7), reflecting the residual effects of front-loaded coverage. The stratum coverage rates stabilized around 75 trips under all three simulation scenarios.

Setting the low-coverage threshold equal to the target coverage produced the most equitable distributions of vessel-level observer coverage relative to the $0 \%$ and $100 \%$ thresholds (Figure 14). The $0 \%$ threshold does nothing to affect the non-compliant vessels, which subsequently experience coverage rates much lower than the target $30 \%$. The compliant vessels tend to have above-target coverage, which is needed to meet overall stratum targets given the low coverage of non-compliant vessels. The $100 \%$ low-coverage threshold results in above-target coverage for all vessels, regardless of status, since all vessels are penalized for cancelation of trips scheduled for observer coverage, regardless of their realized coverage rate. When the low-coverage threshold was set equal to the target, the median coverage of non-compliant vessels was below-target; however, the interquartile range of most of the non-compliant vessels extended above the target level. Median coverage of non-compliant vessels tended to approach the target with increasing activity. For compliant vessels, the opposite was true, with slightly elevated coverage for lowactivity vessels and near-target coverage for higher activity vessels. Overall, the variability in coverage declined with increasing vessel activity. A general conclusion from this is that there is some degree of system acclimation required before the compliance aspect of the PTNS has an effect; e.g., with a limited number of trips, low-activity compliant vessels tend to experience above-target coverage and non-compliant vessels tend to experience below-target coverage. The acclimation period is most likely attributable to providers declining trips that were selected by the PTNS for coverage, thus reflecting actual conditions under which the PTNS operates. Since not all trips selected for coverage will receive coverage, some amount of time is required for any coverage adjustments to be effective, whether the adjustments are due to the compensating nature of the linear method or are an attempt to address low-coverage through coverage thresholds.

Given the general lack of bias and reduced variability properties of the $30 \%$ low-coverage threshold, a second simulation exercise was performed examining how a system would perform with a minimum trip criterion. Under this simulation, the coverage thresholds were not applied until a vessel had taken more than 10 trips. This minimum trip criterion was based on the knowledge that there is a high degree of random variability among the coverage of vessels that have only taken a few trips. This compares to the first simulation exercise which focused on achieving equitable vessel-level coverage regardless of a vessel's activity level. The results of this second simulation suggest that a minimum trip criteria of 0 results in median unbiased stratum coverage, whereas the median coverage tended to be below-target under the 10-trip minimum scenario (Figure 15). The explanation for these results can be seen in the coverage distributions of the individual vessels (Figure 16). Since most of the non-compliant vessels in
this simulation were low-activity vessels, there was little opportunity for the PTNS to positively affect their coverage. Consequently, the median coverage of compliant vessels tended to be slightly higher under the 10-trip minimum scenario.

Based on the collective simulation results, the PTNS was modified to use a low-coverage threshold equal to the target threshold with no minimum trip requirement. Setting the lowcoverage threshold equal to the target coverage rate was expected to reduce the likelihood that vessels not intentionally attempting to avoid observer coverage would experience excessively high observer coverage, without negatively impacting the overall stratum coverage rates. Additionally, treating all low-coverage vessels equally, regardless of the number of trips a vessel had taken, would ensure more equitable vessel-level coverages and a higher probability that the realized strata coverage rates would be equal to the specified targets.

## Provider selection

Unlike NEFOP coverage, where the service provider contract is issued to a single provider, the ASM contracts (either NMFS or industry-funded) could potentially be issued to multiple providers. For tiers where multiple providers could exist, a systematic method was needed to offer trips to individual providers in an objective manner. Additionally, there was a desire to offer individual ASM trips to multiple providers on a given trip to increase the likelihood that an observer would be assigned to each trip selected for ASM coverage.

The agreed-upon solution for assigned coverage types where multiple providers existed was to apply a weighted probability selection to identify two service providers for each trip (provider 1 and provider 2). The probability of provider selection would be proportional to the number of certified observers each provider had in service at the time of the notification. This is a variant of probability-proportional-to-size (PPS) sampling, with the selection performed sequentially without replacement (select provider 1, remove it from the provider list, select provider 2 based on recalculated proportions). Under this selection process, provider 1 would receive the right of first refusal, and if provider 1 declined the trip or failed to accept the trip in a specified amount of time, the trip would then be offered to provider 2.

The provider selection process is performed based on the following six steps (ASM coverage has been used as an example for any coverage selection where multiple providers exist):

1. Assign each trip selected for ASM coverage a random number, $\mathrm{r}_{\mathrm{provider}}$, between 0 and 1 .
2. Calculate the proportion of observers each provider has relative to the total number. *Note that provider observer counts are updated within the system on a regular basis (e.g., monthly).
3. Order the providers based on the proportion of monitors and calculate the cumulative proportions.
4. Select the provider where $r_{\text {provider } 1} \leq$ the provider's cumulative proportion, but greater than the provider with the next lowest cumulative proportion. This provider becomes
provider 1 (see example in Table 2: if $r_{\text {provider }}=0.294$ then provider 2 would be selected as ASM provider D).
5. Remove the selected ASM provider 1 and recalculate the cumulative proportions (repeat steps 2 and 3).
6. Select the provider where $r_{\text {provider }} \leq$ the provider's cumulative proportion, but greater than the provider with the next lowest cumulative proportion. (see example in Table 2: if $r_{\text {provider }}=0.294$ then provider A would be selected as ASM provider 2).

## SYSTEM IMPLEMENTATION AND PERFORMANCE

The PTNS was initially implemented on May 1, 2010. Between the start of the 2010 fishing year and end of the 2012 fishing year, the PTNS has undergone eight revisions, three of which represent major modifications (Table 3). The current system has been in place since May 2, 2011. The section below describes the major components of the PTNS.

## System components

There are five major components to the PTNS production system (Figure 17). The most visible aspect of the PTNS is the web-based graphical user interface, or GUI (Figure 18). The webbased GUI is written with the following scripting languages: Perl, PHP (hypertext preprocessor), JavaScript, and jQuery. The application runs on an Apache web server located outside the NEFSC firewall with a Linux CentOS operating system. The purpose of the user interface is multi-faceted; it is used by vessel representatives (e.g., owners, operators, sector managers), observer service providers, and PTNS staff. The primary function of the PTNS user interface is to allow vessel representatives to make initial trip declarations as well as to view and edit pending trips; however, not all vessel operators use the web-based application directly. A fraction of the groundfish fleet submits their trip information to on-duty PTNS staff either through a toll-free telephone number or via email. A PTNS staff member then enters the trip information on behalf of the vessel representative. Regardless of the submission method, all trips are ultimately entered through the web-based application either by a vessel representative or PTNS staff. The web interface is also used by observer service providers to manage offered trips and report vessel assignments. All trip entries and changes made through the GUI write directly to an Oracle database.

Vessels that intend to fish in the groundfish (multispecies) fishery, and hold either a multispecies category D (hook gear), F (large mesh individual DAS), E (combination), K (open access), or A (individual DAS) permit, are required to notify their intent to take a groundfish trip through the PTNS at least 48 hours in advance of sailing. When making an initial trip declaration, the vessels must login with the vessel permit number and a personal identification number (PIN). This allows the system to identify the vessel as well as the groundfish sector to which it belongs, since there is a unique relationship at any given time between a vessel and groundfish sector. The vessel must provide the PTNS with the following information: anticipated sail date and time, estimated trip duration, port of departure, the type of gear that will be used on the trip, and the
general fishing region (regions shown in Figure 2). Additionally, the vessel must indicate if it intends to fish in an SMP, since some SMPs have separate observer coverage levels that must be achieved in addition to the baseline coverage required for the groundfish fishery.

The PTNS utilizes two separate Oracle databases (PTNS components two and three; Figure 17). The first Oracle database resides outside the NEFSC firewall and serves as the principal production database for the PTNS GUI. The second database is located inside the NEFSC firewall and serves as the master PTNS database where all the core support tables originate. The master database has established database links to other core fisheries-dependent data collection programs to ensure the consistency of data content and coding schemes across systems. If, for example, changes are made to a vessel's permit status through the Permit System, it would automatically be reflected in the PTNS master database. The master database also serves as an archive of the data collected and managed in the production system; Procedural Language/Structured Query Language (PLSQL) procedures execute hourly to backup the core data entry tables from the production system. Nightly, PLSQL procedures push support table updates from the master to the production database.

The fourth component of the PTNS is a set of Perl cron jobs, which run every 15 minutes on the Apache web server (Figure 17). The cron jobs are responsible for making database edits to vessel and provider status selections as well as the sending of automated email notifications whenever any of the system time thresholds have been crossed (Figure 19). Fishing trips can be declared up to nine days prior to the date of sailing, but must be declared at least 48 hours prior the scheduled sail date. The vessel is not informed of a trip's preliminary selection status at the time of notification; 48 hours prior to the trip sail date, the cron job changes the trip status from 'pending' to either 'waived' or 'selected for observer coverage,' based on the results of the selection process that occurred when the trip was entered. An email is then automatically sent to the vessel notifying it of its selection status. If the trip was selected for coverage, an email is also sent to the selected observer provider. In the case of trips scheduled for NEFOP coverage, the provider will have 24 hours to make a determination as to whether or not it will deploy an observer on that trip. In the event the provider does not make a determination within the 24 -hour window, the cron job will automatically decline the trip for the provider, issue the vessel a waiver, and notify the vessel via email. In the case of trips scheduled for NMFS-funded ASM coverage, the first provider has 12 hours to make a determination as to whether or not it will deploy an ASM for the trip (from 48 hours prior until 36 hours prior to the trip sail date). If provider 1 either declines the trip or fails to act within the 12-hour window, the trip is offered to provider 2. Provider 2 then has until 24 hours prior to the trip sail date to make a selection determination. If provider 2 fails to act, at the end of the 24 -hour window the vessel will be issued a waiver and notified via email.

The fifth component of the PTNS is a web-based reporting and monitoring utility. The chief function of this utility is to provide a PTNS system administrator with a near real-time understanding of system performance and industry usage (i.e., a system dashboard). In addition
to providing general information on system performance, it also tracks several areas of vessel compliance. The web-based reporting and monitoring utility was developed using SAS (Cary, NC) and runs daily. Several minor database maintenance procedures are controlled automatically through the SAS code, including the maintenance of the 'keep active' and 'do not deploycoverage’ list tiers.

## System performance over time

There are two primary objectives of the PTNS: 1) optimize the sea days allocated to the fishery in a given contract year; and, 2) distribute the available sea days in a manner that provides unbiased observer coverage of the fishery (i.e., proportional to fishing activity). Annually, the PTNS is budgeted a fixed number of NEFOP and NMFS-funded ASM sea days for coverage of the groundfish fishery (e.g., NEFSC/NERO 2012). These allocated sea days represent the total number of sea days the PTNS has available for each contract year. Provider contract years run from April 1 to March 31 and therefore do not entirely overlap with the fishing year. From this allocation of sea days, an estimate is made to establish interim coverage rates for use in the PTNS at the start of each contract year. These estimates are based on the budgeted sea days and an expectation of the coming year's fishing activity. The interim target rates are usually adjusted soon after the start of the year based on a close monitoring of the sea day burn rate (i.e., rate at which sea days are being utilized) by a system administrator. Using the PTNS web-based reporting and monitoring utility, the system administrator evaluates the sea day burn rates of both NEFOP and NMFS-funded ASM sea days relative to two factors:

Constant burn trajectory: This provides a general overview of the sea day burn rate and indicates whether sea days are being burned too fast (the sea day budget will be exceeded before the end of the year) or too slow (a surplus of sea days will remain at the end of the year). If fishing activity were constant throughout the year, then the PTNS target rates would only have to be adjusted to maintain a constant sea day burn; however, there are temporal variations in fleet activity throughout the year and it is critical that sea day burns are controlled to ensure that observer coverage is temporally unbiased.

Comparison of the current year's fishing activity to that of the previous year: This provides the administrator with an indication of the expected seasonal trends in the fishery based on previous fishing years, as well a gauge of whether the current year's fishing activity is higher or lower relative to previous years (Figure 20). Both are taken into consideration and used to make adjustments to the PTNS target coverage rates which control the sea day burn rates.

The target coverage rates used in PTNS often have little bearing on the realized coverage rates. They can be considered unitless accelerator/decelerator knobs. For example the PTNS NEFOP target coverage rate may have to be adjusted to 0.15 (15\%) to achieve a specific burn rate, which may result in a realized observer coverage of $6 \%$. A number of factors affect the relationship between the target coverage rates, burn rates, and realized observer coverage, although one of the
most common factors is the number of observers/monitors currently available for the groundfish fishery and the subsequent provider decline rates. For example, if $100 \%$ of available observers are being assigned to trips and yet the sea days are still being under-burned, subsequent increases to the target coverage rates will not increase the sea day burn rates or realized coverage rates. Given the complexities of running the PTNS, one should avoid preconceived notions about expected coverage rates that were established at the start of the fishing year based on the total allocated sea days. The realized coverage rates at the end of the year will be contingent on the number of sea days initially allocated, the activity of the groundfish fishery, and the availability of observers/monitors.

The following sections will describe the performance of the PTNS in years 2010 through 2012 relative to meeting its two primary objectives: utilization of the allocated sea days and unbiased observer coverage of the fishery.

## Sea day burn rates, target coverage rates and trip selection probabilities

In contract years 2010 through 2012, over $90 \%$ of the allocated NMFS-funded ASM sea days were utilized annually, with the sea day burn exceeding the allocated sea days in 2011 ( $1 \%$ overage; Table 4, Figure 21). In contract years 2010 through 2012, 80-99\% of the NEFOP sea days were utilized. The magnitude of the NEFOP sea day under-utilization in 2010 ( $85 \%$ utilization) and 2011 ( $80 \%$ utilization) is undesirable, though the reasons for the under-utilization vary by year. PTNS target coverage rates were adjusted over time in an effort to optimize the sea day utilization (Figure 22). Modifications to the PTNS target coverage rates impact the relationship between trip selection probabilities and realized stratum coverage, consistent with the linear selection design of the PTNS (Figure 23). Changes to PTNS target coverage rates affect the slope of the relationship between the trip selection probability and the realized stratum coverage; as PTNS target coverage rates are increased, the trip selection probability for a given realized stratum coverage increases. Consistent with the self-adjusting design of the PTNS, at a fixed PTNS target coverage rate the trip selection probabilities vary linearly, depending on the current realized coverage for each stratum. It is important to note that from May 2010 to April 2011, the trip selection probabilities for the NEFOP tier were capped at the target due to the combined tier design.

In 2010, the realized coverage rates for the NEFOP tier were generally in excess of the PTNS target coverage rates (Figure 24). Typically, when realized coverage rates exceeded the targets, the system would compensate by lowering the trip selection probability. However, due to the combined tier design of the 2010 PTNS, the minimum coverage rate of the NEFOP tier had to be held equal to the target coverage rate, which negatively impacted the compensatory capabilities of the PTNS. Because the realized coverage rates were in excess of the PTNS NEFOP targets, it is highly likely that the system could have achieved higher coverage rates had the target rates been increased. This would have improved the utilization of NEFOP sea days in 2010. Target coverage rates were not increased for the NEFOP tier until around November 1 (Figure 22), and
only from 0.08 to 0.10 . The target coverage rates for the NEFOP tier in 2010 should have been increased earlier in the year to better utilize the allocated NEFOP sea days.

In 2011, the NEFOP sea day burn slowed about the same time as in 2010 (approximately June 1). The similarities in timing may be coincidental, or they may relate to the deployment of NEFOP observers in other fisheries. The service provider for NEFOP observers is instructed to offer preference to certain non-groundfish fisheries when demand for observers is high. Increased activity in other fisheries, such as herring, which tends to increase in early summer, may compete with the groundfish fishery when the number of observers is limited. Unlike 2010, the 2011 NEFOP target coverage rates were continually increased beginning in early July (Figure 22), in an effort to counteract the slow burn. The increased target coverage rates had little impact on the sea day burns (Figure 21). During this period, the PTNS was exhibiting signs of system stress: realized coverage rates dropped below target coverage rates and the trip selection probabilities spiked in excess of 0.30 (Figure 24). Despite the increased probability of trip selection, the PTNS was unsuccessful in increasing the sea day burn to a level that would fully utilize the allocated NEFOP sea days. The unresponsiveness of the sea day burn to increases in target coverage rates is symptomatic of there being too few observers to fully utilize the allocated NEFOP sea days (i.e., observer saturation). A comparison of the percentage of PTNS trips selected at the NEFOP tier in 2011 (40.0\%) to the percentage observed (7.3\%) further illustrates the impacts of observer saturation (Table 5); i.e., in an effort to increase the burn of NEFOP sea days, the PTNS was assigning trips for NEFOP-level coverage at a rate 5.5 times that which could actually be achieved by the available NEFOP observers.

Interestingly, the PTNS also exhibited signs of stress in 2011 with respect to the coverage of the NMFS-funded ASM tier: realized coverage rates were generally below target coverage rates, and there were large increases in the trip selection probabilities (Figure 24). However, unlike the NEFOP tier, the allocated sea days for the NMFS-funded ASM tier were fully utilized (Figure 21). Similar to what was done for the NEFOP tier, target coverage rates were increased early in the fishing year in response to an under-burn of sea days. Unlike the NEFOP tier, the system was responsive to the increase in target coverage rates and the sea day burns increased to a level consistent with full utilization (Figure 21). It is notable that the NMFS-funded ASM target coverage rates remained at 0.45 for the majority of fishing year 2011, yet the 0.45 target only achieved a realized coverage of 0.195 (Table 6). The discrepancy between PTNS target coverage rates and realized coverage rates can be partially explained by provider declines of offered trips. Not all trips offered to providers are accepted, so there is not a $1: 1$ relationship of PTNS trip selection probabilities and realized coverage. This highlights a point made previously: the PTNS target coverage rates have little bearing on the realized coverage rates and should be considered in terms of unitless accelerator/decelerator knobs and not as indicators of the realized coverage rates.

## Observer coverage rates

A primary objective of the PTNS is to distribute the available sea days in a manner that provides unbiased observer coverage of the fishery such that it is proportional to fishing activity. Evaluating the coverage achievements of the PTNS can be done either using data internal to the PTNS or from external sources (Vessel Monitoring System, or VMS, activity declarations, observer data, etc.). The optimal performance of the PTNS is contingent on the accuracy of the self-reported information contained within it; most importantly, the PTNS estimates of the realized strata coverage rates. This requires that the PTNS data accurately reflect how many total groundfish trips are taken and how many are observed. Unfortunately, there is no unique trip identifier to link PTNS trip declarations to the other fisheries-dependent data sources used to monitor the groundfish fishery. Absent a trip identifier, the PTNS cannot communicate directly with the other fisheries-dependent data collection systems to verify the accuracy of its information.

While there is no direct communication between the PTNS and other fisheries-dependent systems, the information contained in other data collection systems can be used to verify externally the accuracy of PTNS data and evaluate system performance. External verification methods such as matching on the vessel permit number and sail date are often useful; however, the match between the PTNS-declared sail date and actual sail date is inexact and often off by as much as 48 hours. Due to the inability to directly match trips, validation is limited to an examination of the total number of trips taken and observed. An additional issue in externally verifying PTNS information is the difficulty in identifying strata in the VMS activity declaration. Vessel operators must submit a groundfish activity declaration via VMS to NMFS prior to sailing on every groundfish trip. The activity declaration offers the only definitive way to classify groundfish versus non-groundfish trips from a regulatory perspective. Vessel identity, and by extension sector affiliation, can be determined from the activity declaration; however, determining the other criteria of the strata definition - gear category and fishing region - is difficult and imprecise. For this reason, attempts to validate the PTNS-realized strata coverage are inexact and not altogether useful. However, because vessel- and sector-level coverage can be verified using observer data and VMS activity declarations, a gross examination of the PTNS information can be conducted at these levels. These will be discussed in subsequent sections.

## Impacts of trip cancelations on PTNS trip counts

It is critically important that the PTNS maintains an accurate accounting of the true number of groundfish trips taken. This also applies to an accurate accounting of the number of trips not taken. Given the need to fish around weather windows, crew availability, and equipment malfunctions, it is often difficult for vessel operators to determine 48 hours in advance whether they will fish on a particular day. Vessels operators will often declare trips in weekly batches while only actually sailing on a fraction of the declared days, to maintain flexibility given the 48hour pre-trip notification requirement. While this practice is allowed, it is required that the vessel cancel all PTNS notifications for trips not taken. The non-cancelation of trips negatively impacts

PTNS performance by inflating the total trip count, effectively lowering the PTNS-estimated realized coverage.

Trip cancelations are particularly common among the 'day-boat' fleet, which generally comprises smaller vessels that are more sensitive to inclement weather. The cancelation rates for day trips were consistently four to six times higher than that of multi-day trips (trip duration >48 hours; Figure 25). There is a seasonal cycle to the cancelation rates of day trips, with cancelation rates lowest during the summer months and highest in the winter months, consistent with the need to fish around weather windows. Interestingly, there are no consistent seasonal cycles for multi-day trip cancelations. The September 2, 2010 release of the PTNS (Table 3) required a major change in the underlying database such that trip-type (i.e., day, multi-day) cannot be reliably tracked prior to that release. Despite the partial information for 2010, there is a notable increase in the cancelation rates of day trips from 2010 to 2011. This does not reflect a true increase in the fraction of declared trips that did not sail; rather, it reflects efforts taken by the NEFSC Fisheries Sampling Branch (FSB) staff to improve communication and outreach with the fishing industry on the need to cancel trips not taken, as well as improved monitoring of noncanceled trips. This pattern can also be seen in a comparison of PTNS-declared trips to VMSdeclared trips that will be discussed in the next section.

## Comparison of external and internal vessel-level coverage

Comparison of the internal PTNS estimates of total trip counts, observed trips and coverage rates to those from external sources is critical to evaluating the performance of the PTNS. Overall, the PTNS estimates of number of observed trips compare closely with the true number of observed trips on a vessel-by-vessel basis (Figure 26). Because the determination of whether a trip was observed is based on information provided by the service providers, who are contractually obligated to enter the information, these data within the PTNS generally tend to be of a higher quality than the data input by the fishing industry. There are slight differences between the PTNS and external observer data, though these are small, with most vessels falling close to the $1: 1$ identity line. There is greater variability between the PTNS estimates of groundfish trips and those estimates from VMS data, though the variability has generally decreased with each successive fishing year. The large numbers of vessels above the $1: 1$ identity line in 2010 indicate those vessels having a high incidence of not canceling PTNS notifications for trips that did not sail. Vessels falling below the $1: 1$ identity line represent vessels failing to notify all groundfish trips through the PTNS. Interestingly, the number of vessels where VMS declared groundfish trips exceeded the number of PTNS notifications has increased over time (137 vessels in 2010, 187 vessels in 2011, and 197 vessels in 2012). While this could indicate declines in general PTNS compliance, the trends could be obscured by improvements in PTNS trip cancelations; for example, non-cancelation of PTNS trips could be offsetting non-notifications.

Overall the PTNS estimates of vessel coverage rates relative to the observer/VMS-based realized coverage rates have generally improved over time. In addition, the level of variability in the coverage rates among vessels decreased considerably from 2011 to 2012. The decrease in the
variability in vessel-level coverage will be explored in depth in a subsequent section. While improvements have been made over time in the level of agreement between PTNS- and externally-estimated vessel coverage, there are several vessels in fishing year 2012 that exhibit much higher internal PTNS coverage rates relative to the observer/VMS-realized coverage. The most likely explanation for these discrepancies is failure to declare all groundfish trips through the PTNS. As will be shown in the next section, these vessels are not spread homogenously throughout the fishery, but rather have a tendency to belong to certain groundfish sectors. These types of patterns can be improved in the future through targeted outreach and enforcement.

## Comparison of external and internal sector-level coverage

A comparison of the PTNS estimates of sector-level coverage to those obtained externally from observer and VMS activity declarations show similar patterns to the vessel-level comparisons. In fishing year 2010, there was a tendency for PTNS coverage estimates to be lower than the observer/VMS-based estimates for all but four sectors (Figure 27). As with the vessel-level coverage, the most likely reason for the lower coverage rates estimated internally within the PTNS is the non-cancelation of trips that were declared but never sailed. In both 2011 and 2012 fishing years, there was greater consistency between the PTNS estimates of sector coverage and those obtained from observer data and VMS activity declarations. This can be directly attributed to improved compliance and monitoring of non-canceled trips. The variability in coverage rates between sectors was considerably reduced from 2011 to 2012. This is consistent with the patterns observed in the internal individual vessel coverage rates. The decrease in variability reflects directed efforts to ensure equitable observer coverage across all vessels. Examination of the distribution of vessel coverage within individual sectors highlights this point (Figure 28); the size of the interquartile ranges has decreased over time, and there is less spread in the mean and median sector-level coverage rates around the overall mean.

In all years, there are one to three sectors where the PTNS has estimated much larger observer coverage rates relative to the realized observer/VMS-based coverage (Figure 27). The cause of these discrepancies is failure to declare groundfish trips through the PTNS (i.e., non-compliance with the PTNS notification requirement). One sector - the common pool - is responsible for a moderately large number of trips in each of the fishing years and represents the most egregious offender. While efforts have been made to reach out this component of the fishery, without directed enforcement of PTNS notification requirements there is little that can be done to improve compliance.

Interestingly, there are seasonal trends in the degree of compliance with the PTNS notification requirement. Overall, there is lower PTNS compliance in April and May and peak compliance July through September (Figure 29). The seasonal trends are related to fishery activity, with the compliance trends being negatively correlated with the level of targeted monkfish activity (Figure 30). Monkfish-targeted behavior (i.e., fishing on a monkfish DAS) can be determined from the VMS activity declaration. Groundfish vessels fishing on a multispecies DAS but targeting monkfish are still subject to all groundfish reporting requirements, including the filing
of a PTNS notification. Based on the relationship between vessel compliance and monkfishtargeted activity, it appears that the industry is not entirely cognizant of their groundfish reporting requirements when fishing simultaneously on both monkfish and groundfish DAS. One aspect to the low PTNS compliance among the common pool vessels is that, proportionally, a much larger fraction of common pool trips are targeting monkfish compared to sector vessels. Between 2010 and 2012, greater than $56 \%$ of common pool trips were fishing on monkfish DAS, compared to less than $11 \%$ of sector trips (Table 7). Common pool compliance with the PTNS notification requirement ranged from 69-76\% when not fishing on a monkfish DAS (targeted groundfish trip), but less than $15 \%$ when fishing on a monkfish DAS. Comparatively, the compliance rate among sector vessels was greater than $79 \%$ when fishing on a monkfish DAS and greater than $89 \%$ when not fishing on a monkfish DAS.

## PTNS internal strata-level coverage

While it is nearly impossible to accurately verify internal PTNS strata-level coverage using external sources, given the limitations of the NMFS's Northeast Region's fisheries-dependent data collection systems, the sector- and vessel-level comparisons have shown that, overall, the data contained in the PTNS provides an accurate representation of the realized coverage rates for the majority of groundfish vessels. This provides confidence in the internal PTNS data and allows inferences to be made about the strata-based coverage using only internal PTNS data. The distribution of strata-level coverage for the NEFOP and NMFS-funded ASM tiers is consistent with the expected system performance, based on the simulation results shown in Figure 7. There is high variability for strata with limited numbers of trips, but the variability decreases with an increasing number of trips, with strata-level coverage converging on the mean tier coverage as the number of trips increases (Figure 31). Annual estimates of tier-level coverage are provided in Table 6. Overall, at the strata-level the PTNS has performed consistent with the system design.

Despite the front-loading nature of the PTNS, there are a large number of strata with no observer coverage (Figure 32). While there may be a large number of strata, it is important to consider that they are not all highly active. In 2010 through 2012, there were 429, 316, and 195 trips, respectively, among strata that received no observer coverage. Relative to the total number of trips that occur in the groundfish fishery (Table 6), these represent less than $3.5 \%$ of the total annual trips.

## Examination of alternate coverage metrics

The sampling unit of the PTNS is a fishing trip, and the target coverage rates are evaluated with respect to the ratio of observed trips relative to total trips occurring within a defined stratum. Other sampling frames/coverage metrics, such as days absent or total groundfish landings, while useful to evaluate, are difficult to define at the point of trip notification and therefore impractical for use in PTNS coverage selection. However, if the trip-based coverage is accomplished in an unbiased manner, coverage should be similar regardless of the metric used to evaluate it. As part of the PTNS web-based monitoring utility, coverage of both days absent and groundfish landings are regularly monitored.

The distribution of sector-level days absent-, groundfish landings-, and trip-based coverage were compared to the aggregate annual (fishing year total) trip-based coverage to determine the uniformity of observer coverage across alternate coverage metrics and evaluate whether there was evidence of temporal bias. Aggregate annual coverage levels are provided in Table 6. Between 2010 and 2012, the aggregate annual trip-based coverage levels were within +/- 1 standard deviation of the weekly mean (mean across sectors) of all three coverage metrics (Figure 33). The degree of variability in weekly coverage rates over time is consistent with the expectation from the simulation experiments. As time progresses and more trips enter the PTNS, the variability in the realized coverage generally decreases. Overall, there is little evidence of large-scale temporal biases in the rates. There was little fluctuation of the coverage rates after stabilizing around week 8 of the fishing year, with weekly mean rates similar to the overall annual trip-based coverage. Coverage based on days absent was slightly higher than the annual trip-based coverage in 2010 and 2011. This suggests that observed trips tended to be slightly longer than unobserved trips in these fishing years, though the cause of this pattern is unclear.

## External evaluation of vessel-level coverage

PTNS is designed to provide equitable coverage across strata (sector, region and gear category) with sampling within individual stratum being random. This means that the linear selection method of the PTNS does not explicitly attempt to deploy coverage equitably among vessels. However, because coverage at the vessel level should be random, the vessel-level coverage at any particular activity level (number of trips) should be uniformly distributed, with the coverage converging on the stratum mean as activity increases (i.e., variability should decrease with increased activity). A Runs Test (Bradley 1968) was performed on the $r_{\text {trip }}$ values generated by the PTNS to demonstrate the randomness of trip coverage assignments. Runs Tests were performed on $r_{\text {trip }}$ values from fishing years 2011 and 2012 with the NEFOP- and NMFS-funded ASM evaluated separately. Due to the major change to the system design at the end of the 2010 fishing year, tier-level $r_{\text {trip }}$ values are not available for fishing year 2010. The p-values from the Runs Tests were in excess of 0.3 for all fishing year, tier combinations indicating that the null hypothesis of randomness could not be rejected (Table 8). This finding is not surprising, given that the PTNS produces the $r_{\text {trip }}$ values using a random number generator. These results demonstrate the random selection on a trip-by-trip basis and, by extension, on a vessel-by-vessel basis.

While, the selection of vessels for observer coverage by the PTNS is random, there are several non-random external factors that can influence whether a vessel actually ends up carrying an observer. Shortly after implementation of the PTNS in May 2010, it became clear that there was active vessel avoidance of observer coverage. Additionally, there were concerns raised by the fishing industry, particularly from fishing vessel operators who were experiencing high levels of observer coverage, that vessel-level coverage was non-random. These two concerns were directly related: the number of vessels experiencing no coverage negatively impacted the equitability of the coverage across all vessels. Since the PTNS is attempting to maintain strata-
level coverage, low coverage on some fraction of vessels within a stratum must be compensated for by raising coverage on other vessels. Over time, directed efforts were made to mitigate vessel coverage inequities in a variety of ways. The first steps were taken in the August 16, 2010 PTNS update (Table 3) in an attempt to address the observer avoidance issue. As discussed in the design section, this fix effectively addressed those vessels exhibiting observer avoidance behavior, but has the unintended consequence of increasing observer coverage on vessels legitimately canceling trips (fishing around weather windows, etc.). The May 2, 2011 PTNS update (Table 3) addressed this issue by implementing low-coverage thresholds for placement on 'must deploy' tiers. In addition, changes were made to the web-based monitoring utility to scan for vessels that either fall below or exceed specified coverage levels. The web monitoring utility temporarily adds these vessels to the 'keep active' or 'do not deploy - coverage' selection tiers. Once a vessel falls back within the tolerance range, it is removed from these list tiers and returned to the normal random selection protocols. Usage of both tiers increased over time, though generally the use of these tiers is minimal relative to the random selection tiers (Table 5).

Evaluation of vessel-level coverage using observer data and VMS activity declarations shows that, overall, vessel coverage was random and uniformly distributed at a given activity level, and, with increasing vessel activity, the coverage converges on the overall mean (Figure 34). Comparison of vessel-level coverage across fishing years shows the influence of the various system modifications on vessel-level coverage. Overall, the level of variability of vessel-level coverage has declined in each successive fishing year. Because of the expected high variability when the number of trips is low, vessels were separated into two categories: those having taken fewer than ten trips and those having taken ten trips or greater (Figure 35). The reductions in vessel coverage variability from 2010 to 2011 were primarily due to the implementation of the low-coverage monitoring modifications to the PTNS released on May 2, 2011 (Table 3). A subsequent reduction in the coverage variability occurred from 2011 to 2012. While there were no system modifications from fishing year 2011 to 2012 that would have affected the coverage variability, there were several monitoring efforts taken to ensure more equitable coverage across fishing vessels. First, as noted above, there was more active management of the 'keep active' and 'do not deploy - coverage' tiers to increase the coverage on low-coverage vessels while reducing coverage on high-coverage vessels. Secondly, beginning during the 2011 fishing year, there was a concerted outreach initiative to observer service providers to ensure equitable coverage across vessels.

Outside of observer availability, there are at least two factors that affect the decision of a provider to select a particular trip for coverage: the vessel identity and trip characteristics. Providers are informed which vessels are taking the trips they have been offered, which can potentially result in the preferential coverage of certain vessels or avoidance of others. Both actions would contribute to non-equitable coverage across vessels. In 2010, there was considerable variability in vessel-level coverage including a large percentage (20\%) of vessels that had received $100 \%$ coverage and those that had received no coverage at all $(10 \%$; Figure
36). By 2012 there were reductions in both extremes and an overall decline in the variability of coverage levels among vessels. There was still an undesirably high number of vessels at the two extremes, but these were largely restricted to vessels that have taken fewer than 50 trips.

One trip characteristic that may affect a provider's ability to accept a fishing trip is the port of sailing. Vessels sailing out of ports outside the region of core activity may experience lower observer coverage due to the difficulty in deploying observers to these areas, and to high travel costs in the event observers are not regularly stationed in the regions. In fishing year 2010, there was considerable disparity in coverage among states with the Mid-Atlantic states (New York, New Jersey, and Virginia) receiving lower coverage relative to the New England states (Figure 37). The lower coverage in the Mid-Atlantic states was not due to differential selection by the PTNS, but rather higher provider decline rates for these states. ASM observers are not regularly stationed in the Mid-Atlantic states. Incremental improvements were seen in the state-level coverage in both 2011 and 2012. By fishing year 2012, provider decline rates were similar across states. Some of this may have been due to improvements within the provider operations, but there was also a notable decrease in the overall number of trips sailing from Mid-Atlantic ports from 2010 through 2012.

Trip duration (e.g., day vs. multi-day) is also a trip characteristic that has the potential to affect a provider's willingness to accept a trip that has been selected by the PTNS. Logistically, multiday trips are easier to coordinate, given the lower likelihood of a trip being canceled and greater reward in the form of more sea days per coordination efforts. In the past, providers have complained about the inequitable offering of multi-day trips to each provider. While the complaints were investigated and found to be unfounded, it is evidence of the high value of multi-day trips to providers. To evaluate the decline rate by trip type, an odds ratio test was conducted. The odds ratios indicated that day trips were between 2.9 and 7.7 times more likely to be declined than multi-day trips in 2010 and 2011 (Table 9). Correspondingly, the observer coverage rates were higher for multi-day trips. Interestingly, in 2012, multi-day trips were 2.3 times more likely to be declined than day trips, resulting in higher observer coverage of day trips. It is unknown exactly why there was a reversal in the patterns from 2011 to 2012. While it can't be quantified, it is known that in 2010 and 2011 some providers would initially accept more day trips than could be covered to increase their flexibility, given that 'day-boat' trips would experience a higher vessel cancelation rate. This practice was discontinued in 2012. There was also a change in the NEFOP service provider in 2012, which could have impacted both NEFOP and ASM coverage in unexpected ways.

## Meeting the needs of other monitoring programs

In addition to deploying observer coverage to meet the base coverage requirements of the groundfish catch monitoring, the PTNS is also responsible for meeting other coverage requirements within the groundfish fishery. These include providing coverage of the four groundfish SMP and protect species bycatch monitoring.

In fishing years 2010 to 2012, use of the SMP tiers within the PTNS were seldom utilized (Table 5). The primary reason for this is that the SMP coverage requirements were always less than the base groundfish fishery coverage requirements. For example, mandated SMP coverage ranges from 10 to $20 \%$, depending on the SMP, yet the base coverage exceeded $20 \%$ in all years (Table 6). Because of the compensatory nature of the linear selection, the probability of selection at the SMP tiers was low. In the future, if the base coverage declines below the mandated SMP coverage requirements, then use of these selection tiers would be expected to increase.

Observer deployment for the monitoring of protected species bycatch in the groundfish fishery is accommodated in the PTNS using a sea day schedule (Figure 3). The NEFSC Protected Species Branch generates a sea day schedule annually based on an expectation of fleet activity on a port, month, and gear type basis. Frequently, fleet activity within individual sea day strata are not sufficient to meet the specified sea day coverage and the unused sea days must be manually 'rolled' over to the next month. Typically, the port and gear stratification is held identical to the previous month, but occasionally the sea days are reallocated to different ports where fishing activity is more likely. The need to continually 'rollover’ unused sea days highlights the difficulty and lack of efficiency of a sea day schedule deployment scheme. From the perspective of sampling design, the sea day schedule approach assumes that fishing activity during the deployment period will be identical to fishing activity from the reference period. As has been demonstrated through three years of deployment of protected species coverage using a sea day schedule, this is often not the case. Similar to how groundfish bycatch monitoring is deployed, an adaptive deployment approach where observer deployment was distributed proportional to fishing effort would offer improvements over the sea day schedule.

## DISCUSSION

Overall, the PTNS has worked consistent with the system design and was successful in meeting the diverse objectives of a complex observer deployment system. The PTNS utilized over 93\% of the nearly twenty-five thousand sea days allocated to it from 2010 to 2012. Equally important, the sea day utilization was accomplished in a manner that spread observer coverage proportional to fishing effort, resulting in consistent coverage over time and across multiple coverage metrics, including days absent and groundfish landings. This provides some indication that, at least at a gross level, there is no strong evidence of observer bias, though there are some indications of observed trips being slightly longer in 2010 and 2011. The issue of observer bias requires additional research and is outside the scope of this paper. The deployments of both NEFOP- and NMFS-funded ASM observers was done in such a way as to make the resulting discard rates from these two programs statistically indistinguishable across a broad range of groundfish species and gear types (Wigley et al. 2012).

The self-adjusting nature of the PTNS linear selection method was effective at reducing coverage variability and, in turn, increasing coverage equitability as additional trips entered the PTNS. Additionally, the self-adjusting nature mitigated many of the coverage rate perturbations induced
by external factors, such as vessel avoidance and observer saturation. These are expected characteristics of the PTNS and reflect the importance of simulation work during the design of complex monitoring systems. Some of the real-world complexities of running such a system were not considered in the initial simulations, and required system modifications over time to address. These highlight the need to regularly evaluate system performance and identify areas of improvement.

## Need for continued improvements

It is one thing to design a system that performs optimally in simple theoretical simulations, but extremely difficult to design a system robust to the realities of a production deployment. The PTNS encountered its share of these realities over time, some of which were addressed through system enhancements and others through external low-coverage monitoring and outreach to observer service providers. The net results of these efforts were sequential improvements in system performance between 2010 and 2012. Many of the remaining issues can be addressed through minor system improvements in concert with continued improvements in coverage monitoring and outreach activities. While system improvements may lead to marginal gains in performance, the biggest challenge for the PTNS is compensating for external human factors such as vessel compliance, observer availability, and objective provider selection of vessels and trips.

Perhaps the largest external factor affecting optimal performance of the PTNS relates to vessel compliance, both with respect to declaring all groundfish trips and canceling all trips that were declared but never sailed. The optimal performance of the PTNS requires the accuracy of the internal trip count information. While the analyses show that the current system has reasonable accuracy, there continue to be small differences in both the counts of observed trips and total groundfish trips. Compliance among vessels targeting monkfish continues to be the most problematic area with respect to trip counts, particularly for common pool vessels. Targeted outreach and education to this portion of the fleet could lead to large improvements in PTNS notification compliance. The cancelation of declared trips that did not sail was a large problem in fishing year 2010 but has decreased over time, primarily as the result of monitoring and outreach by the NEFSC Fisheries Sampling Branch staff. In fishing year 2012, the non-cancelation of fishing trips had minimal impact on PTNS performance. Both of these issues highlight the need for the PTNS to directly communicate with the other fisheries-dependent data collection systems, like VMS activity declarations and observer data.

A means of direct communication between data collection systems would greatly improve compliance monitoring and enforcement efforts. Equally important, a means for the PTNS to directly communicate with other data collection systems would allow the PTNS to incorporate a feedback loop to auto-correct the declaration information and maintain accurate accounting of the number of groundfish trips taken. The most obvious solution to this problem is to create a unique trip identifier that can be used to link trips across all of the regional fisheries-dependent
data collection systems. The unique trip identifier should be generated by the first system that a vessel must report to for a given fishing trip; for the groundfish fishery, that system is the PTNS (i.e., 48 hours in advance of sailing). The unique trip identifier would then propagate through to the other data collection systems. As more of the region's data collection systems migrate towards electronic collection (e.g., electronic vessel trip reports), the ease of propagating a unique trip identifier from system to system should improve. Uniquely linking trips across data collection systems would also lead to improved efficiencies by reducing the amount of duplicative information currently being collected from the fishing industry.

The ability to utilize all of the sea days allocated to the PTNS is contingent upon having a sufficient number of observers available for deployment. As seen with NEFOP coverage in 2011, an insufficient number of observers can lead to sub-optimal utilization of the allocated sea days. The availability of observers is affected by many factors, including the total number of certified observers in the region, the number of allocated sea days, and the competing coverage demands of other fisheries. For service providers, balancing these demands is a difficult task requiring planning and coordination. Having too few observers is problematic from the perspective of coverage deployment, but too many observers can be detrimental to the retention of qualified observers. Maintaining sufficient observers requires a balancing of seasonal coverage demands, employee losses, and training sessions for new observers. Continued experience with balancing these demands should improve observer availability in future fishing years.

There remains a need to continue to work with observer providers to further improve the equitability of provider selection, with respect to both vessels and trips. Ensuring that providers are not preferentially selecting or declining trips based on the identity of the vessel is critical. A modification to the PTNS to hide the vessel identity from the provider until after the trip selection has been made may be one possible solution to the provider selection issue. Unfortunately, unlike the vessel identity, the trip characteristic information (port of sailing, trip duration) is critical for provider planning purposes and cannot be hidden from the provider. These areas can be addressed through real-time monitoring of provider decline rates across a range of metrics, including port of sailing and trip duration, and then working with providers to ensure unbiased selection.

While external factors pose the biggest challenges to PTNS performance, there are several areas of the PTNS where improvements could be made. The PTNS has required manual interventions to adjust target coverage rates in response to fleet behavior and provider capacity. While this is anticipated, more automated methods need to be explored to adjust target coverage rates in response to sea day burn trajectories and realized observer coverage. Not only will this reduce the extent of manual intervention on the part of the system administrator, it will also help prevent the types of sea day under-utilization similar to what occurred with the NEFOP sea days in 2010. This under-burn had less to do with observer saturation and more to do with a lack of responsiveness to the under-burn.

Automation of the 'keep active' and 'do not deploy - coverage' list tier maintenance is also needed. The process is currently managed through a semi-automated procedure run through the PTNS web-based monitoring and reporting utility; however, it requires some manual intervention on the part of a system administrator to adjust the coverage tolerance ranges that control when vessels are added and removed from these lists. The maintenance of these list tiers should be moved to the database level and linked directly back to mean vessel coverage rates such that the tolerances are established dynamically based on some plus/minus percentage of the mean vessel coverage rate at any given time.

Meeting system requirements, providing flexibility, and minimizing the burden to industry was, and continues to be, a challenge. The trip-based nature of the PTNS works well from the perspective of system design but it has proven to be burdensome for 'day-boat' operators and observer service providers. As discussed previously, many 'day-boat' vessel operators will submit a notification for every day of the week in order to maintain the flexibility to fish around weather and/or crew availability; trips on which they don't sail are then canceled both before and after the provider assignment. With the service provider potentially varying from trip to trip this translates numerous phone calls, emails, and communication with a variety of contacts in a given week and is a source of frustration. Industry has expressed a desire to be selected for an entire week's worth of trips, such that any time the vessel sails during that week, an observer must be on board and communication would only occur with a single provider. The weekly notification strategy is currently employed in the herring fleet; however, there are large differences in size and complexity between the two fisheries. Additionally, observer coverage in the herring fishery is deployed using a manual call-in system, not an automated statistical design. Weekly notifications would require significant restructuring of the PTNS but has been considered for future upgrades.

## Criticisms of the PTNS

A recent report criticized several aspects of the PTNS (NEI 2011); however, these criticisms were levied without a full understanding of how the PTNS functions. One aspect of the report criticized the PTNS for not achieving normally distributed coverage. As was illustrated in the theoretical simulations (Figures 9 and 10) and documented in practice, it is not expected that the distribution of PTNS selections will be normally distributed. The linear selection method of the PTNS actively works to reduce variance, resulting in under-dispersion. The authors of the NEI (2011) report did accurately capture some of the vessel coverage equitability issues that had plagued the PTNS design in fishing year 2010; however, by the time the report was published in September 2011, these issues had largely been resolved.

The NEI (2011) authors incorrectly assumed that the inequities across sector level coverage (e.g., Figure 27 and 28) were due to varying target coverage rates across strata in response to meeting specified CV requirements. "It is reasonably clear that combined coverage levels of NEFO[P]s and ASMs across sectors were unequal in FY 2010 from a statistical perspective...We believe
that one plausible reason for this is that NEFSC-FSB goals in setting coverage levels were based on meeting "coefficient of variation" requirements for specific gears fished in specific areas (Gear/Area Stratum) as outlined in the 2010 SBRM process (NEFSC-FSB, 2010b). These requirements are likely to be at odds with a goal to have fair and equitable coverage levels across sectors, particularly if SBRM coverage levels vary across strata and if sectors have varying levels of participation in different strata." Their assumption is not correct. In 2010, all strata within a tier were assigned identical target coverage rates, with the exception of the NMFS-funded ASM target coverage rate for the common pool. The inequities across strata in 2010 were the result of differential vessel compliance with PTNS requirements and provider selections.

The NEI (2011) report also took issue with the fact that the coverage of the groundfish fishery was not achieving fishing year 2010 coverage goals of $38 \%$ that were being referenced publicly. Ultimately, the groundfish fishery was covered at approximately $29.3 \%$ in 2010 (Table 6). The discrepancy between publicly referenced targets and realized coverage raises important issues about the realities of developing sea day budgets and running a PTNS-type system. If the PTNS could operate off of a limitless budget, it could be tuned to realized target coverage rates. However, that is not the reality of how most observer deployment programs are operated. The sea days allocated prior to the start of the fishing years are contingent on many factors, one of which is the desired coverage levels. Once the fishing year begins, sea day allocations seldom change, and the realized target coverage rates are primarily a function of allocated sea days, fleet activity, and observer availability.

## Expansion to other Northeast U.S. fisheries

Automated observer deployment systems will likely become more commonplace as fishery regulations become more complex in response to industry demands for greater flexibility and need for improved accuracy and precision in monitoring fishery catches. While the PTNS was a first-of-its-kind automated deployment system, since the deployment of the PTNS in May 2010, at least one other system has been developed and deployed in North America. The National Marine Fisheries Service’s Alaska Region developed and deployed their Observer Declare and Deploy System (ODDS) for the groundfish and Pacific halibut, Hippoglossus stenolepis, fisheries on January 1, 2013 (USOFR 2012). The system has objectives similar to the PTNS in that it attempts to deploy observers in a statistically unbiased manner among a subset of the fleet chosen for trip-based selection.

Though not described in this paper, based on the initial success of the PTNS in the groundfish fishery, the PTNS was expanded to the targeted long finned squid (Doryteuthis pealeii) fishery in January 2011 (Table 3). There are other fisheries in the northeast U.S. with existing observer notification requirements, such as the Atlantic sea scallop (Placopecten magellanicus) and Atlantic herring (Clupea harengus) fisheries, which could be incorporated into the PTNS. For vessels participating in multiple fisheries, a single observer notification system could streamline
vessel reporting requirements. Additionally, it may offer efficiencies with respect to system administration and support. While broadening the scope of the PTNS can offer many efficiencies, past experiences with large-scale improvements and application to multiple fisheries has shown that large changes to a system of this complexity are not simple and require extensive planning and development time to properly implement.

## ACKNOWLEDGEMENTS

We would like to thank Chris Legault and Susan Wigley for informative discussions leading to the final design of the PTNS. The NEFSC Data Management Systems staff provide support of the networks and databases on which this system resides. A debt of gratitude is also owed to members of the NEFSC Fisheries Sampling Branch who provide the administrative and operational support for the PTNS without which the system would not function.

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## TABLES

Table 1. List of the selection tiers within the groundfish Pre-Trip Notification System (PTNS).

| Tier <br> order | Selection tier |  | Tier description | Tier Type | Coverage type |
| :---: | :--- | :--- | :--- | :--- | :--- |

Table 2. Example of the provider selection process when multiple providers exist for a Pre-Trip Notification selection tier. In this example the random selection variable, $r_{\text {provider }}$ $=0.294$. The lists are sorted in ascending order based on the number of certified observers each provider has in service at the time of the trip notification. Selection is performed based on a comparison of the random selection variable to the cumulative proportion of each provider. The selected provider of At-Sea Monitor (ASM) coverage for each step is highlighted in grey.

| Provider <br> selection <br> step | ASM <br> provider | Certified <br> observers | Total <br> observers in <br> region | Proportion <br> of observers <br> in region | Cumulative <br> proportions |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Provider C | 4 | 39 | 0.103 | 0.103 |
|  | Provider A | 5 | 39 | 0.128 | 0.231 |
|  | Provider D | 10 | 39 | 0.256 | 0.487 |
|  | Provider B | 20 | 39 | 0.513 | 1.000 |
|  | Provider C | 4 | 29 | 0.138 | 0.138 |
| 2 | Provider A | 5 | 29 | 0.172 | 0.310 |
|  | Provider B | 20 | 29 | 0.690 | 1.000 |

Table 3. List of Pre-Trip Notification System (PTNS) modifications over time.

| Version number | Date | Scope of modification | System modification |
| :---: | :---: | :---: | :---: |
| 1.0.1 | May 1, 2010 | Major | Initial release |
| 1.0.2 | May 18, 2010 | Minor | Miscellaneous bug fixes |
| 1.0.3 | June 16, 2010 | Minor | Improved functionality and usability |
| 1.1.1 | August 16, 2010 | Major | Handling of set-only gillnet trips and first attempt to address observer avoidance issues |
| 1.1.2 | September 2, 2010 | Moderate | Addition of the protected species coverage tier, collection of trip duration information |
| 1.1.3 | November 3, 2010 | Minor | Miscellaneous system work to improve functionality and prepare the system to accommodate other non-groundfish fisheries |
| 1.2.1 | December 30, 2010 | Major | Incorporation of the directed long-finned squid fishery (non-groundfish) |
| 1.2.2 | January 4, 2011 | Minor | Upgrade to the PTNS web-server |
| 1.3.1 | May 2, 2011 | Major | Implementation of 'separate' tier selection and compliance thresholds |

Table 4. Summary of the Northeast Fisheries Observer Program (NEFOP) and At-Sea Monitor (ASM) sea days allocation and utilization by fishing year.

| Coverage <br> type | Year | Allocated <br> sea days | Utilized <br> sea days | Percent sea <br> days utilized <br> (\%) |
| :---: | :---: | ---: | ---: | ---: |
|  | 2010 | 2,208 | 1,863 | $84.4 \%$ |
| NEFOP | 2011 | 3,386 | 2,694 | $79.6 \%$ |
|  | 2012 | 1,338 | 1,320 | $98.7 \%$ |
|  | 2010 | 5,991 | 5,761 | $96.2 \%$ |
| ASM | 2011 | 6,814 | 6,909 | $101.4 \%$ |
|  | 2012 | 5,225 | 4,887 | $93.5 \%$ |

Table 5. Summary of Pre-Trip Notification System (PTNS) trip selections by fishing year and selection tier. Trips indicated as observed within the PTNS are also summarized. Note that trip and observed trip counts reflect internal PTNS counts and may not match the external estimates contained in Tables 6-8. Acronyms: At-Sea Monitoring (ASM), National Marine Fisheries Service (NMFS), Northeast Fisheries Observer Program (NEFOP), Special Management Program (SMP).

| Fishing year | Total annual declared trips | Tier order | Selection tier | Trips selected | Percentage of total trips (\%) | Trips observed | Percentage of total trips (\%) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2010 | 15,851 | 1 | Manual waiver | 559 | 3.5 |  | 0.0 |
|  |  | 2 | Set-only | 108 | 0.7 |  | 0.0 |
|  |  | 3 | Do not deploy - safety | 83 | 0.5 |  | 0.0 |
|  |  | 4 | Do not deploy - coverage | 213 | 1.3 |  | 0.0 |
|  |  | 5 | NEFOP | 3,354 | 21.2 | 882 | 5.6 |
|  |  | 6 | SMP | 38 | 0.2 | 14 | 0.1 |
|  |  | 7 | Protected species limited coverage | 203 | 1.3 | 51 | 0.3 |
|  |  | 8 | NMFS-funded ASM | 5,489 | 34.6 | 3,044 | 19.2 |
|  |  | 10 | Keep active | 12 | 0.1 | 4 | 0.0 |
|  |  | 11 | Not selected | 5,792 | 36.5 |  | 0.0 |
| 2011 | 14,062 | 1 | Manual waiver | 333 | 2.4 |  | 0.0 |
|  |  | 2 | Set-only | 172 | 1.2 |  | 0.0 |
|  |  | 3 | Do not deploy - safety | 160 | 1.1 |  | 0.0 |
|  |  | 4 | Do not deploy - coverage | 303 | 2.2 |  | 0.0 |
|  |  | 5 | NEFOP | 5,618 | 40.0 | 1,029 | 7.3 |
|  |  | 6 | SMP | 8 | 0.1 | 6 | 0.0 |
|  |  | 7 | Protected species limited coverage | 133 | 0.9 | 111 | 0.8 |
|  |  | 8 | NMFS-funded ASM | 4,669 | 33.2 | 3,022 | 21.5 |
|  |  | 10 | Keep active | 228 | 1.6 | 110 | 0.8 |
|  |  | 11 | Not selected | 2,438 | 17.3 |  | 0.0 |
| 2012 | 12,745 | 1 | Manual waiver | 213 | 1.7 |  | 0.0 |
|  |  | 2 | Set-only | 89 | 0.7 |  | 0.0 |
|  |  | 3 | Do not deploy - safety | 61 | 0.5 |  | 0.0 |
|  |  | 4 | Do not deploy - coverage | 842 | 6.6 |  | 0.0 |
|  |  | 5 | NEFOP | 2,395 | 18.8 | 806 | 6.3 |
|  |  | 6 | SMP | 8 | 0.1 | 1 | 0.0 |
|  |  | 7 | Protected species limited coverage | 50 | 0.4 | 45 | 0.4 |
|  |  | 8 | NMFS-funded ASM | 2,372 | 18.6 | 1,701 | 13.3 |
|  |  | 10 | Keep active | 709 | 5.6 | 590 | 4.6 |
|  |  | 11 | Not selected | 6,006 | 47.1 |  | 0.0 |

Table 6. Estimates of observer coverage rates in the groundfish fishery for fishing years 2010-2012 by coverage type.
Acronyms: At-Sea Monitoring (ASM), National Marine Fisheries Service (NMFS), Northeast Fisheries Observer Program (NEFOP), Vessel Monitoring System (VMS).
$\begin{array}{clrcrl}\hline \text { Fishing } \\ \text { Year }\end{array} \quad$ Tier Name $\quad$ Observed trips $\begin{array}{c}\text { Total VMS } \\ \text { trips }\end{array} \quad$ Tier coverage $\left.\begin{array}{c}\text { Fraction of annual } \\ \text { trips receiving } \\ \text { observer coverage }\end{array}\right]$

Table 7. Summary of Pre-Trip Notification System (PTNS) compliance by fishing year, sector type (common pool or sector) and Vessel Monitoring System (VMS) activity declaration (groundfish, monkfish). PTNS compliance refers the fraction of groundfish trip declared through a VMS activity declaration with a positive PTNS notification. Note that the PTNS trip counts only include PTNS notifications that could be matched to a VMS-declared trip within a 48 hour tolerance window.

| Sector type | Fishing year | Trip type | Total groundfish trips | Fraction of groundfish trips fishing on monkfish DAS | Trips declared into PTNS | Fraction of trips declared into PTNS |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Common pool | 2010 | Groundfish | 776 | 0.569 | 586 | 0.755 |
|  |  | Monkfish | 1,026 |  | 124 | 0.121 |
|  | 2011 | Groundfish | 316 | 0.795 | 228 | 0.722 |
|  |  | Monkfish | 1,228 |  | 175 | 0.143 |
|  | 2012 | Groundfish | 213 | 0.794 | 146 | 0.685 |
|  |  | Monkfish | 819 |  | 60 | 0.073 |
| Sector | 2010 | Groundfish | 10,281 | 0.107 | 9,238 | 0.899 |
|  |  | Monkfish | 1,230 |  | 979 | 0.796 |
|  | 2011 | Groundfish | 12,690 | 0.098 | 11,728 | 0.924 |
|  |  | Monkfish | 1,380 |  | 1,168 | 0.846 |
|  | 2012 | Groundfish | 12,153 | 0.085 | 10,843 | 0.892 |
|  |  | Monkfish | 1,130 |  | 908 | 0.804 |

Table 8. Results of a Runs Test for randomness on the Pre-Trip Notification System (PTNS) $r_{\text {tier }}$ values. The $Z$ statistics are presented by fishing year and PTNS selection tier for with the associated $p$-values shown in parentheses. Tier-level $r_{\text {tier }}$ were not available prior to fishing year 2011.

| Tier | $\mathbf{2 0 1 1}$ | $\mathbf{2 0 1 2}$ |
| :--- | :---: | :---: |
| NEFOP | $0.985(0.325)$ | $0.587(0.557)$ |
| NMFS-funded ASM | $-0.735(0.462)$ | $0.843(0.399)$ |

Table 9. Provider decline rates by trip type (day and multi-day). Odds ratio are expressed in terms of decline rates between trip types (odds ratios are multi-day/day). Note that 2010 is a partial year since trip type could not be tracked prior to September 2, 2010. Additionally, trip counts and associated observer coverage rates will differ from those in Table 4 due to differences in the information source (internal Pre-trip Notification System data vs. external sources).

| Fishing year | Trip type | Total trips taken | Trips offered to provider | Trips accept by provider | Trips declined by provider | Observer coverage level | Probability of provider declining the trip | Odds of provider decline | Odds ratio (95\% CI) | $P$-value |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2010 | Day | 7,771 | 4,485 | 1,859 | 2,626 | 0.24 | 0.59 | 1.41 | 0.12 (0.10-0.16) | <. 0001 |
|  | Multi-day | 1,670 | 576 | 491 | 85 | 0.29 | 0.15 | 0.17 |  |  |
| 2011 | Day | 11,586 | 9,187 | 3,373 | 5,814 | 0.29 | 0.63 | 1.72 | 0.35 (0.31-0.39) | <. 0001 |
|  | Multi-day | 2,476 | 1,446 | 905 | 541 | 0.37 | 0.37 | 0.60 |  |  |
| 2012 | Day | 10,390 | 4,316 | 2,654 | 1,662 | 0.26 | 0.39 | 0.63 | 2.30 (2.02-2.62) | <. 0001 |
|  | Multi-day | 2,355 | 1,199 | 491 | 708 | 0.21 | 0.59 | 1.44 |  |  |

## FIGURES



Figure 1. Observer coverage rate estimates for the northeast United States groundfish fishery between 2000 and 2009. The dashed line indicated the mean coverage rate over the time period. Note that groundfish coverage rate estimates are sensitive to many analytical assumptions and are illustrative rather than definitive.


Figure 2. Map of the offshore waters of the northeast United States showing the three fishing regions as defined by the Pre-Trip Notification System within the U.S. Exclusive Economic Zone (EEZ). The gridded area delineates North Atlantic Fisheries
Organization (NAFO) statistical areas. The 50 m and 100 m bathymetry lines are indicated by thin grey lines.


Figure 3. Schematic diagram illustrating the hierarchal tier selection of the groundfish Pre-Trip Notification System. Acronyms: At-Sea Monitoring (ASM), National Marine Fisheries Service (NMFS), Northeast Fisheries Observer Program (NEFOP), Special Management Program (SMP).


Figure 4. Schematic illustrating the 'fixed' method for determining trip selection probabilities. The application of the fixed method at three different target coverage rates ( $0.20,0.30,0.38$ ) is shown.


Figure 5. Schematic illustrating the 'incremental' method for determining trip selection probabilities. The selection probability is a function of the total number of trips existing within the stratum combined with a sequential decrementing of the selection probability based on a pre-determined increment amount ( $0.1,0.25,1.0$ ). In all examples the target coverage rate is set at 0.38 .


Figure 6. Schematic illustrating the 'linear’ method for determining trip selection probabilities. In the 'linear' method, selection probabilities are determined based on the realized observer coverage rates for each stratum at the time at which the trip is entered into the selection process. The 'linear' method requires specification of three parameters: a maximum probability (probability of selection when realized coverage is equal to zero), a target probability (i.e., target coverage rate), and a minimum coverage rate.


Figure 7. Comparative performance of the 'fixed', ‘incremental', and 'linear’ selection methods with respect to meeting a target coverage rate. Results are based on 500 iterations of a simple single-tier simulation with a specified target coverage rate of 0.38 (dashed red line). The mean coverage (solid black line) and 95\% confidence intervals (grey band) from all simulation runs is shown.


Figure 8. Mean probability of having no observer coverage within a stratum as a function of total stratum trips when using the 'fixed’ method to assign observer coverage at three target coverage levels ( $0.20,0.30,0.38$ ). Results shown are based on 100 iterations of a simple, single-tier simulation.


Figure 9. Histogram of coverage distributions from 'fixed’, 'incremental', and 'linear’ selection methods. Results are from 500 iterations of a simple single-tier simulation with a specified target coverage rate of 0.38 (dashed red line).


Figure 10. Quantile-quantile plots (Q-Q plots) from 'fixed’, 'incremental’, and ‘linear’ selection methods. Results are from 500 iterations of a simple single-tier simulation.


Figure 11. Examples of a 'separate’ and 'combined’ selection design under a three-tiered system. In both examples the target coverage rates for the selection tiers are as follows: Tier $1=0.08$, Tier $2=0.30$, Tier $3=0.12$. The tier-level target coverage rates are identified by the markers in each of the plots. In a 'combined' system, each trip is assigned a single random value and the tier selection probabilities are cumulative; e.g., Tier 1 is assigned a 0.08 target probability, Tier 2 is assigned a 0.38 target ( $0.08+0.30$ ) and Tier 3 is assigned a 0.50 target $(0.08+0.30+0.12)$. In a 'separate' system, with the exception of the last tier, the minimum coverage rates must be set equal to the target coverage. In a 'combined' system, each trip is assigned a separate random value for each selection tier and the selection probabilities are independent of other tiers. In a 'separate' system the minimum coverage rates can be set to any desired value at or below the target coverage rate.


Figure 12. An example of the performance of the 'separate' and 'combined' selection designs in both a two- and three-tier system. For each scenario, 500 trips were entered into a single-stratum simulation; the results shown reflect one realization of the simulation. The target coverage rates for the tiers in each simulation are: Tier $1=0.08$, Tier $2=0.30$, Tier $3=0.12$.


Figure 13. Distribution of 100 simulated PTNS stratum coverage rates as function of the number or trips declared using three different low-coverage thresholds: $0 \%, 30 \%$ (target), and $100 \%$. In all simulations the target coverage rate was set at $30 \%$ with a $1 \%$ minimum and the provider decline rate was held constant at $10 \%$. Boxes show the 25th, 50th and 75th percentiles; whiskers reflect the 10th and 90th percentiles.


Figure 14. The median and 25th and 75th percentile of individual vessel trip counts and coverage rates from 100 PTNS simulations run under three different low-coverage thresholds: $0 \%$, $30 \%$ (target), and $100 \%$. In all simulations the target coverage rate was set at $30 \%$ with a $1 \%$ minimum and the provider decline rate was held constant at $10 \%$.


Figure 15. Distribution of 250 simulated PTNS stratum coverage rates as function of the number or trips declared using two different minimum trip thresholds: 10 trips and 0 trips. In both simulations the target coverage rate was set at $30 \%$ with a $5 \%$ minimum, the provider decline rate was held constant at $10 \%$ and the low-coverage threshold was set at $30 \%$. Boxes show the 25th, 50th and 75th percentiles; whiskers reflect the 10th and 90th percentiles and the dots reflect the 5th and 95th percentiles. The bold red line represents the mean.


Figure 16. The mean and standard deviation of individual vessel trip counts and coverage rates from 250 PTNS simulations run under two different minimum trip thresholds: 10 trips and 0 trips. In both simulations the target coverage rate was set at $30 \%$ with a $5 \%$ minimum, the provider decline rate was held constant at $10 \%$ and the low-coverage threshold was set at $30 \%$.


Figure 17. Data flow processes and major information technology components of the PreTrip Notification System (PTNS).

```
New Trip Entry Form
Please fill out the information below and hit the submit button. If no errors are displayed on the screen then the data was submitted successfully. The confirmation number and notification status will be sent to the email(s) listed in the Registration tab. You can also click on the "Pending Trips" Tab to view recently submitted trips.
You will only be allowed to notify for fisheries that you are permitted to participate in. Currently the PTNS system is used for notifications in the Multispecies/Large Mesh Groundfish (MUL) Fishery and the Squid/Mackerel/Butter fish (SMB) Fishery for directed Loligo trips (i.e., trips on which the vessel operator intends to land greater than or equal to 2500 lb of Loligo squid). If you are trying to notify for a fishery that does not appear, please contact the PTNS coordinator.
```



Figure 18. Screenshot of the trip declaration screen from the web-based Pre-Trip Notification System (https://fish.nefsc.noaa.gov/cgi-bin/PTNS/login.pl).


Figure 19. Timeline of observer Pre-Trip Notification System (PTNS). After initial trip entry the system events are controlled by Unix cron jobs. Once a provider has accepted a trip the PTNS will send an automatic notification to the email informing them of the selection and identifying the provider.


Figure 20. Groundfish trips over time by fishing year as estimated from VMS activity declarations.


Figure 21. Sea day utilization over time (solid black line) relative to the annual allocated sea days (cap, thick dashed red line) and a constant burn trajectory (projected, dashed red line) for both Northeast Fisheries Observer Program (NEFOP) and National Marine Fisheries Service funded AtSea Monitors (NMFS-funded ASM) for the years 2010 to 2012. Note that the years reflect sea day contract years which run from April 1 to March 30. In 2010, the contract year did not start until the start of the groundfish fishing year on May 1, 2010.


Figure 22. Target coverage rate settings of the Pre-Trip Notification System (PTNS) from May 1, 2010 to April 30, 2013 for both the Northeast Fisheries Observer Program (NEFOP) and National Marine Fisheries Service funded At-Sea Monitors (NMFS-funded ASM) tiers. The dashed red lines denote the start of the provider contract years on April 1 and the black vertical lines denote the start of individual fishing years on May 1.


Figure 23. Relationship between the trip selection probability ( $p$ ) and the realized stratum coverage by tier and fishing year. Acronyms: At-Sea Monitoring (ASM), National Marine Fisheries Service (NMFS), Northeast Fisheries Observer Program (NEFOP). Note that 2010 values were recreated from the PTNS data that existed immediately prior to migration to the 2011 system; 2010 realized stratum coverages are approximated. Trips where realized stratum coverage is zero and the trip selection probability is less than 1.0 are products of this approximation. In actuality the realized stratum coverages were greater than zero at the time the trip declaration occurred.


Figure 24. Deviations of the trip selection probability ( $p$ ) and realized coverage from the target coverage rate by tier and fishing year. Results are summarized by fishing year week.


Figure 25. Trip cancellation rates by trip type (day or multi-day) and fishing year. Day trips are defined as any trip anticipated to be less than or equal to two days in duration. Multi-day trips are those trips anticipated to be longer than two days in duration.


Figure 26. Comparison of the Pre-Trip Notification System (PTNS) estimate of observed, total trips and coverage rates for an individual vessel to the realized coverage estimated from observer and Vessel Monitoring System (VMS) data. Comparison plots are shown by fishing year. The dashed line indicates the $1: 1$ identity line.


Figure 27. Comparison of the Pre-Trip Notification System (PTNS) estimated coverage for an individual sector to the realized coverage estimated from observer and Vessel Monitoring System (VMS) data. Comparison plots are shown by fishing year. The dashed line indicates the $1: 1$ identity line. The common pool is colored red.


Figure 28. Box-plot distribution of vessel-level coverage within individual sectors for fishing years 2010 to 2012. The dashed red line indicates the annual mean across all vessels. The solid black line indicates the median, the black circle is the mean, the grey box represents the interquartile range (Q1 - Q3) and the whiskers indicate observations within 1.5(IQR).


Figure 29. Monthly PTNS compliance by fishing year. PTNS compliance refers the fraction of groundfish trip declared through a VMS activity declaration with a positive PTNS notification.


Figure 30. Relationship of monthly PTNS compliance rates as a function of the fraction of groundfish trips fishing on a monkfish day-at-sea (DAS). PTNS compliance refers the fraction of groundfish trip declared through a VMS activity declaration with a positive PTNS notification.


Figure 31. Comparison of individual strata coverage rates to the total number of trips taken within each stratum summarized by tier type and fishing year. The dashed red line indicates the aggregate annual trip based coverage based on total observed trips/total Vessel Monitoring System trips. Acronyms: At-Sea Monitoring (ASM), National Marine Fisheries Service (NMFS), Northeast Fisheries Observer Program (NEFOP).


Figure 32. Histogram of strata coverage rates by tier type and fishing year. Acronyms: AtSea Monitoring (ASM), National Marine Fisheries Service (NMFS), Northeast Fisheries Observer Program (NEFOP).


Figure 33. Mean weekly sector coverage rates over time calculated using three different metrics: days absent, groundfish landings and trips. The dashed red line indicates the aggregate annual trip based coverage (across all groundfish trips) based on total observed trips/total VMS trips.


Figure 34. Comparison of individual vessel coverage rates and the total number of trips taken by an individual vessel. The dashed red line indicates the aggregate annual trip based coverage based on total observed trips/total VMS trips.


Figure 35. Histogram of individual vessel coverage rates by fishing year. Vessels are grouped into two categories: those taken fewer than 10 trips and those with 10 or more fishing trips.


Figure 36. Histogram of provider decline rates for individual vessels by fishing year. Vessels are grouped into two categories: those taken fewer than 10 trips and those with 10 or more fishing trips.


Figure 37. Provider decline rates (black) and coverage rates (grey) by fishing year state. The total number of trips offered to each provider is displayed above the decline rates.

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[^74]
## Attachment 2



Science. Education. Community.

# Analysis of Landings/Discards-Proportional Allocation Scheme for the At-Sea 

## Monitoring Program of the Groundfish Fishery in New England



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The report has been uploaded to the GMRI Monitoring Working Group website at www.gmri.org/monitoringworkinggroup. The author thanks comments from Jessica Joyce and Jonathan Labaree in the Community Team at GMRI and help from William Bowman as a GMRI intern sponsored by the Forest Foundation internship program. Any remaining errors are the author's responsibility.


#### Abstract

The New England groundfish At-Sea Monitoring (ASM) observer program's 30\% coefficient of variation (CV) standard deploys observers at an almost equal rate across various groundfish vessel sizes, gear types, and in terms of broad stock area. This results in too many observers being allocated to trips with low landings and discards, lowering the degree of accuracy for overall catch estimates. Continued use of the $30 \%$ CV fixed target as a measure of relative standard deviation precision will result in similar coverage levels across vessel categories (size and gear).

Given that funding is limited to support the billable seadays taken by observers in all trips, the purpose of this analysis is to identify whether the groundfish sector ASM observer seadays were equitably assigned across all appropriate strata in fishing year (FY) 2010 and in FY2011. Furthermore, this study focuses on how many billable seadays were taken by observers by trip type and vessel size. The appropriateness of these additional strata as predictors of discards for each stock is examined using a Seemingly Unrelated Regression model. The results of the model are then used to present an alternate monitoring approach for FY2014 and beyond.

Based on the Data Matching and Imputation System (DMIS) dataset for FY2010 and FY2011, more seadays were observed per pound of groundfish catch on smaller vessels, especially gillnetters, than on larger vessels, especially those fishing with otter trawl gear. That is to say, more ASM resources were expended to observe less catch in the former category. Allocation of the observer seadays based on discard volume is proposed as a cost-effective method to ensure an accurate accounting of landings and discards for each sector.


## 1. Background and Motivation

The current, stated objective for the At-Sea Monitoring (ASM) program in Amendment 16 to the Northeast Multispecies Fishery Management Plan is to "verify area fished, catch, and discards by species, by gear type." The calculated discards by stock assigned to each sector are assumed to be proportional to landings by fishing area and gear type. However, the current monitoring coverage rate is calculated based on the number of trips in each strata and is not distinguished by the magnitude of landings or discards in each strata, operating vessel size, or the number of billable seadays per trip.

The New England Fishery Management Council (NEFMC) revised certain elements of the groundfish monitoring program through Framework Adjustment 48 (FW 48) to the Northeast Multispecies Fishery Management Plan. These measures were voted on during their December 2012 meeting, and were implemented by the National Marine Fisheries Service (NMFS) for FY2013. Through their vote, NEFMC revised the goals and objectives for the ASM program; clarified the coefficient of variation (CV) standard; removed the requirement for industry-funded ASM in FY2013 (i.e., fund ASM for sectors at the level NMFS can afford); limited the responsibility of the industry to pay for the salary of an at-sea monitor; lowered coverage rates for sector trips on a monkfish day-at-sea (DAS) in the Southern New England Broad Stock Area using extra-large mesh gillnet gear; and eliminated the dockside monitoring program. While the Groundfish Oversight Committee requested that the Plan Development Team (PDT) develop monitoring standards that address both accuracy and precision, ultimately these revisions did not address accuracy or give the industry much flexibility in using various tools to meet the monitoring goals and standards. Further, while FW 48 deferred industry funding of ASM in FY2013, there is no guarantee the NMFS budget will be able to cover this level of monitoring in FY2014, yet the fishery will still be required to meet Amendment 16 standards for monitoring (i.e, $30 \% \mathrm{CV}$ as determined by the Standardized Bycatch Reporting Methodology [SBRM]).

This analysis attempts to identify the distribution of monitoring effort by estimating the average historical landings and discards that were observed in each seaday among different vessel sizes and fishing gear configurations, in order to see if these categories should serve as appropriate strata to adjust coverage levels. This approach could still include sector/area-fished
strata as ASM vendors have broad stock area information, vessel size and gear type prior to embarkation to help them determine the appropriate coverage rate under each category.

During the early developmental stages of FW 48, the Gulf of Maine Research Institute (GMRI) convened a Monitoring Working Group (MWG) with members from industry, NMFS, NEFMC staff, and other non-profit organizations. ${ }^{1}$ The purpose of the MWG was to increase industry participation in the development of the revised monitoring standards, and to develop multiple monitoring alternatives for sectors to propose in their operations plans, which were required to meet the new monitoring goals and objectives in FW 48. A MWG meeting on April 19, 2012 identified the need for analysis of alternative monitoring allocations in order to give sectors the necessary time to thoughtfully adapt their monitoring programs to the new goals and standards and negotiate contracts with monitoring providers prior to FY 2013. ${ }^{2}$

As part of this process, the MWG developed several alternatives that each sector could review with their manager and board of directors to determine the ideal option for their operations. Throughout summer and fall of 2012, the PDT vetted setting the coverage rate proportional to discards, although the analysis was not completed in time for further consideration in FW48, primarily due to the lack of available data for the 2011 fishing year. Therefore, having missed the September deadline for sectors to propose any of these alternatives for FY2013, this analysis is now aimed toward FY2014 and beyond, although implementation of this approach may require regulatory changes outside of those included in sector operations plans.

## Literature Review

ASM coverage distribution within a fleet is not a topic that is abundant in literature. Most studies were found to focus mainly on the total observer coverage rate, rather than across vessel sizes and gear types. Zollett et al. (2011) gives an extensive overview of effective monitoring programs. In terms of setting the level of observer coverage, guiding principles included a formal threat assessment and/or a cost-benefit analysis, and consideration for the needs of industry. In

[^75]terms of program costs, guiding principles included shifting the burden of responsibility to the industry and an aim to implement a program that can fund its own resource. Moving observer program costs to industry is intended to incentivize vessel operators to fish "cleaner".

Furlong and Patrick (2001) focus on the optimal level of observer coverage in a fishery through which maximum net benefits are realized. The benefits come in the form of reduced illegal and underreported fishing and are measured against the costs of observer coverage. While this paper does not employ a cost-benefit analysis framework to find the optimal overall rate of coverage, multiple scenarios are presented so as to present several possibilities. The tradeoffs here include discards observed (more equals more reliable data) vs. observer costs.

Rossman (2007) highlights the importance of looking at observer coverage and relative bycatch rates for each stratum with respect to marine mammals in the Northeast and MidAtlantic bottom trawl and gillnet fisheries. Those vessels responsible for higher marine mammal mortality were deemed a priority in receiving observer coverage. Similarly, those vessels responsible for mortalities of mammal populations in particularly poor shape were also given priority observer coverage.

This analysis expands on these previous studies in showing that while there may be an optimal level of observer coverage within a fishery, there is also an optimal way to disperse those observers among fleet members. Put another way, a certain level of ASM coverage is required to effectively enforce quota controls but that ASM coverage can come in different forms.

Currently, the $30 \%$ CV standard applied to GF trips will result in about $30 \%$ of trips observed and around $30 \%$ of landings and discards observed. However, by targeting those vessels that land and discard the most, fewer trips can carry an observer while observing the same volume of landings and discards. If the goal were to observe the most landings of highly utilized GF species, then using a weighted GF stock utilization rate would be necessary. This model is similar to what Rossman (2007) proposed for protecting marine mammals in the Northeast and Mid Atlantic bottom trawl and gillnet fisheries.

## Overview of Groundfish Activity by Trip Type, Vessel Size, and Fishing Gear

The data in this analysis was compiled from the individual trip level DMIS dataset, which was acquired by GMRI through a data access agreement for a project evaluating the viability of sectors as businesses. The sector viability project is funded in part by the Social Sciences Branch of the Northeast Fisheries Science Center, which restricts access of these confidential data to the GMRI staff directly working on the project, except in aggregated form. Since ASM costs are closely associated with sector viability, GMRI was given permission to use the DMIS dataset for this monitoring analysis; however, no funding from the sector viability project was used for this study.

Table 1 shows relevant data for FY2010 and FY2011, including number of trips, number of seadays, landings volume, and discards volume for all groundfish (GF). We considered GF trips to be any trip identified in the DMIS dataset performing groundfish fishing activities. The trips were then categorized by vessel size and gear type. This method yielded a total of 13,982 GF trips in 2010 and 16,609 GF trips in FY2011. These figures are slightly higher than those indicated in Table 1, as trips taken on vessels less than 30 feet in length are not included in the table. Both figures are also slightly higher than those reported in the 2011 NMFS groundfish fishery performance report (Murphy et al., 2012). This discrepancy is due to double counting for a small number of trips in which more than one type of fishing gear was used. ${ }^{3}$

For vessel size, four classes were chosen: class 1 vessels, less than 30 feet in length; class 2 vessels, measuring 30 to 50 feet; class 3 vessels, measuring 50 to 75 feet; and class 4 vessels, those longer than 75 feet. The DMIS dataset indicates that only two trips made on class 1 vessels (landing less than $1 \%$ of total GF landings in FY2011) had ASM coverage in for FY2011; ${ }^{4}$ thus they are not indicated individually in the tables, but are included in the totals. Those vessels that made less than 30 trips in hand line, longline or Ruhle trawl categories are also not indicated individually in the tables but are included in the totals. In both the 2010 and 2011 fishing years, the majority of trips on class 2 vessels used gillnets, and the majority of trips on larger, class 3 and 4 vessels fished with otter trawl gear. Overall, the majority of GF trips were made by class 2

[^76]vessels using gillnets, however the majority of seadays were made by class 3 and class 4 boats using otter trawl gear, as shown in Columns A and B in Table 1.

The number of seadays was calculated in accordance with the definition provided in a request for northeast observer contractors (NMFS, 2011). That is, the first calendar day the vessel leaves port is counted as one seaday regardless of when the vessel leaves or returns, the day the vessel lands is prorated from the beginning of the day to the time landed (unless the vessel lands on the same day it sails), and any interim days are counted as one seaday. ${ }^{5}$ The number of observed trips and observed seadays were summed in each sub-category, with all observer data coming from the Northeast Fisheries Observer Program (NEFOP) or the ASM program.

The current ASM observer program defines the coverage rate based on number of trips without considering how the scale of landings and discards vary substantially based on the size of the vessel and the length of the trip. Since the majority of GF seadays were made by class 3 and 4 multiday-trip boats with otter trawls, and their average seadays per trip is about 3 to 7 days, their landings and discards per trip are expected to be much higher than that of the class 2 day-trip boats. This study proposes to evaluate the distribution of observed seadays, GF landings, and GF discards, such as shown in the following section, in order to find a fair and equitable way to allocate the observer on various types of trips.

## Estimates of Observer Coverage Rates and Distribution of Seadays, Landings, and Discards

Observer coverage rates in the $j^{\text {th }}$ category of trips (based on vessel size and gear type) were calculated as follows: a dummy variable was assigned to each trip, where $i$ indexes the GF trips in the $j^{\text {th }}$ sub-category.

$$
\text { Observer }_{i j}= \begin{cases}1, & \text { when trip } i \text { was observed } \\ 0, & \text { otherwise }\end{cases}
$$

To find the coverage rate by trip, we simply used the mean of the $O_{\text {Oserver }}^{i j}$ dummy. Note that this is equivalent to dividing the number of observed trips by the total number of trips.

[^77]The estimated coverage rate weighted by GF landings was then calculated, with the variable $L_{i j}$ being the round weight of all GF landed on the $i^{\text {th }}$ trip of the $j^{\text {th }}$ sub-category.

$$
P_{j}^{L}=\frac{\sum_{i=1}^{N} \text { Observer }_{i j} \cdot L_{i j}}{\sum_{i=1}^{N} L_{i j}}
$$

The coverage rate by trips and by seadays, so as weighted by GF landings and discards, were calculated in a similar manner and defined in Table 2 for each category of vessel size and fishing gear in Columns A-D of Table 2 for FY2010 and FY2011 as the percentage of trips that carried an observer on board (A); the percentage of seadays fished with an observer on board (B); the percentage of total GF landings that were observed (C); and the percentage of total GF discards that were observed (D).

The percentage of trips that carry observers (coverage rate by trip) is the category that the current monitoring system is most concerned with. The result of this method of ASM is similar values for the percentage of trips observed vs. the percentage of total landings or discards observed. However, this does not necessarily indicate equitable distribution of monitoring resources. In 2010, class 3 and 4 otter trawl trips accounted for a total of $73.2 \%$ ( $27.3 \%$ and $45.9 \%$, respectively, in Table 2 Column F) of total GF landings and $74.8 \%$ ( $31.3 \%$ and $43.5 \%$, respectively, in Table 2 Column G) of total GF discards, but only $55.4 \%$ ( $25.1 \%$ and $30.3 \%$, respectively, in Table 2 Column E) of total observed seadays were used to monitor them.

A disparity between monitoring effort and GF landings and discards is generally present for all gear types under various vessel sizes, though it is most pronounced for the large vessels fishing with otter trawl gear and the small vessels using gillnets. These two vessel categories made the majority of GF trips, shown in Table 1 Column A, though their total landings and discards differed greatly.

Table 2 shows the GF landings by class 4 vessels using otter trawls were 3.9 times ( $45.9 \%$ vs. $11.7 \%$ in Column F) the GF landings by class 2 vessels using gillnets with large mesh. Large otter trawls also discarded 4.5 times ( $43.5 \%$ vs. $9.6 \%$ in Column G) more than the small gillnetters, in FY2010. This is a large discrepancy considering the ASM observed seadays were only 1.5 ( $30.3 \%$ vs. $20.6 \%$ ) times higher for large otter trawlers than small gillnetters in FY2011, as shown in Column E. A similar disparity between catch/discards and monitoring effort appeared for these vessel categories for FY2011 indicated in Table 2.

Large vessels fishing with otter trawls produce more discards per trip than most of the other fishing activity categories. In addition, by comparing the discards by seadays (shown in Table 3 Column G), what was discarded by an average class 4 otter trawler in one seaday in 2010 would take a class 2 extra-large mesh gillnet vessel an average of 13.03 seadays to discard an equivalent amount of fish (Table 3 Column H). Clearly this is a large discrepancy that is not being accounted for when evaluating the tradeoffs of assigning one observer seaday in various vessel size classes in order to observe the majority of the discards.

This mismatch is caused by the $30 \%$ CV precision standard by trip, which is a normalized formal equality measure of dispersion required for all ASM of groundfish sector trips. The 30\% CV criteria is a precision measurement by using the ratio of the sample standard deviation(s) to the sample mean $(\bar{x})$. As shown in the coverage rate on seadays indicated in Table 2 Column B, the coverage rate by trip, seaday, landings, and discards for small gillnett and larger otter trawl are all around $30 \%$. Neither the magnitude of the average landings and discards per seaday nor the distribution of total discards across vessel size and gear type category is taken into account in deciding how high of the CV is needed for various fishing activities.

This mismatch suggests two avenues for improvement: first, allocate coverage effectively (and its associated costs) to better reflect the magnitude of GF landings and discards by vessel categories, and increase the amount of both landings and discards that can be monitored; second, achieve the same industry-wide observed magnitude of GF landings and discards with less monitoring effort and at a reduced cost. The first avenue could be approached by adding vessel size as strata under the current ASM program when deciding coverage rates, the second by making coverage rates proportional to the landings or discards produced per seaday within the industry-wide stratified categories. If observing most of the discards is preferable, the higher the discard the higher the coverage rate that would be assigned, i.e. discard-proportional monitoring approach.

CVs measure precision of discard rates in the trip base, which is to say how much they vary around an average of the trip no matter the trip length. However, while the discard rates may be precise in fulfilling the $30 \% \mathrm{CV}$ requirement, they likely are not accurate across all trip lengths and vessel size categories. In addition, how precise a discard rate is needed depends on how meaningful it is for monitoring Annual Catch Entitlement (ACE). By comparing the relative
costs for paying each observer seaday with the outcomes (discards observed), it is not as costeffective to assign observers on trips that experience so little landings and discards per seaday than those trips discarding at a higher rate.

From a limited monitoring funding point of view, there is a need to reallocate the observers in a more cost-effective way to observe most of the discards and to monitor the majority of the ACE under the quota management objective. Allard and Chouinard (2011), show the importance of a cost-efficient strategy in enforcing regulations against discarding. Therefore, the approach proposed in this paper primarily addresses how to identify whether observed trips are distributed efficiently and equitably and how should the relative magnitude of the landings and discards across vessel size and gear be considered in the monitoring program. There is a compelling and time-sensitive need to have a comprehensive evaluation of the requirement to set the strata to assigning observers with the transition to an industry-funded ASM program on the horizon. If the majority of observers are assigned to observe the majority of the landings and discards, then it would more accurately ensure that a sector does not exceed their ACE.

## Utilization Rate of Groundfish Stocks

The PDT report from July 25, 2012 suggests that there may be differences in monitoring coverage levels by various vessel size, fishing gear, and broad stock area for three stocks (GOM cod, GB haddock, and pollock). In order to be comprehensive, all 22 GF stocks are considered in this paper to explore a system multivariate regression model to identify if adding trip type and vessel size as an additional strata to sector, fishing gear, and broad stock area as a significant factor in determining the discard level by stock.

The collective members' landings and discards are counted against a sector's ACE for each GF stock. To maximize the value of catch, sector members wish to catch or utilize a large percentage of the ACE for various species. Table 4 shows that there is great variability in the utilization rate of GF stocks. Stocks such as Georges Bank haddock and redfish were not heavily utilized in FY2011, while others, such as white hake and Georges Bank yellowtail flounder, had almost their entire ACE utilized. To combat this variability, a weighting scheme was introduced for the discards in this analysis in order to put more weight to allocate more observer seadays to observe those stocks that are highly utilized. By using pollock as the equivalent-based stock in
standardizing the discard rates for all stocks relative to their utilization rate, GB cod East and GB cod West were assigned with 2.838 and 1.634 times the discards for each pound of discards than the discards of pollock, as shown in Table 4. A weighted discard model will also be specified in the discard system equation model in addition to the discard level by stock.

## Correlations of Landings and Discards vs. Trip Length and Vessel Size

As discards are calculated based on the amount of landings for each trip, it is reasonable to believe that landings and discards should have a strong, positive correlation with trip length and vessel size. Indeed, such a correlation appears in FY2011, as shown in Figure 1. A positive correlation also exists between trip duration and discards, shown in Figure 2. Note that for trips shorter than 5 days, discards per trip are strongly concentrated below 1,000 pounds, while trips 5 days or longer do not follow this trend. The relationships between landings, trip duration, and discards are not surprising, nor are they especially useful from a management perspective, as landings and trip duration cannot be known prior to a given trip.

There are, however, variables that can be determined prior to a fishing trip that are strongly correlated with landings and trip duration. Larger vessels have a greater hold capacity, and it is logical to believe that these vessels will have higher landings per trip. Figure 3 shows that in FY2011 there was in fact a strong, positive correlation between vessel length and discards. Also, while the exact length of a multiday trip generally depends on several factors that occur during the trip, it is generally known in advance when a vessel intends to return on the same day it leaves. So while trip duration may be unknown prior to departure, it is reasonable to categorize trips as day trips or multiday trips before they leave port. Therefore, vessel length and trip type (day vs. multiday) serve as proxies for landings and trip duration, which are expected to be strong predictors of discards.

There is also considerable variability in the distribution of landings and discards by vessel size and gear type among different GF stocks. Therefore, allocating ASM observer coverage based on the overall total discards by various vessels and gear types may result in better monitoring coverage for some stocks over others. Figures 4 and 5, which show the distribution of GF landings and discards by stock among different gear types in FY2010 and FY2011, illustrate this variability. By utilizing the preceding simulation model, the overall discard coverage will be
improved for stocks having a discard distribution similar to the combined stock distribution in Figure 1 (the rightmost value on the horizontal axis). However, this same model may result in lesser coverage for those stocks with distributions that differ greatly from the total discard distribution. Most notably, GOM cod, GOM pollock, and GBE haddock have lower discard percentages by class 3 otter trawlers compared to other fishing gears and vessel sizes for FY2010.

## 2. Specification Discard Regression Model

Regression analysis is utilized to show the explanatory power of vessel size and trip length variables in relation to discards, with the best fit being a double-log Seemingly Unrelated Regression (SUR) model. This method accounts for the high correlation of the error terms in the species models resulting from the species being landed together in a multispecies fishery. The SUR model utilizes an aggregate regression to estimate discards for all groundfish stocks combined, and also runs separate regressions for each stock. The data used in this model was compiled from the individual trip level DMIS dataset for FY2011 and contains 14,946 observations. Discards in this dataset have been inputted using the weighted average of the discard rate assigned to each vessel by NOAA using gear type, broad stock area, and sector strata.

The regression dependent variable is discards per trip measured in pounds. The key explanatory variables for this analysis are trip type and vessel size. Vessel size is divided into four classes. Class 1 vessels are dropped because they do not carry observers, and class 2 is used as the base size. The regression therefore indicates how the larger vessels compare to the class 2 category. A positive value on the class 3 or class 4 coefficient would indicate that larger vessels are associated with higher discards. For trip length, a binary variable, dday, is used, which takes a value of 1 if the trip is shorter than 24 hours and a value of 0 if the trip is longer than 24 hours. A negative value for this variable would indicate that day trips are associated with lower discards. Dummy variables are also included for the strata currently used by the ASM program: sector, gear type, and broad stock area. All sectors are specified that take the value 0 or 1 as dummy variables to sort data into mutually exclusive categories to indicate the absence or presence of the sector effect that may be expected to shift the discards, which represents
differential intercept coefficients in the discard model. For gear type, the base of comparison is the otter trawl, and the broad stock area base group is Southern New England (SNE). The explanatory variables and their definitions appear in Table 5.

The regression results are based on all groundfish trips in FY2011 and are summarized in Table 5. A total of 3,625,779 pounds of groundfish were discarded in FY2011, an average of 226.6 pounds per trip. The average trip duration was 1.4 days. For the dummy variables, the mean value can be interpreted as the percent of trips that belong to that category. For example the variable dFixedgear has a mean of 0.18 , meaning that $18 \%$ of groundfish trips in FY2011 were taken by vessels in the Fixed Gear Sector. Similarly the mean of dGillnetExtraLargeMesh is 0.38 indicating that extra-large mesh gillnets were used on $38 \%$ of the trips in FY2011. The sum of the mean from various gear type dummy variables shows $61.32 \%$ trips were taken by all of the gear type indicated in Table 5 and indicates the rest of the $38.68 \%$ trips are taken by otter trawls as the base category.

## Regression Results

The log dependent variable SUR results for all stocks combined are displayed in Table 6 and the regression results for all 22 individual stocks is also available upon request from the author. The binary variable dday is negative (-1.872) and statistically significant. For specifications with a logged dependent variable and dummy independent variables, the following formula is used to estimate the percentage change associated with the dummy variable category over the base group with exponential of coefficient minus one.

Therefore, the interpretation of the dday coefficient is that trips lasting fewer than 24 hours are associated with an $85 \%\left(\mathrm{e}^{-1.875}-1\right)$ decrease in discards compared to multiday trips. The coefficients for the vessel size class variables were both positive, but only the coefficient for dclass 4 was statistically significant. The value for dclass 4 can be interpreted as follows: a trip on a vessel greater than 75 feet long is associated with discards $106 \%$ higher than trips on vessels shorter than 50 feet.

The $R^{2}$ value for the aggregated stock model was 0.401 ; the model explained about $40 \%$ of the variation in discards. However, once the information from the individual stock models was incorporated using the SUR method, the system $\mathrm{R}^{2}$ value increased to 0.834 .

A joint test for significance was conducted on all of the vessel class and trip type variables in the model. The test returned an F statistic value of 66.79 with 69 degrees of freedom in the numerator and 343,114 degrees of freedom in the denominator. The null hypothesis was therefore rejected and we conclude that vessel class and trip type are highly statistically significant in explaining discards.

## 3. Allocation Proportional to Relative Volume of Discards across Vessel/Gear Categories

The following simulation is based on the premise that the optimal allocation of observed seaday resources should be proportional to the amount of discards recorded in each category for the GF fishery. For reference, Table 2 Column G shows the actual distribution of GF discards for these various categories of GF trips in FY2010 and FY2011. As observed seadays determine most of the cost of the monitoring program, it is identified as the basic unit of observing effort in this simulation.

Two scenarios of the simulated ideal allocation of observed seadays for groundfish trips in FY2010 and FY2011 are shown in Table 7. Scenario 1 re-allocates the actual 7,726 observed seadays in FY2010, shown in Table 1 Column D. Without increasing the monitoring effort, the percentage of weighted discards observed increases to 36\% (Column D in Table 7) from the actual average observed GF discard of $29 \%$ (Column D in Table 2) in FY2010.

Scenario 2 shows how to achieve the same volume of discards observed in FY2010 ( 869,044 in Table 1 Column H) while reducing the total observed seadays. The results of this simulation are shown in Columns E through I in Table 7. The overall observed seadays are thereby reduced by 1,477 seadays from 7,726 to 6,249 , shown in Column E. The reduction is achieved by increasing monitoring for trawl class 3 vessels by 31 seadays and class 4 vessels by 377 seadays, and reducing the seadays of all other gears by 1,885 .

For FY2011 the percentage of GF discards observed could be increased from $30 \%$ to $37 \%$ while using the same number of observed seadays in Column A under scenario 1, or observer effort could be reduced by 1,616 seadays under scenario 2 , shown in Column I, and the same total volume of discards could be observed as the status quo shown in Table 1 Column H under 2011.

## Allocation Based on Weighted Volume of Discards across Vessel/Gear Categories

As with the allocation scheme based on total discards, the weighted discard simulation is presented in Table 8 with scenarios 3 and 4 as the corresponding scenarios to scenarios 1 and 2 in Tables 7, respectively, relative to the status quo. Scenario 1 re-allocates the actual 7,726 observed seadays in FY2010, shown in Table 1 Column D. Without increasing the monitoring effort, in scenario 3 the percentage of weighted discards observed increases to $57 \%$ in FY2010 (Column D in Table 8) from the average weighted observed GF discard of $29 \%$ in FY2010. Such an increase would be of great assistance to fishery managers and scientists in evaluating the impact of discards on GF stocks and fisheries.

Scenario 4 shows how to achieve the same percentage of weighted discards observed in FY2010 ( $29 \%$ ) while reducing the total observed seadays. The results of this simulation are shown in Columns E through H in Table 8. The overall observed seadays is thereby reduced by 1,530 seadays from 7,726 to 6,196 , shown in Column E. The reduction is achieved by increasing monitoring for trawl (Otter and Ruhle) class 3 vessels by 45 seadays and class 4 vessels by 333 seadays, so the seadays of all other gears could be reduced by 1,908 .

For FY2011 the percentage of weighted GF discards observed could be increased from $30 \%$ to $47 \%$ while using the same number of observed seadays in Table 1 Column D, or observer effort could be reduced by 1,691 seadays and the same volume of weighted discards could be observed as the status quo, shown in Column G.

## Costs of Monitoring

While similar to the sector ASM program, the existing NEFOP, which currently provides $8 \%$ coverage, will not be replaced by the industry-funded ASM program. Based on FY2010, the
overall cost ${ }^{6}$ of an ASM seaday is $\$ 917.95$. The cost for an at-sea monitor can be separated into two components: at-sea and infrastructure. In this case, the industry (or NOAA) could have saved $\$ 1,355,812(\$ 917.95 * 1,477)$ in FY2010 and $\$ 1,483,407(\$ 917.95 * 1,616)$ in FY2011 by allocating ASM based on the volume of discards across vessel categories (size and gear), as shown in Table 7 under scenario 2.

If ASM were allocated proportional to weighted discard volume of various sizes of vessels, at a cost of $\$ 917.95$ per ASM seaday, $\$ 1,483,407$ ( $\$ 917.95^{*} 1,530$ seadays) could be saved by allocating ASM more efficiently under scenario 3 in 2010 and $\$ 1,552,253$ ( $\$ 917.95^{*} 1,691$ seadays) could have been saved in FY2011, as shown in Table 8 under scenario 4. Once again, shifting observer seadays away from small gillnetters to class 4 otter trawlers is where most of the savings occur.

If the goal was to reach the FY2011 level of observed discards using the least amount of coverage possible, significant monetary resources could be saved by allocating ASM based on volume of discards by vessel size and trip length.

One potential method to distribute the monitoring burden equitably in scenarios where vessels with higher discards are covered at higher rates could be for individual sectors to develop a transfer scheme. Vessels with lower coverage rates could help compensate the vessels that have higher coverage rates so they could collectively reduce the number of observed seadays but would still be able to effectively monitor the ACE. For example, as shown by the ratio in Column H of Table 3 in FY2010, a sector could increase observed seadays for otter trawl class 4 vessels (accounting for $43.5 \%$ of all GF discards), by 1 seaday in order to reduce coverage assigned to class 2 extra-large mesh gillnet vessels (accounting for $1.6 \%$ of all GF discards), by 13 seadays.

This compensation scheme would be possible since the overall observed seadays are less than the current status quo for most of the vessels. Nearly all vessels, except class 4 otter trawlers, would be saving substantially with less coverage than the status quo. This savings would be more than enough to compensate the cost to the large otter trawlers. How a sector

[^78]would establish their compensation scheme would be at their discretion, and this is merely one possible scenario of many that a sector could develop. Importantly, when all types of vessels and gears are combined in a sector, the percentage of discards observed would not be less than the actual FY2011 percentage.

Monitoring costs will be one of the major factors affecting groundfish sector viability moving forward, especially with decreased federal assistance. Based on "Developing Effective Monitoring for the Northeast Multispecies Fishery: Methods and Considerations," draft white paper for NEFMC on April 12, 2012, sectors are required to monitor their members to ensure compliance with self-regulating measures designed to prevent a sector allocation overage. Currently all sectors employ a sector manager, who typically oversees reporting requirements and implements an ASM program, amongst other duties.

Currently, coverage rates must meet a minimum requirement to get at the precision goal, unless NEFMC removes the $30 \%$ CV language following NMFS' 3-year review of the discard rate methodology, or the language is otherwise modified in Amendment 16. Therefore, this approach may need to be used as one component of a monitoring program, and allow precision to be covered by NEFOP or another approach unless these regulations are revised.

However, how to interpret what's fair and equitable at the sector level, and not the vessel level, might also need to be further investigated. CVs measure precision of discard rates, which is to say how much they vary around an average. However, as indicated by a PDT member, while the discard rates may be precise, they do not vary a lot around their central value, and therefore they may not be accurate - their central value may be far from the true discard rate.

Therefore, the approach proposed in this paper primarily addresses the accuracy of the monitoring program (which was not addressed in FW 48 and will not be addressed in FW 51 either), and not the precision. In addition, the current flat CV of $30 \%$ applies no matter what the distribution of ACE or discards is geographically, temporally, or by vessel size and gear type. This is not the most cost effective method, and doesn't help identify whether observed trips are distributed efficiently and equitably. There is a compelling need to have a comprehensive evaluation of the requirement to set the strata to assigning observers. If more observers were assigned to observe trips with high rates of landings and discards, then the monitoring program
could more effectively ensure that a sector does not exceed their ACE, and more accurate data could be integrated into stock assessments and other analyses that utilize catch and discards.

## 4. Conclusion and Discussion

According to the "Sector Operations Plan, Contract, and Environmental Assessment Requirements for FY 2013," the regulations stated in 50 CFR 648.87(b)(1)(v)(B)(3), contain the following objectives for an ASM program:

- Objective 1: It must provide coverage that is fair and equitable.
- Objective 2: It must be distributed in a statistically random manner among all trips.
- Objective 3: Coverage must be representative of fishing activities and operations by all vessels within the sector throughout the entire FY.

The stated goal of ASM is: "To verify area fished and catch (landings and discards), by species and gear type, for the purposes of monitoring sector ACE utilization."

We offer two methods of allocating observer coverage that will be an improvement over the status quo. The first is to assign coverage to vessels based on discard volume; the second is to assign coverage based on discards per seaday. Both distribute costs to those who produce the most discards, and result in collection of data that is more reflective of actual fishing activity. These proposed options are tiered allocation schemes, so observers could still be assigned randomly within each tier. These approaches also incentivize vessels to reduce discards and meet other proposed goals for a monitoring program. While the precision standard is not specifically addressed, it may either be used in conjunction with the current $30 \% \mathrm{CV}$, or an alternate precision standard could be developed and implemented to meet the overarching goals of monitoring. ${ }^{7}$

Assigning ASM coverage proportionally to discards meets the FW 48 (78 FR 53363; August 29, 2013) monitoring Goal 1, improve documentation of catch, because it increases accuracy (i.e., the true discard estimates instead of a relative ratio without taking into account

[^79]the scale for various GF fishing activity per seaday) over the existing program. The proposed allocation methods therefore meet the objective to determine total catch and effort of target species. The objective to achieve coverage levels sufficient to minimize effects of potential observer bias was analyzed by the PDT, which ultimately concluded that they could not determine how observer bias related to discards on unobserved trips.

The proposed ASM schemes fully meets monitoring Goal 2, reduce the cost of monitoring, in that the monitoring costs and coverage levels do not conform to the one-size-fits all approach, which equates to similar costs whether you are landing higher volumes (and getting more of a return per trip) with a large vessel or smaller volumes with a smaller boat. This alternative distributes the costs of monitoring commensurate to the pounds caught, and avoids high coverage rates on small boats that have lower than proportional volume landings/discards than large boats on a daily basis. The proposed ASM schemes support monitoring Goal 3, incentivize reducing discards, as vessels that have a lower relative volume of discards (or volume per seaday) would be assigned lower coverage levels. Coverage levels will be assigned to specified vessel categories within a sector, and the status quo, which does not reward individual vessels with low discards, will be improved upon.

The proposed ASM schemes would not provide additional data streams for stock assessments (Goal 4), beyond the data already collected under the existing program. While there could be alterations to accommodate this goal, they could directly contradict Goal 2, unless the government could fund these data streams. The proposed schemes do, however, provide more accurate data streams for stock assessments.

Vessel size would serve as an appropriate strata and would help to determine more suitable coverage rates that would cut costs for the industry and incentivize reducing discards while achieving monitoring goals and providing accounting of ACE for the fishery.

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Figure 1 Landings vs. Discards per Trip in FY2011

Figure 2 Trip Length (Seadays) vs. Discards per Trip in FY2011


Figure 3 Vessel Length vs. Discards per
Trip in FY2011


[^80]

[^81]

Note: Abbreviation of Groundfish stock are defined as follows and those stocks with an "*" indicated are zero possession prohibited species under landing/possession limits

CODGBE: GB Cod East; CODGBW: GB Cod West; CODGMSS: GOM Cod; FLDSNEMA*: Southern Windowpane FLWGMSS: GOM Winter Flounder;
FLWSNEMA*: SNE Winter Flounder; HADGBE: GB Haddock East; HADGM: GOM Haddock; HALGMMA: Halibut; HKWGMMA: White Hake OPTGMMA*: Ocean Pout; PLAGMMA: American Plaice;

POKGMASS: Pollock; REDGMGBSS: Redfish; WITGMMA: Witch Flounder; WOLGMMA*:Wolffish;


[^82]Table 1 Number of Trips, Seadays, Landings, and Discards for GF Trips in FY 2010

| Size <br> Class | Gear Type | Trips <br> (A) | Seadays <br> (B) | Observed Trips (C) | Observed Seadays (D) | GF <br> Landings <br> (E) | Non-GF Landings (F) | GF <br> Discards <br> (G) | Observed GF <br> Discards (H) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| FY 2010 |  |  |  |  |  |  |  |  |  |
| $\begin{gathered} 2 \\ \left(0^{\prime}-\right. \\ \left.50^{\prime}\right) \end{gathered}$ | Gillnet, XL Mesh | 2,955 | 3,585 | 564 | 656 | 814,477 | 12,451,412 | 47,020 | 9,209 |
|  | Gillnet, L Mesh | 4,524 | 5,185 | 1,367 | 1,594 | 7,609,899 | 5,259,914 | 286,156 | 89,358 |
|  | Hand Line | 271 | 297 | 40 | 43 | 99,625 | 158,660 | 12,556 | 3844 |
|  | Longline | 547 | 745 | 185 | 242 | 1,249,132 | 386,952 | 72,371 | 18,827 |
|  | Otter Trawl | 1,328 | 1,643 | 399 | 488 | 2,328,292 | 687,035 | 195,397 | 67,399 |
| $\begin{gathered} 3 \\ (50 '- \\ \left.75^{\prime}\right) \end{gathered}$ | Gillnet, XL Mesh | 271 | 502 | 38 | 79 | 170,105 | 1,018,179 | 9,605 | 2130 |
|  | Gillnet, L Mesh | 172 | 413 | 58 | 120 | 768,548 | 291,740 | 27,978 | 10,915 |
|  | Haddock Sep. Trawl | 15 | 46 | 4 | 11 | 187,285 | 10,359 | 5,135 | 1,157 |
|  | Otter Trawl | 2,438 | 6,657 | 745 | 1,936 | 17,783,821 | 9,350,367 | 930,740 | 269,042 |
|  | Ruhle Trawl | 8 | 50 | 0 | 0 | 115,547 | 44,944 | 5,822 | 0 |
| $\begin{gathered} 4 \\ \left(75^{\prime}+\right) \end{gathered}$ | Haddock Separator Trawl | 81 | 547 | 24 | 182 | 3,318,470 | 121,026 | 77,768 | 25,558 |
|  | Otter Trawl | 1,214 | 7,571 | 361 | 2,339 | 29,900,139 | 6,441,003 | 1,293,505 | 369,709 |
|  | Ruhle Trawl | 17 | 117 | 6 | 36 | 727,338 | 26,576 | 11,461 | 1,896 |
|  | Total* | 13,845 | 27,362 | 3,791 | 7,726 | 65,073,596 | 36,249,551 | 2,975,574 | 869,044 |
| FY 2011 |  |  |  |  |  |  |  |  |  |
| $\begin{gathered} 2 \\ \left(30^{\prime}-\right. \\ \left.50^{\prime}\right) \end{gathered}$ | Gillnet, XL Mesh | 2,854 | 3,573 | 379 | 486 | 174,417 | 14,466,542 | 23,316 | 4,177 |
|  | Gillnet, L Mesh | 5,485 | 6,511 | 1,520 | 1,745 | 9,209,041 | 7,534,108 | 324,231 | 90,349 |
|  | Hand Line | 444 | 459 | 29 | 29 | 157,499 | 109,995 | 7,982 | 826 |
|  | Longline | 745 | 865 | 137 | 154 | 1,201,593 | 466,010 | 105,039 | 16,974 |
|  | Otter Trawl | 2,022 | 2,349 | 503 | 601 | 3,326,165 | 1,030,607 | 273,134 | 76,775 |
| $\begin{gathered} 3 \\ (50 '- \\ \left.75^{\prime}\right) \end{gathered}$ | Gillnet, XL Mesh | 291 | 472 | 29 | 49 | 28,114 | 1,440,591 | 2,302 | 639 |
|  | Gillnet, L Mesh | 269 | 595 | 107 | 240 | 987,089 | 457,267 | 52,890 | 18,594 |
|  | Haddock Sep. Trawl | 18 | 26 | 4 | 4 | 16,289 | 3,751 | 6,870 | 1,653 |
|  | Longline | 1 | 1 | 1 | 1 | 13 | 3,010 | 0 | 0 |
|  | Otter Trawl | 2,903 | 7,983 | 794 | 2,424 | 20,032,274 | 11,697,859 | 1,301,553 | 424,915 |
|  | Ruhle Trawl | 4 | 30 | 0 | 0 | 56,882 | 14,972 | 1,679 | 0 |
| $\begin{gathered} 4 \\ \left(75^{\prime}+\right) \end{gathered}$ | Haddock Sep. Trawl | 37 | 263 | 17 | 115 | 1,247,060 | 79,098 | 29,178 | 13,286 |
|  | Hand Line | 5 | 7 | 0 | 0 | 739 | 5,168 | 279 | 0 |
|  | Otter Trawl | 1,196 | 8,225 | 400 | 2,845 | 30,666,386 | 9,062,349 | 1,468,505 | 427,654 |
|  | Ruhle Trawl | 49 | 368 | 19 | 139 | 1,390,287 | 172,761 | 28,729 | 13,500 |
|  | Total* | 16,326 | 31,732 | 3,939 | 8,831 | 68,500,349 | 46,545,612 | 3,625,779 | 1,089,342 |

Table 2 Observer Coverage Rates and Proportion of Observed Seadays, Landings, and Discards during GF Trips in FY 2010

| Size Class | Gear Type | Observer Coverage rate (\%) by Category |  |  |  | Distribution \% across Category |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Trips <br> (A) | Seadays $(\mathbf{B})$ | GF <br> Landings <br> (C) | GF Discards (D) | Observed Seadays (E) | GF <br> Landings <br> (F) | GF <br> Discards <br> (G) |
| FY 2010 |  |  |  |  |  |  |  |  |
| 2 (30'-50') | Gillnet, XL Mesh | 19.1\% | 18.3\% | 24.2\% | 19.6\% | 8.5\% | 1.3\% | 1.6\% |
|  | Gillnet, L Mesh | 30.2\% | 30.7\% | 35.1\% | 31.2\% | 20.6\% | 11.7\% | 9.6\% |
|  | Hand Line | 14.8\% | 14.5\% | 34.1\% | 30.6\% | 0.6\% | 0.2\% | 0.4\% |
|  | Longline | 33.8\% | 32.5\% | 28.8\% | 26.0\% | 3.1\% | 1.9\% | 2.4\% |
|  | Otter Trawl | 30.0\% | 29.7\% | 30.1\% | 34.5\% | 6.3\% | 3.6\% | 6.6\% |
| 3 (50'-70')) | Gillnet, XL Mesh | 14.0\% | 15.7\% | 28.8\% | 22.2\% | 1.0\% | 0.3\% | 0.3\% |
|  | Gillnet, L Mesh | 33.7\% | 29.1\% | 28.7\% | 39.0\% | 1.6\% | 1.2\% | 0.9\% |
|  | Haddock Separator Trawl | 26.7\% | 23.9\% | 34.6\% | 22.5\% | 0.1\% | 0.3\% | 0.2\% |
|  | Otter Trawl | 30.6\% | 29.1\% | 30.2\% | 28.9\% | 25.1\% | 27.3\% | 31.3\% |
|  | Ruhle Trawl | 0.0\% | 0.0\% | 0.0\% | 0.0\% | 0.0\% | 0.2\% | 0.2\% |
| 4 (75'+) | Haddock Separator Trawl | 29.6\% | 33.3\% | 39.6\% | 32.9\% | 2.4\% | 5.1\% | 2.6\% |
|  | Otter Trawl | 29.7\% | 30.9\% | 30.5\% | 28.6\% | 30.3\% | 45.9\% | 43.5\% |
|  | Ruhle Trawl (Class 3\&4) | 35.3\% | 30.8\% | 27.2\% | 16.5\% | 0.5\% | 1.1\% | 0.4\% |
| Average/Total* |  | 27.4\% | 28.2\% | 31.1\% | 29.2\% | 100.0\% | 100.0\% | 100.0\% |
| FY 2011 |  |  |  |  |  |  |  |  |
| 2 (30'-50') | Gillnet, XL Mesh | 13.3\% | 13.6\% | 21.0\% | 17.9\% | 5.5\% | 0.3\% | 0.6\% |
|  | Gillnet, L Mesh | 27.7\% | 26.8\% | 26.1\% | 27.9\% | 19.8\% | 13.4\% | 8.9\% |
|  | Hand Line | 6.5\% | 6.3\% | 7.4\% | 10.3\% | 0.3\% | 0.2\% | 0.2\% |
|  | Longline | 18.4\% | 17.8\% | 13.2\% | 16.2\% | 1.7\% | 1.8\% | 2.9\% |
|  | Otter Trawl | 24.9\% | 25.6\% | 26.1\% | 28.1\% | 6.8\% | 4.9\% | 7.5\% |
| 3 (50'-75') | Gillnet, XL Mesh | 10.0\% | 10.4\% | 47.6\% | 27.8\% | 0.6\% | 0.0\% | 0.1\% |
|  | Gillnet, L Mesh | 39.8\% | 40.3\% | 41.2\% | 35.2\% | 2.7\% | 1.4\% | 1.5\% |
|  | Haddock Sep. Trawl | 22.2\% | 15.4\% | 20.8\% | 24.1\% | 0.0\% | 0.0\% | 0.2\% |
|  | Longline | 100.0\% | 100.0\% | 100.0\% | - | 0.0\% | 0.0\% | 0.0\% |
|  | Otter Trawl | 27.4\% | 30.4\% | 31.7\% | 32.6\% | 27.4\% | 29.2\% | 35.9\% |
|  | Ruhle Trawl | 0.0\% | 0.0\% | 0.0\% | 0.0\% | 0.0\% | 0.1\% | 0.0\% |
| 4 (75'+) | Haddock Separator Trawl | 45.9\% | 43.7\% | 60.8\% | 45.5\% | 1.3\% | 1.8\% | 0.8\% |
|  | Hand Line | 0.0\% | 0.0\% | 0.0\% | 0.0\% | 0.0\% | 0.0\% | 0.0\% |
|  | Otter Trawl | 33.4\% | 34.6\% | 33.7\% | 29.1\% | 32.2\% | 44.8\% | 40.5\% |
|  | Ruhle Trawl | 38.8\% | 37.8\% | 34.2\% | 47.0\% | 1.6\% | 2.0\% | 0.8\% |
|  | Total* | 24.1\% | 27.8\% | 31.8\% | 30.0\% | 100.0\% | 100.0\% | 100.0\% |

Table 3 Landings and Discards per Trip and per Seaday for GF Trips in FY 2010

| Size Class | Gear Type | GF <br> Landings per Trip <br> (A) | Non-GF Landings per Trip <br> (B) | GF as \% of Total Landings <br> (C) | GF <br> Discards per Trip <br> (D) | GF Landings per seaday <br> (E) | Non-GF <br> Landings per seaday <br> (F) | GF <br> Discards per seaday <br> (G) | Relative Seaday Ratio** $(\mathbf{H})=$ $[\operatorname{Max}(\mathbf{G})$ $/(\mathbf{G})]$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| FY 2010 |  |  |  |  |  |  |  |  |  |
| $\begin{gathered} 2\left(30^{\prime}-\right. \\ \left.50^{\prime}\right) \end{gathered}$ | Gillnet, XL Mesh | 276 | 4,214 | 6.14\% | 16 | 227 | 3,473 | 13 | 13.03 |
|  | Gillnet, L Mesh | 1,682 | 1,163 | 59.13\% | 63 | 1,468 | 1,014 | 55 | 3.10 |
|  | Hand Line | 368 | 585 | 38.57\% | 46 | 335 | 534 | 42 | 4.04 |
|  | Longline | 2,284 | 707 | 76.35\% | 132 | 1,677 | 519 | 97 | 1.76 |
|  | Otter Trawl | 1,753 | 517 | 77.22\% | 147 | 1,417 | 418 | 119 | 1.44 |
| 3 (50'-75') | Gillnet, XL Mesh | 628 | 3,757 | 14.32\% | 35 | 339 | 2,028 | 19 | 8.93 |
|  | Gillnet, L Mesh | 4,468 | 1,696 | 72.48\% | 163 | 1,861 | 706 | 68 | 2.52 |
|  | Haddock Sep. Trawl | 12,486 | 691 | 94.76\% | 342 | 4,071 | 225 | 112 | 1.53 |
|  | Otter Trawl | 7,294 | 3,835 | 65.54\% | 382 | 2,671 | 1,405 | 140 | 1.22 |
|  | Ruhle Trawl | 14,443 | 5,618 | 72.00\% | 728 | 2,311 | 899 | 116 | 1.47 |
| 4 (75'+) | Haddock Sep. Trawl | 40,969 | 1,494 | 96.48\% | 960 | 6,067 | 221 | 142 | 1.20 |
|  | Otter Trawl | 24,629 | 5,306 | 82.28\% | 1065 | 3,949 | 851 | 171 | 1.00 |
|  | Ruhle Trawl | 42,785 | 1,563 | 96.47\% | 674 | 6,217 | 227 | 98 | 1.74 |
|  | Total* | 4,700 | 2,618 | 64.22\% | 215 | 2,378 | 1,325 | 109 | 1.57 |
|  |  |  |  | FY 2011 |  |  |  |  |  |
| 2 (30'-50') | Gillnet, XL Mesh | 61 | 5,069 | 1.19\% | 8 | 49 | 4,049 | 7 | 40.49 |
|  | Gillnet, L Mesh | 1,679 | 1,374 | 55.00\% | 59 | 1,414 | 1,157 | 50 | 5.31 |
|  | Hand Line | 355 | 248 | 58.88\% | 18 | 343 | 240 | 17 | 15.19 |
|  | Longline | 1,613 | 626 | 72.06\% | 141 | 1,389 | 539 | 121 | 2.18 |
|  | Otter Trawl | 1,645 | 510 | 76.34\% | 135 | 1,416 | 439 | 116 | 2.27 |
|  | Ruhle Trawl | 6,466 | 930 | 87.43\% | 62 | 2,155 | 310 | 21 | 12.79 |
| 3 (50'-75') | Gillnet, XL Mesh | 97 | 4,950 | 1.91\% | 8 | 60 | 3,052 | 5 | 54.18 |
|  | Gillnet, L Mesh | 3,669 | 1,700 | 68.34\% | 197 | 1,659 | 769 | 89 | 2.97 |
|  | Haddock Sep. Trawl | 905 | 208 | 81.28\% | 382 | 627 | 144 | 264 | 1.00 |
|  | Longline | 13 | 3,010 | 0.43\% | 0 | 13 | 3,010 | 0 | - |
|  | Otter Trawl | 6,901 | 4,030 | 63.13\% | 448 | 2,509 | 1,465 | 163 | 1.62 |
|  | Ruhle Trawl | 14,221 | 3,743 | 79.16\% | 420 | 1,896 | 499 | 56 | 4.72 |
| 4 (75'+) | Haddock Sep. Trawl | 33,704 | 2,138 | 94.04\% | 789 | 4,742 | 301 | 111 | 2.38 |
|  | Hand Line | 148 | 1,034 | 12.51\% | 56 | 106 | 738 | 40 | 6.63 |
|  | Otter Trawl | 25,641 | 7,577 | 77.19\% | 1,228 | 3,728 | 1,102 | 179 | 1.48 |
|  | Ruhle Trawl | 28,373 | 3,526 | 88.95\% | 586 | 3,778 | 469 | 78 | 3.38 |
|  | Total* | 4,196 | 2,851 | 59.54\% | 222 | 2,159 | 1,467 | 114 | 2.31 |

Table 4 Annual Catch Entitlement of Groundfish to Groundfish Sector, Catches, and the Utilization Rate by Species/Stocks

| Groundfish Species/stocks | 2010 ACE <br> (lb) <br> (A) | 2010 Catch <br> (Landings + Discards) <br> (lb) <br> (B) | $\begin{gathered} 2011 \\ \mathrm{ACE}(\mathbf{l b}) \end{gathered}$ <br> (C) | 2011 Catch (Landings + Discards)(lb) <br> (D) | Predicted <br> Utilization <br> Rate for 2011 $(\mathrm{E}=\mathrm{B} / \mathrm{C})$ | Actual Utilization Rate for 2011 $(\mathrm{F}=\mathrm{D} / \mathrm{C})$ | Standardized Ratio based on Pollock <br> (G) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CC/GOM Yel. Fl. | 1,608,084 | 1,234,074 | 2,169,519 | 1,752,995 | 56.88\% | 80.80\% | 1.614 |
| GB Cod East | 717,441 | 558,835 | 431,357 | 357,959 | 100.00\% | 83.00\% | 2.838 |
| GB Cod West | 6,563,099 | 5,494,540 | 9,544,297 | 6,730,519 | 57.57\% | 70.50\% | 1.634 |
| GB Haddock East | 26,262,695 | 4,019,295 | 21,122,576 | 2,337,362 | 19.03\% | 11.10\% | 0.540 |
| GB Haddock West | 62,331,182 | 14,164,402 | 54,741,830 | 6,103,776 | 25.87\% | 11.20\% | 0.734 |
| GB Winter Fl. | 4,018,496 | 3,047,725 | 4,796,109 | 4,242,164 | 63.55\% | 88.50\% | 1.803 |
| GB Yellowtail Fl. | 1,770,451 | 1,629,253 | 2,474,662 | 2,178,073 | 65.84\% | 88.00\% | 1.868 |
| GOM Cod | 9,540,389 | 7,974,284 | 11,357,677 | 9,629,834 | 70.21\% | 84.80\% | 1.992 |
| GOM Haddock | 1,761,206 | 816,869 | 1,871,943 | 1,066,284 | 43.64\% | 57.00\% | 1.238 |
| GOM Winter Fl. | 293,736 | 177,934 | 716,989 | 348,756 | $24.82 \%$ | 48.60\% | 0.704 |
| Plaice | 6,058,149 | 3,315,063 | 7,302,377 | 3,597,139 | 45.40\% | 49.30\% | 1.288 |
| Pollock | 35,666,741 | 12,014,768 | 34,096,310 | 16,629,760 | 35.24\% | 48.80\% | 1.000 |
| Redfish | 14,894,618 | 4,725,257 | 18,034,606 | 5,959,501 | 26.20\% | 33.00\% | 0.744 |
| SNE/MA Yel. Fl. | 517,372 | 336,125 | 941,762 | 802,444 | 35.69\% | 85.20\% | 1.013 |
| White Hake | 5,522,677 | 4,884,630 | 7,038,744 | 6,645,585 | 69.40\% | 94.40\% | 1.969 |
| Witch Fl. | 1,824,125 | 1,533,027 | 2,847,251 | 2,189,017 | 53.84\% | 76.90\% | 1.528 |
| Grand Total | 179,350,461 | 65,926,081 | 179,488,008 | 70,762,673 | $\mathbf{3 6 . 7 3 \%}$ | $\mathbf{3 9 . 4 0 \%}$ | - |

Table 5 Variable definitions and descriptive statistics

| Variable | Definition | Mean | Std. Dev. |
| :--- | :--- | ---: | ---: |
| Discards | Discards per trip (Lbs) | 226.62 | 529.25 |
| Landings | Landingss per trip (Lbs) | $4,482.43$ | $10,561.93$ |
| trip_length | Length of the trip by number of seadays | 1.39 | 2.25 |
| Dday | $=1$ if trip less than 24 hours, and =0 otherwise | 0.76 | 0.43 |

- Size class (omitted if vessel size is less than 30')

| class2 (base) | $=0$ if vessel size is $30^{\prime}$ to $<50^{\prime}$ |  |  |
| :--- | :--- | ---: | ---: |
| dclass3 | $=1$ if vessel size is $50^{\prime}$ to $<75^{\prime}$ | 0.21 | 0.41 |
| dclass4 | $=1$ if vessel size is $>75^{\prime}$ | 0.09 | 0.29 |

- Sectors (NEFS4 and the common pool are omitted)

| dFixedgear | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.18 | 0.38 |
| :--- | :--- | ---: | ---: |
| dSHS | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.08 | 0.26 |
| dPortclyde | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.05 | 0.22 |
| dNEFS7 | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.02 | 0.15 |
| dNEFS 8 | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.01 | 0.09 |
| dNEFS11 | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.11 | 0.32 |
| dNEFS12 | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.02 | 0.13 |
| dNEFS2 | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.14 | 0.35 |
| dNEFS3 | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.20 | 0.40 |
| dNEFS10 | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.07 | 0.26 |
| dNEFS13 | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.03 | 0.17 |
| dNEFS5 | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.03 | 0.17 |
| dNEFS5 | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.04 | 0.20 |
| dTristate | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.00 | 0.06 |
| dNEFS6 | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.01 | 0.09 |
| dNCCS | $=1$ if vessel belongs to that sector, and $=0$ if otherwise | 0.00 | 0.06 |


| Gear |  |  |  |
| :--- | :--- | ---: | ---: |
| dLongline | $=1$ if Longline gear was used to land catch | 0.05 | 0.21 |
| dHandline | $=1$ if Hand Line gear was used to land catch | 0.01 | 0.10 |
| dGillnetLarg <br> eMesh | $=1$ if Large Mesh Gillnet was used to land catch | 0.38 | 0.48 |
| dGillnetExtra <br> LargeMesh | $=1$ if Extra Large Gillnet was used to land catch | 0.16 | 0.37 |
| dRuhleTrawl | $=1$ if Ruhle Trawl was used to land catch | 0.00 | 0.06 |
| dHaddockSe <br> paratorTrawl | $=1$ if Haddock Separator Trawl was used to land catch | 0.01 | 0.10 |

- Broad Stock Areas

| dGOM | $=1$ if landings occurred in the Gulf of Maine (515) | 0.61 | 0.49 |
| :--- | :--- | :--- | :--- |
| dGBW | $=1$ if landings occurred in the George's Bank West (521) | 0.20 | 0.40 |
| dGBE | $=1$ if landings occurred in the George's Bank East (525) | 0.00 | 0.07 |

Table 6 Double Log SUR Regression Results

| Variables | Unweighted Discards Model |  | Weighted Discards Model |  |
| :--- | ---: | ---: | ---: | ---: |
|  | Parameter <br> Estimate | t statistic | Parameter <br> Estimate | t statistic |
| dday | -1.872 | -15.820 | -1.658 | -17.190 |
| dclass3 | 0.072 | 0.560 | 0.104 | 0.990 |
| dclass4 | 0.723 | 3.620 | 0.720 | 4.430 |
| dFixedgear | 3.827 | 15.740 | 4.543 | 22.940 |
| dSHS | 4.844 | 22.910 | 5.298 | 30.770 |
| dPortclyde | 4.978 | 19.530 | 5.506 | 26.520 |
| dNEFS7 | 4.746 | 17.290 | 5.318 | 23.800 |
| dNEFS8 | 4.160 | 10.020 | 5.051 | 14.940 |
| dNEFS11 | 5.290 | 22.060 | 5.652 | 28.940 |
| dNEFS12 | 3.814 | 12.450 | 4.619 | 18.520 |
| dNEFS2 | 4.867 | 23.580 | 5.361 | 31.890 |
| dNEFS3 | 5.117 | 21.440 | 5.657 | 29.100 |
| dNEFS10 | 4.783 | 19.430 | 5.442 | 27.140 |
| dNEFS13 | 5.580 | 21.240 | 6.135 | 28.670 |
| dNEFS9 | 1.675 | 6.480 | 2.977 | 14.150 |
| dNEFS5 | 6.242 | 26.870 | 6.789 | 35.890 |
| dTristate | 4.979 | 8.450 | 5.702 | 11.890 |
| dNEFS6 | 4.834 | 11.840 | 5.377 | 16.170 |
| dNCCS | 5.060 | 7.400 | 5.791 | 10.400 |
| dLongline | 0.007 | 0.030 | 0.126 | 0.680 |
| dHandline | -3.315 | -8.810 | -2.947 | -9.610 |
| dGillnetLargeMesh | -1.726 | -11.420 | -1.605 | -13.040 |
| dGillnetExtraLargeMesh | -3.708 | -20.850 | -3.308 | -22.850 |
| dRuhleTrawl | -2.134 | -3.550 | -2.169 | -4.430 |
| dHaddockSeparatorTrawl | -0.804 | -2.300 | -0.831 | -2.920 |
| dGOM | 0.928 | 5.730 | 0.729 | 5.530 |
| dGBW | 0.726 | 4.810 | 0.587 | 4.780 |
| dGBE | 1.872 | 3.650 | 1.578 | 3.780 |
| Number of Observation | 14,946 |  |  | 14,946 |
| Discard model R-squared | 0.401 |  | 0.571 |  |
| System weighted | 0.834 |  |  | 0.842 |
| R-squared |  |  |  |  |
|  |  |  |  |  |


|  | Gear Type | Scenario 1: Reallocation of Observed Seadays |  |  |  | Scenario 2: Reduce Observed Seadays by 19\% |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Observed Seadays <br> (A) | Observed Seadays \% (B) | Observed Discards <br> (C) | Observed Discards \% <br> (D) | Observed Seadays <br> (E) | Observed Seadays \% (F) | Observed Discards <br> (G) | Observed Discards \% (H) | Change in Observed Seadays (I) |
| FY 2010 |  |  |  |  |  |  |  |  |  |  |
| $\begin{gathered} 2 \\ \left(30^{\prime}\right. \\ - \\ \left.50^{\prime}\right) \end{gathered}$ | Gillnet, XL Mesh | 122 | 3\% | 1,601 | 3\% | 99 | 3\% | 1,295 | 3\% | -557 |
|  | Gillnet, L Mesh | 743 | 14\% | 41,005 | 14\% | 601 | 12\% | 33,164 | 12\% | -993 |
|  | Haddock S.Trawl | 0 | 8\% | 5 | 8\% | 0 | 7\% | 4 | 7\% | - |
|  | Hand Line | 33 | 11\% | 1,378 | 11\% | 26 | 9\% | 1,115 | 9\% | -17 |
|  | Longline | 188 | 25\% | 18,254 | 25\% | 152 | 20\% | 14,764 | 20\% | -90 |
|  | Otter Trawl | 507 | 31\% | 60,337 | 31\% | 410 | 25\% | 48,799 | 25\% | -78 |
| $\begin{gathered} 3 \\ \left(50^{\prime}\right. \\ - \\ \left.75^{\prime}\right) \end{gathered}$ | Gillnet, XL Mesh | 25 | 5\% | 477 | 5\% | 20 | 4\% | 386 | 4\% | -59 |
|  | Gillnet, L Mesh | 73 | 18\% | 4,921 | 18\% | 59 | 14\% | 3,980 | 14\% | -61 |
|  | Haddock S. Trawl | 13 | 29\% | 1,488 | 29\% | 11 | 23\% | 1,203 | 23\% | 0 |
|  | Otter Trawl | 2,417 | 36\% | 337,880 | 36\% | 1,955 | 29\% | 273,267 | 29\% | 19 |
|  | Ruhle Trawl | 15 | 30\% | 1,760 | 30\% | 12 | 24\% | 1,424 | 24\% | 12 |
| $\begin{gathered} 4 \\ (75 \\ +) \end{gathered}$ | Haddock S. Trawl | 202 | 37\% | 28,708 | 37\% | 163 | 30\% | 23,218 | 30\% | -19 |
|  | Otter Trawl | 3,359 | 44\% | 573,808 | 44\% | 2,716 | 36\% | 464,080 | 36\% | 377 |
|  | Ruhle Trawl | 30 | 25\% | 2,915 | 25\% | 24 | 21\% | 2,358 | 21\% | -12 |
|  | Total* | 7,726 | 28\% | 1,074,523 | 36\% | 6,249 | 23\% | 869,044 | 29\% | -1,477 |
| FY 2011 |  |  |  |  |  |  |  |  |  |  |
| $\begin{gathered} 2 \\ \left(30^{\prime}\right. \\ - \\ \left.50^{\prime}\right) \end{gathered}$ | Gillnet, XL |  |  |  |  |  |  |  |  |  |
|  | Mesh | 57 | 2\% | 371 | 2\% | 46 | 1\% | 303 | 1\% | -440 |
|  | Gillnet, L Mesh | 790 | 12\% | 39,325 | 12\% | 645 | 10\% | 32,129 | 10\% | -1,100 |
|  | Hand Line | 19 | 4\% | 338 | 4\% | 16 | 3\% | 276 | 3\% | -13 |
|  | Longline | 256 | 30\% | 31,067 | 30\% | 209 | 24\% | 25,382 | 24\% | 55 |
|  | Otter Trawl | 665 | 28\% | 77,353 | 28\% | 544 | 23\% | 63,199 | 23\% | -57 |
|  | Ruhle Trawl | 0 | 5\% | 3 | 5\% | 0 | 4\% | 2 | 4\% | 0 |
| $\begin{gathered} 3 \\ \left(50^{\prime}\right. \\ - \\ \left.75^{\prime}\right) \end{gathered}$ | Gillnet, XL |  |  |  |  |  |  |  |  |  |
|  | Mesh | 6 | 1\% | 27 | 1\% | 5 | 1\% | 22 | 1\% | -44 |
|  | Gillnet, L Mesh | 129 | 22\% | 11,451 | 22\% | 105 | 18\% | 9,356 | 18\% | -135 |
|  | Haddock <br> S.Trawl | 17 | 64\% | 4,421 | 64\% | 14 | 53\% | 3,612 | 53\% | 10 |
|  | Longline | 0 | 0\% | 0 | - | 0 | 0\% | 0 | - | -1 |
|  | Otter Trawl | 3,170 | 40\% | 516,852 | 40\% | 2,590 | 32\% | 422,275 | 32\% | 166 |
|  | Ruhle Trawl | 4 | 14\% | 229 | 14\% | 3 | 11\% | 187 | 11\% | 3 |
| $\begin{gathered} 4 \\ (75 \\ +) \end{gathered}$ | Haddock |  |  |  |  |  |  |  |  |  |
|  | S.Trawl | 71 | 27\% | 7,884 | 27\% | 58 | 22\% | 6,441 | 22\% | -57 |
|  | Otter Trawl | 3,577 | 43\% | 638,592 | 43\% | 2,922 | 36\% | 521,738 | 36\% | 77 |
|  | Ruhle Trawl | 70 | 19\% | 5,463 | 19\% | 57 | 16\% | 4,463 | 16\% | -82 |
|  | Total* | 8,831 | 28\% | 1,333,321 | 37\% | 7,215 | 23\% | 1,089,341 | 30\% | -1,616 |

Table 8 Weighted Discard Simulation of Observed Seadays for GF Trips in FY 2010

| Size <br> Class | Gear Type | Scenario 3: Reallocation of Observed Seadays |  |  |  | Scenario 4: Reduce Observed Seadays by 20\% |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Observed Seadays <br> (A) | Observed Seadays \% (B) | Observed Weighted Discards (C) | Observed Discards \% (D) | Observed Seadays <br> (E) | Observed Seadays \% (F) | Observed Weighted Discards (G) | Observed Discards \% (G) | Change in Observed Seadays (I) |
| 2010 |  |  |  |  |  |  |  |  |  |  |
| $\begin{gathered} 2 \\ \left(30^{\prime}-\right. \\ \left.50^{\prime}\right) \end{gathered}$ | Gillnet, XL Mesh | 135 | 4\% | 3,054 | 6\% | 108 | 3\% | 2,449 | 5\% | -548 |
|  | Gillnet, L Mesh | 708 | 14\% | 58,448 | 20\% | 568 | 11\% | 46,871 | 16\% | -1,026 |
|  | Haddock S. Trawl | 0 | 10\% | 11 | 18\% | 0 | 8\% | 9 | 14\% | 0 |
|  | Hand Line | 39 | 13\% | 3,036 | 24\% | 31 | 10\% | 2,435 | 19\% | -12 |
|  | Longline | 224 | 30\% | 40,835 | 56\% | 180 | 24\% | 32,747 | 45\% | -62 |
|  | Otter Trawl | 518 | 32\% | 98,829 | 51\% | 416 | 25\% | 79,255 | 41\% | -72 |
| $\begin{gathered} 3 \\ (50 '- \\ 75 ') \end{gathered}$ | Gillnet, XL Mesh | 26 | 5\% | 817 | 9\% | 21 | 4\% | 655 | 7\% | -58 |
|  | Gillnet, L Mesh | 61 | 15\% | 5,428 | 19\% | 49 | 12\% | 4,353 | 16\% | -71 |
|  | Haddock S. Trawl | 12 | 25\% | 1,788 | 35\% | 9 | 20\% | 1,434 | 28\% | -2 |
|  | Otter Trawl | 2,453 | 37\% | 546,256 | 59\% | 1,967 | 30\% | 438,065 | 47\% | 31 |
|  | Ruhle Trawl | 18 | 36\% | 3,931 | 68\% | 14 | 29\% | 3,152 | 54\% | 14 |
| $\begin{gathered} 4 \\ \left(75^{\prime}+\right) \end{gathered}$ | Haddock S. Trawl | 167 | 31\% | 30,941 | 40\% | 134 | 25\% | 24,813 | 32\% | -48 |
|  | Otter Trawl | 3,332 | 44\% | 886,101 | 69\% | 2,672 | 35\% | 710,600 | 55\% | 333 |
|  | Ruhle Trawl | 32 | 27\% | 5,248 | 46\% | 26 | 22\% | 4,208 | 37\% | -10 |
|  | Total* | 7,726 | 28\% | 1,684,723 | 57\% | 6,196 | 23\% | 1,351,047 | 45\% | -1,530 |
| 2011 |  |  |  |  |  |  |  |  |  |  |
| $\begin{gathered} 2 \\ \left(30^{\prime}-\right. \\ \left.50^{\prime}\right) \end{gathered}$ | Gillnet, XL Mesh | 63 | 2\% | 715 | 3\% | 51 | 1\% | 578 | 2\% | -435 |
|  | Gillnet, L Mesh | 740 | 11\% | 54,093 | 17\% | 598 | 9\% | 43,734 | 13\% | -1,147 |
|  | Hand Line | 22 | 5\% | 682 | 9\% | 18 | 4\% | 551 | 7\% | -11 |
|  | Longline | 292 | 34\% | 63,584 | 61\% | 236 | 27\% | 51,408 | 49\% | 82 |
|  | Otter Trawl | 717 | 31\% | 140,734 | 52\% | 580 | 25\% | 113,783 | 42\% | -21 |
|  | Ruhle Trawl | 0 | 6\% | 8 | 13\% | 0 | 5\% | 6 | 10\% | 0 |
| $\begin{gathered} 3 \\ (50 '- \\ \left.75^{\prime}\right) \end{gathered}$ | Gillnet, XL Mesh | 6 | 1\% | 50 | 2\% | 5 | 1\% | 41 | 2\% | -44 |
|  | Gillnet, L Mesh | 105 | 18\% | 11,895 | 22\% | 85 | 14\% | 9,617 | 18\% | -155 |
|  | Haddock S. Trawl | 20 | 76\% | 9,514 | 138\% | 16 | 61\% | 7,692 | 112\% | 12 |
|  | Longline | 0 | 0\% | 0 | - | 0 | 0\% | 0 | - | -1 |
|  | Otter Trawl | 3,281 | 41\% | 866,945 | 67\% | 2,653 | 33\% | 700,925 | 54\% | 229 |
|  | Ruhle Trawl | 5 | 16\% | 470 | 28\% | 4 | 13\% | 380 | 23\% | 4 |
| $\begin{gathered} 4 \\ \left(75^{\prime}+\right) \end{gathered}$ | Haddock S. Trawl | 62 | 23\% | 9,305 | 32\% | 50 | 19\% | 7,523 | 26\% | -65 |
|  | Hand Line | 1 | 10\% | 44 | 16\% | 1 | 8\% | 36 | 13\% | 1 |
|  | Otter Trawl | 3,442 | 42\% | 926,051 | 63\% | 2,783 | 34\% | 748,712 | 51\% | -62 |
|  | Ruhle Trawl | 76 | 21\% | 9,963 | 35\% | 61 | 17\% | 8,055 | 28\% | -78 |
|  | Total* | 8,831 | 28\% | 2,094,054 | 58\% | 7,140 | 23\% | 1,693,043 | 47\% | -1,691 |

## Appendix F Example SBRM Report and Data Queries

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## EXAMPLE - EXAMPLE - EXAMPLE - EXAMPLE - EXAMPLE

## Northeast Region SBRM Review Report

[Note:This is an example report to illustrate one possible structure for presenting information relevant for reviewing and evaluating the Northeast Region SBRM. An alternative example could be the SBRM 3-yr Review Report 2011, published in two Center Reference Documents (CRD11-09 ${ }^{1}$ and CRD12-27²). This information should be considered preliminary and is not intended for Council action. If the Councils select options for both a SBRM review report and a discard report, the SBRM review report may provide a review of previous discard estimations without repeating previously estimated discards.]

## Monkfish

## Background

Amendment 3 to the Monkfish Fishery Management Plan (FMP), part of the Omnibus Standardized Bycatch Reporting Methodology (SBRM) Amendment to the Northeast Region FMPs, implemented several requirements regarding the reporting of bycatch information for the monkfish fishery. This amendment was developed under the authority of section 303(11)(a) of the Magnuson-Stevens Act, which requires that all FMPs establish an SBRM. The SBRM Amendment addressed four elements: (1) The bycatch reporting and monitoring mechanisms used to obtain information on discards in Northeast fisheries; (2) the analytical techniques used to estimate discards and to allocate at-sea observer effort; (3) establishing a precision-based performance standard for the SBRM; and (4) requiring a periodic review and reporting process as part of the SBRM.

This document complies with the fourth element of the SBRM implemented under Amendment 3: The periodic SBRM Report. This report is intended to provide information with which the New England and Mid-Atlantic Fishery Management Councils (Councils) and NOAA Fisheries Service would consider the effectiveness of the SBRM and, if necessary, take appropriate steps to improve the SBRM. As described in Amendment 3, the SBRM Report would provide the following information: (1) A review of the recent levels of observer coverage in each applicable fishery; (2) a review of recent observed encounters with each species in each fishery, and a summary of observed discards by weight; (3) a review of the coefficient of variation (CV) of the discard information collected for each fishery; (4) an estimate of the total amount of discards associated with each fishery (these estimates may differ from estimates generated and used in stock assessments, as different methods and stratification may be used in each case); (5) an evaluation of the effectiveness of the SBRM at meeting the specified target for each fishery; (6) a description of the methods used to calculate the reported CVs and to determine target observer coverage levels, if the methods used are different from those

[^83]described and evaluated in the SBRM Amendment; and (7) an evaluation of the implications for management of the discard information collected under the SBRM.

The information to be provided in the report for the purpose of determining the effectiveness of the SBRM in meeting the CV standards should not be confused with the level of information a Council may want or need to address specific management issues. More detailed discard-related information, structured in a way and at a scale meaningful for the particular management issue, can always be provided at the Councils' request.

## Analytical Overview

This report focuses on the monkfish fishery, as managed under the Monkfish FMP, but addresses the discards of all species in the monkfish fishery as well as the discards of monkfish in other fisheries. There are three primary fishing gear modes that comprise the monkfish fishery: New England large-mesh otter trawl; New England extra-large-mesh gillnet; and Mid-Atlantic extra-large-mesh gillnet. This analysis will examine the discards of all species that occur in these three fishing modes.

In addition to the three primary monkfish fishing modes identified above, there are another 17 fishing modes for which at least some amount of monkfish was discarded in 2004. Of these, there are nine that contributed at least 1 percent of the total estimated monkfish discards in 2004: New England and Mid-Atlantic open area, limited access scallop dredge; New England and Mid-Atlantic small-mesh otter trawl; New England and Mid-Atlantic open area, general category scallop dredge; New England and Mid-Atlantic closed area, limited access scallop dredge; and Mid-Atlantic large-mesh otter trawl. This analysis will examine monkfish discards in these fishing modes.

## Review of Recent Levels of Observer Coverage

Table 1 identifies the observer coverage in 2004 for the primary monkfish fishery and monkfish discard fishing modes. This table also identifies the number of FVTR reports submitted for each fishing mode, in order to calculate an observer coverage rate for 2004.

| Fishing Mode | Observed Trips | Observed Sea <br> Days | FVTR Trips | Coverage Rate |
| :--- | :---: | :---: | :---: | :---: |
| NE large-mesh otter trawl | $386(153)$ | $1,076(871)$ | 16,156 | $2 \%(3 \%)$ |
| NE x-large-mesh gillnet | $445(124)$ | $533(168)$ | 4,712 | $9 \%(12 \%)$ |
| MA x-large-mesh gillnet | $27(115)$ | $30(122)$ | 2,568 | $1 \%(6 \%)$ |
| NE OL scallop dredge | $26(10)$ | $344(113)$ | 1,229 | $2 \%(3 \%)$ |
| MA OL scallop dredge | $69(9)$ | $591(84)$ | 1,822 | $4 \%(4 \%)$ |
| NE small-mesh otter trawl | $142(58)$ | $449(128)$ | 3,484 | $4 \%(6 \%)$ |
| NE OG scallop dredge | $9(11)$ | $11(13)$ | 3,566 | $0.25 \%(1 \%)$ |
| NE CL scallop dredge | 86 | 805 | 292 | $29 \%$ |
| MA CL scallop dredge | 35 | 373 | 78 | $45 \%$ |
| MA OG scallop dredge | $22(17)$ | $33(22)$ | 3,433 | $1 \%(1 \%)$ |
| MA large-mesh otter trawl | $75(1)$ | $183(3)$ | 8,850 | $1 \%(1 \%)$ |
| MA small-mesh otter trawl | $194(11)$ | $471(18)$ | 5,222 | $4 \%(4 \%)$ |

Table 1. 2004 observer coverage rates for the primary fishing modes associated with either the monkfish fishery (landings) or monkfish discards. Numbers in parentheses represent additional

## SBRM Amendment

observer coverage included in the protected resources dataset (either training trips or "limited protocol" trips). For modes with no number in parentheses, there were no additional trips in the protected resources dataset.

## Recent Observed and Estimated Discards

## Discards in the Monkfish Fishery

As noted above, there are three primary fishing modes that comprise the monkfish fishery: New England large-mesh otter trawl; New England extra-large-mesh gillnet; and Mid-Atlantic extra-large-mesh gillnet. Together, three fishing modes accounted for over 92 percent of monkfish landings in 2004 (see Table 2). Although there were 142 species observed to be discarded in 2004 by these three fishing modes, the top 10 discard species accounted for 83 percent, by weight, of the total observed discards (see Table 3). Winter and little skates were the primary discard species, together comprising over 41 percent of observed discards. All skates combined represented 58 percent of all observed discards in these three fishing modes. Spiny dogfish accounted for another 14 percent of observed discards; monkfish, 4 percent; Jonah crab, 3.2 percent; American lobster, 2.9 percent; and thorny skate, 2.8 percent. All other discard species represented 1 percent or less of the total observed discards for these three fishing modes. Attachments 1, 2, and 3, identify all observed discards, by weight, for the three primary monkfish fishing modes.

| Fishing Mode | $\mathbf{2 0 0 4}$ Monkfish <br> Landings (lb) (FVTR) | Percent of Total <br> $\mathbf{2 0 0 4}$ Monkfish <br> Landings | Cumulative <br> Percentage of <br> Landings |
| :--- | :---: | :---: | :---: |
| NE Large-mesh Trawl | $14,955,163$ | $47.6 \%$ | $47.6 \%$ |
| NE X-Large-mesh Gillnet | $9,836,119$ | $31.3 \%$ | $78.9 \%$ |
| MA X-Large-mesh Gillnet | $4,301,618$ | $13.7 \%$ | $92.6 \%$ |
| NE Scallop Dredge | 878,931 | $2.8 \%$ | $95.4 \%$ |
| NE Large-mesh Gillnet | 615,585 | $2.0 \%$ | $97.3 \%$ |
| MA Scallop Dredge | 348,132 | $1.1 \%$ | $98.4 \%$ |
| MA Large-mesh Trawl | 346,457 | $1.1 \%$ | $99.5 \%$ |
| NE Small-mesh Trawl | 49,150 | $0.2 \%$ | $99.7 \%$ |
| MA Small-mesh Trawl | 36,600 | $0.1 \%$ | $99.8 \%$ |
| MA Scallop Trawl | 32,555 | $0.1 \%$ | $99.9 \%$ |

Table 2. 2004 monkfish landings, by weight, by fishing mode (FVTR).

| Discard Species | Total 2004 Observed <br> Discards (lb) | Percent of Total <br> Observed Discards | Cumulative Percent of <br> Observed Discards |
| :--- | :---: | :---: | :---: |
| Winter skate | 386,292 | $21.5 \%$ | $21.5 \%$ |
| Little skate | 353,072 | $19.6 \%$ | $41.1 \%$ |
| Spiny dogfish | 253,710 | $14.1 \%$ | $55.2 \%$ |
| Skate, NK | 219,095 | $12.2 \%$ | $67.3 \%$ |
| Monkfish | 72,706 | $4.0 \%$ | $71.4 \%$ |
| Jonah crab | 57,026 | $3.2 \%$ | $74.5 \%$ |
| American lobster | 51,748 | $2.9 \%$ | $77.4 \%$ |
| Thorny skate | 50,240 | $2.8 \%$ | $80.2 \%$ |
| Atlantic cod | 27,633 | $1.5 \%$ | $81.7 \%$ |
| Windowpane flounder | 23,448 | $1.3 \%$ | $83.0 \%$ |

Table 3. Top ten discard species, by weight, and percent of total 2004 observed discards in the New England large-mesh otter trawl, and New England and Mid-Atlantic extra-large-mesh gillnet fishing modes, combined.

## Discards of Monkfish in Other Fisheries

As noted above, there are 20 fishing modes, including the three primary modes in the monkfish fishery, for which at least some amount of monkfish was discarded in 2004. Table 4 identifies the discards of monkfish in 2004, based on observed fishing trips in these 20 fishing modes. The table identifies both the observed discards, the ratio of observed monkfish discards to total observed discards (which indicates the degree to which monkfish is a component of the total discards in the fishing mode), an estimate of the total discards of monkfish in these fishing modes (based on the techniques described in the SBRM Amendment), and the percent (and cumulative percent) of the estimated total monkfish discards in these fishing modes.

|  | Observed <br> Monkfish <br> Discards (lb) | Observed <br> Discards, All <br> Species (lb) | Ratio of <br> Monkfish to <br> Total Discards | Estimate of Total <br> Monkfish <br> Discards (lb) | Percent of Total <br> Monkfish <br> Discards | Cumulative <br> Percent of <br> Discards |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| NE Scallop Dredge OL | 37,877 | 806,792 | $4.7 \%$ | $2,896,875$ | $29.71 \%$ | $29.71 \%$ |
| MA Scallop Dredge OL | 45,211 | 787,116 | $5.7 \%$ | $2,027,711$ | $20.79 \%$ | $50.50 \%$ |
| NE Large-mesh Otter Trawl | 41,061 | $1,545,623$ | $2.7 \%$ | $1,313,457$ | $13.47 \%$ | $63.97 \%$ |
| NE Small-mesh Otter Trawl | 26,577 | $1,108,074$ | $2.4 \%$ | $1,136,577$ | $11.66 \%$ | $75.63 \%$ |
| NE X-Large-mesh Gillnet | 29,933 | 241,610 | $12.4 \%$ | 635,797 | $6.52 \%$ | $82.15 \%$ |
| NE Scallop Dredge OG | 3,330 | 9,918 | $33.6 \%$ | 402,741 | $4.13 \%$ | $86.28 \%$ |
| NE Scallop Dredge CL | 123,828 | $1,477,622$ | $8.4 \%$ | 377,988 | $3.88 \%$ | $90.15 \%$ |
| MA Scallop Dredge CL | 67,163 | 960,608 | $7.0 \%$ | 245,389 | $2.52 \%$ | $92.67 \%$ |
| MA Scallop Dredge OG | 1,307 | 3,400 | $3.9 \%$ | 209,696 | $2.15 \%$ | $94.82 \%$ |
| MA Large-mesh Otter Trawl | 3,629 | 208,137 | $1.7 \%$ | 166,051 | $1.70 \%$ | $96.52 \%$ |
| MA Small-mesh Otter Trawl | 7,744 | 776,602 | $1.0 \%$ | 110,351 | $1.13 \%$ | $97.65 \%$ |
| MA X-Large-mesh Gillnet | 1,712 | 13,386 | $12.8 \%$ | 103,961 | $1.07 \%$ | $98.72 \%$ |
| MA Scallop Trawl OL | 275 | 16,019 | $1.7 \%$ | 76,078 | $0.78 \%$ | $99.50 \%$ |
| MA Scallop Trawl OG | 585 | 37,893 | $1.5 \%$ | 28,377 | $0.29 \%$ | $99.79 \%$ |
| NE Large-mesh Gillnet | 878 | 555,903 | $0.2 \%$ | 11,021 | $0.11 \%$ | $99.90 \%$ |
| MA Scallop Dredge CG | 11 | 394 | $2.8 \%$ | 6,106 | $0.06 \%$ | $99.97 \%$ |
| NE Midwater Trawl | 269 | 402,297 | $0.1 \%$ | 2,241 | $0.02 \%$ | $99.99 \%$ |
| MA Midwater Trawl | 94 | 18,637 | $0.5 \%$ | 461 | $0.00 \%$ | $99.99 \%$ |
| NE Shrimp Trawl | 2 | 2,175 | $0.1 \%$ | 428 | $0.00 \%$ | $100.00 \%$ |
| MA Fish Pot | 1 | $0.0 \%$ | 234 | $0.00 \%$ | $100.00 \%$ |  |

Table 4. 2004 discards of monkfish, both observed and estimated total discards, by weight, for the 20 Northeast Region fishing modes with at least 1 lb of observed discards. The ratio of monkfish to total discards indicates, based on observer data, the relative proportion of the total observed discards that are accounted for by discards of monkfish. For example, the data collected by at-sea observers in 2004 suggest that monkfish comprise one-third of all discards in the New England open area, general category scallop dredge fishing mode.

## Precision of Discard Estimates

Based on the information presented in the SBRM Amendment, a CV is a measure of the precision of the data used in developing discard estimates. Table 5 and Table 6 provide the CVs associated with the discard estimates for the fishing modes most relevant to this report. Table 5 identifies the CVs for all relevant species and species groups for the New England large-mesh otter trawl, and the Mid-Atlantic and New England extra-large-mesh
gillnet fishing modes (the primary three fishing modes associated with the monkfish fishery). Table 6 identifies the CVs for monkfish discards for the 12 fishing modes for which the discards of monkfish accounted for at least 1 percent of the total monkfish discards in 2004.

| Discard Species/Species Group |  |  |  |
| :---: | :---: | :---: | :---: |
| Bluefish | 247\% | 18\% | 30\% |
| Atlantic herring | 131\% | 38\% | * |
| Deep-sea red crab | 28\% | N/A | N/A |
| Sea scallop | 35\% | N/A | N/A |
| Mackerel, squid, butterfish | 57\% | 50\% | * |
| Monkfish | 9\% | 17\% | 27\% |
| Large-mesh multispecies | 10\% | 16\% | * |
| Small-mesh multispecies | 18\% | 62\% | N/A |
| Skates | 17\% | 12\% | 11\% |
| Spiny dogfish | 24\% | 16\% | 13\% |
| Summer flounder, scup, black sea bass | 32\% | 23\% | 30\% |
| Surfclam, ocean quahog | N/A | N/A | N/A |
| Tilefish | 53\% | N/A | N/A |
| Sea turtles | * | * | 49\% |

Table 5. The CV of total discards, by fleet and species group, derived from the 2004 Northeast Region Fisheries Observer Program, for the primary three fishing modes associated with the monkfish fishery. "*" indicates that there were zero discards in 2004. "N/A" indicates that the particular combination of species and fishing mode is excluded from the review.

| Fishing Mode | Monkfish <br> Discards |
| :--- | :---: |
| NE Scallop Dredge OL | $32 \%$ |
| MA Scallop Dredge OL | $\mathbf{1 7 \%}$ |
| NE Large-mesh Otter Trawl | $\mathbf{9} \%$ |
| NE Small-mesh Otter Trawl | $40 \%$ |
| NE X-Large-mesh Gillnet | $\mathbf{1 7 \%}$ |
| NE Scallop Dredge OG | $56 \%$ |
| NE Scallop Dredge CL | $\mathbf{2 5 \%}$ |
| MA Scallop Dredge CL | $\mathbf{2 6 \%}$ |
| MA Scallop Dredge OG | $\mathbf{2 0 \%}$ |
| MA Large-mesh Otter Trawl | $\mathbf{2 9 \%}$ |
| MA Small-mesh Otter Trawl | $\mathbf{3 5 \%}$ |
| MA X-Large-mesh Gillnet | $\mathbf{2 7 \%}$ |

Table 6. The CV of total monkfish discards, by fleet, derived from the 2004 Northeast Region Fisheries Observer Program, for the 12 fishing modes for which each mode's monkfish discards account for at least 1 percent of total monkfish discards.

## Evaluation of Effectiveness of Meeting the SBRM Standard

The SBRM Amendment [proposes to] implement a performance standard of a CV of no more than 30 percent for each relevant combination of fishing mode and species/species group in the Northeast Region. The intent of this standard is to ensure that the data obtained through the Northeast Region SBRM is sufficiently precise to enable scientists and managers to confidently use the resulting data for conducting stock assessments and making management decisions.

Based on the information presented in Table 5 and Table 6, we can evaluate whether the SBRM has met the performance standard for the fishing modes relevant to the subject of this report, monkfish. For the three primary monkfish fishing modes, there are five species groups for which a CV could not be calculated because there were no (zero) discards observed in these fishing modes. There were also 10 species groups which are not included due to the "gray-cell" filter process (see SBRM Amendment for explanation of the gray-cell process). Of the remaining 27 combinations of fishing modes and species groups, 17 have CVs of 30 percent or less. Many of these have CVs considerably better than the SBRM standard (e.g., monkfish in New England large-mesh otter trawl, 9 percent; spiny dogfish in Mid-Atlantic extra-large-mesh gillnet, 13 percent). The remaining 10 combinations have CVs that exceeded the standard, and ranged from 32 percent to 247 percent.

For the 12 fishing modes with monkfish discards included in Table 6, 8 have CVs of 30 percent or less. The other four fishing modes have CVs that range from 32 to 56 percent. Overall, of the 41 unique fishing mode and species group combinations subject to the SBRM standard and related to monkfish, 14 (one-third) have CVs that exceed the standard. The remaining 27 combinations either meet the CV standard or have zero discards.

## Implications for Management

In addition to determining whether or not the SBRM standard was met for each applicable combination of fishing mode and species group, it is also important to examine the potential management implications of not meeting the standard. The reasons for not meeting the standard can vary and include: Insufficient sampling; highly variable discard events; rare discard events; etc. Taking stock of the discard information driving the high CVs can be informative for both understanding the implications of not meeting the standard as well as setting priorities for redressing the issues. Table 7 displays, for each of the three primary monkfish fishing modes, the species groups for which the 2004 CV exceeds the SBRM standard and the observed discards, the estimated total discards, and the percent of total catch represented by the estimated total discards. Table 8 shows similar information for monkfish discards by the primary discard fishing modes for which the 2004 exceeds the SBRM standard.

|  | Discard Species/Species Group |  |  | Estimated <br> Total | Discards as <br> Percent of Total <br> Landings |
| :--- | :--- | :---: | :---: | :---: | :---: |
| (lb) |  |  |  |  |  |

Table 7. Summary information regarding the potential impact of discards for species/species groups for which the 2004 CV exceeded the SBRM standard.

| Fishing Mode | $\mathbf{2 0 0 4} \mathbf{~ C V}$ <br> (Monkfish) | Observed <br> Discards (lb) | Estimated <br> Total <br> Discards (lb) | Discards as <br> Percent of Total <br> Landings |
| :--- | :---: | :---: | :---: | :---: |
| NE Scallop Dredge OL | $32 \%$ | 37,877 | $2,896,875$ | $12.58 \%$ |
| NE Small-mesh Otter Trawl | $40 \%$ | 26,577 | $1,136,577$ | $4.93 \%$ |
| NE Scallop Dredge OG | $56 \%$ | 3,330 | 402,741 | $1.75 \%$ |
| MA Small-mesh Otter Trawl | $35 \%$ | 7.744 | 166,051 | $0.48 \%$ |

Table 8. Summary information regarding the potential impact of monkfish discards for fishing modes for which the 2004 CV exceeded the SBRM standard.

Examining the information presented above provides insight into the potential implications for management of the relatively high CVs associated with the discard information collected in 2004 for the primary monkfish fishery fishing modes. With the possible exception of summer flounder, scup, and black sea bass discards in the New England large-mesh otter trawl mode, and sea turtle encounters in the Mid-Atlantic extra-large-mesh gillnet mode, the impacts of the discards associated with relatively high CVs are very likely to be trivial. Except as noted, estimated total discards do not exceed $40,000 \mathrm{lb}$ for any species/species group, and for most cases, the estimated total discards represent less than $1 / 10$ of 1 percent of the total (recreational and commercial) landings. Within the fishing modes that discard monkfish, although New England open area, limited access scallop dredge contributes the most monkfish discards, the CV (32 percent) is very close to the SBRM standard. Mid-Atlantic small-mesh otter trawl also has a CV (35 percent) relatively close to the SBRM standard, and the estimated total discards represent less than $1 / 2$ of 1 percent of the total monkfish landings for 2004.

Further examination of the summer flounder, scup, and black sea bass discards in the New England large-mesh otter trawl fishing mode indicates that over 90 percent of the observed discards for this species group are summer flounder ( $19,723 \mathrm{lb}$ out of 21,854 lb). Table 9 provides additional information on these three species for this fishing mode. In this case, the highest CVs are associated with scup and black sea bass, but estimated total discards for these two species are relatively low ( 0.45 percent and 0.15 percent, respectively, of total (commercial and recreational) 2004 landings). Most of the discards within this species group are summer flounder, but even though the CV is greater than the SBRM standard, it remains relatively close ( 33 percent rather than 30 percent).
$\left.\begin{array}{lcccc}\hline & \text { Individual Species } & \mathbf{2 0 0 4} \mathbf{~ C V} & \begin{array}{c}\text { Observed } \\ \text { Discards (Ib) }\end{array} & \begin{array}{c}\text { Estimated } \\ \text { Total } \\ \text { Discards (lb) }\end{array}\end{array} \begin{array}{c}\text { Discards as } \\ \text { Percent of Total } \\ \text { Landings }\end{array}\right]$

Table 9. Additional summary information regarding the potential impact of discards for species for which the 2004 CV exceeded the SBRM standard.

The implications of CVs exceeding the SBRM target, based on this information, are likely to be most important for the discards of monkfish in the New England small-mesh otter trawl and New England open area, general category scallop dredge fishing modes.

## Trends in Discards

There is no information to be presented at this time on recent or developing trends in discards for the subject fishing modes.

## Notes on the Example

This information should be considered to be preliminary. It is not presented for Council action, but rather is intended solely as an example of the potential structure and content that could be used in preparing future SBRM Reports.

The information presented in this example report was collected prior to the development and implementation of the Northeast Region SBRM. Future evaluations of the SBRM data should be conducted based on information collected after the SBRM is implemented.

Were this an actual SBRM report, additional information could be utilized and incorporated into the report, such as trend information on discards over time. Also, additional information could be presented depending on the specific needs of the Councils, Plan Development Teams, Fishery Management Action Teams, or Monitoring Committees.

Attachment 1: Observed Discards in the NE Large-mesh Otter Trawl Fishing Mode

|  | Species Name | Observed Discards (lb) | Observed <br> Discards, All <br> Species (lb) | Ratio of Discards to All Discards | Cumulative Percent of Total Discards |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | SKATE, WINTER (BIG) | 366,380 | 1,545,623 | 23.70\% | 23.70\% |
| 2 | SKATE, LITTLE | 347,835 | 1,545,623 | 22.50\% | 46.21\% |
| 3 | SKATE, NK | 217,238 | 1,545,623 | 14.06\% | 60.26\% |
| 4 | DOGFISH, SPINY | 149,701 | 1,545,623 | 9.69\% | 69.95\% |
| 5 | CRAB, JONAH | 49,502 | 1,545,623 | 3.20\% | 73.15\% |
| 6 | SKATE, THORNY | 47,074 | 1,545,623 | 3.05\% | 76.20\% |
| 7 | MONKFISH (ANGLER, GOOSEFISH) | 41,061 | 1,545,623 | 2.66\% | 78.85\% |
| 8 | LOBSTER, AMERICAN | 29,328 | 1,545,623 | 1.90\% | 80.75\% |
| 9 | FLOUNDER, SAND DAB (WINDOWPANE) | 23,446 | 1,545,623 | 1.52\% | 82.27\% |
| 10 | FLOUNDER, WITCH (GREY SOLE) | 22,266 | 1,545,623 | 1.44\% | 83.71\% |
| 11 | FLOUNDER, SUMMER (FLUKE) | 19,723 | 1,545,623 | 1.28\% | 84.99\% |
| 12 | SKATE, SMOOTH | 18,832 | 1,545,623 | 1.22\% | 86.20\% |
| 13 | FLOUNDER, YELLOWTAIL | 17,016 | 1,545,623 | 1.10\% | 87.30\% |
| 14 | RAVEN, SEA | 15,844 | 1,545,623 | 1.03\% | 88.33\% |
| 15 | SPONGE, NK | 15,118 | 1,545,623 | 0.98\% | 89.31\% |
| 16 | COD, ATLANTIC | 13,711 | 1,545,623 | 0.89\% | 90.19\% |
| 17 | FLOUNDER, AMERICAN PLAICE | 12,086 | 1,545,623 | 0.78\% | 90.98\% |
| 18 | SCULPIN, LONGHORN | 9,979 | 1,545,623 | 0.65\% | 91.62\% |
| 19 | HADDOCK | 9,724 | 1,545,623 | 0.63\% | 92.25\% |
| 20 | OCEAN POUT | 9,242 | 1,545,623 | 0.60\% | 92.85\% |
| 21 | BASS, STRIPED | 9,217 | 1,545,623 | 0.60\% | 93.45\% |
| 22 | CRAB, TRUE, NK | 8,419 | 1,545,623 | 0.54\% | 93.99\% |
| 23 | SKATE, BARNDOOR | 7,846 | 1,545,623 | 0.51\% | 94.50\% |
| 24 | STARFISH, SEASTAR,NK | 7,529 | 1,545,623 | 0.49\% | 94.99\% |
| 25 | REDFISH, NK (OCEAN PERCH) | 7,220 | 1,545,623 | 0.47\% | 95.45\% |
| 26 | CRAB, DEEPSEA, RED | 6,660 | 1,545,623 | 0.43\% | 95.88\% |
| 27 | CRAB, SPIDER, NK | 4,945 | 1,545,623 | 0.32\% | 96.20\% |
| 28 | FISH, NK | 4,499 | 1,545,623 | 0.29\% | 96.49\% |
| 29 | FLOUNDER, FOURSPOT | 4,474 | 1,545,623 | 0.29\% | 96.78\% |
| 30 | FLOUNDER, WINTER (BLACKBACK) | 3,871 | 1,545,623 | 0.25\% | 97.03\% |
| 31 | HAKE, SILVER (WHITING) | 3,648 | 1,545,623 | 0.24\% | 97.27\% |
| 32 | POLLOCK | 3,570 | 1,545,623 | 0.23\% | 97.50\% |
| 33 | LUMPFISH | 3,481 | 1,545,623 | 0.23\% | 97.73\% |
| 34 | SKATE, CLEARNOSE | 2,997 | 1,545,623 | 0.19\% | 97.92\% |
| 35 | CRAB, ROCK | 2,961 | 1,545,623 | 0.19\% | 98.11\% |
| 36 | ANEMONE, NK | 2,364 | 1,545,623 | 0.15\% | 98.26\% |
| 37 | RAY, TORPEDO | 2,358 | 1,545,623 | 0.15\% | 98.42\% |
| 38 | SHARK, BASKING | 2,000 | 1,545,623 | 0.13\% | 98.55\% |
| 39 | DOGFISH, SMOOTH | 1,999 | 1,545,623 | 0.13\% | 98.68\% |
| 40 | SCUP | 1,879 | 1,545,623 | 0.12\% | 98.80\% |
| 41 | SCULPIN, NK | 1,742 | 1,545,623 | 0.11\% | 98.91\% |
| 42 | HAKE, WHITE | 1,674 | 1,545,623 | 0.11\% | 99.02\% |
| 43 | HAKE, RED (LING) | 1,280 | 1,545,623 | 0.08\% | 99.10\% |
| 44 | CRAB, NORTHERN STONE | 1,253 | 1,545,623 | 0.08\% | 99.18\% |
| 45 | SEA ROBIN, STRIPED | 1,197 | 1,545,623 | 0.08\% | 99.26\% |
| 46 | SCALLOP, SEA | 1,191 | 1,545,623 | 0.08\% | 99.34\% |
| 47 | HALIBUT, ATLANTIC | 942 | 1,545,623 | 0.06\% | 99.40\% |
| 48 | FLOUNDER, NK | 875 | 1,545,623 | 0.06\% | 99.45\% |
| 49 | BLUEFISH | 854 | 1,545,623 | 0.06\% | 99.51\% |
| 50 | CRAB, HORSESHOE | 716 | 1,545,623 | 0.05\% | 99.56\% |
| 51 | CRAB, SNOW | 590 | 1,545,623 | 0.04\% | 99.59\% |
| 52 | HERRING, ATLANTIC | 563 | 1,545,623 | 0.04\% | 99.63\% |
| 53 | CRAB, HERMIT, NK | 468 | 1,545,623 | 0.03\% | 99.66\% |


|  | Species Name | Observed Discards (lb) | Observed Discards, All Species (lb) | Ratio of Discards to All Discards | Cumulative Percent of Total Discards |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 54 | CUSK | 435 | 1,545,623 | 0.03\% | 99.69\% |
| 55 | CRAB, CANCER, NK | 288 | 1,545,623 | 0.02\% | 99.71\% |
| 56 | TILEFISH, GOLDEN | 285 | 1,545,623 | 0.02\% | 99.73\% |
| 57 | SEA ROBIN, NK | 267 | 1,545,623 | 0.02\% | 99.74\% |
| 58 | SEA ROBIN, NORTHERN | 260 | 1,545,623 | 0.02\% | 99.76\% |
| 59 | SEA BASS, BLACK | 253 | 1,545,623 | 0.02\% | 99.78\% |
| 60 | WOLFFISH, ATLANTIC | 251 | 1,545,623 | 0.02\% | 99.79\% |
| 61 | SNAIL, MOONSHELL, NK | 241 | 1,545,623 | 0.02\% | 99.81\% |
| 62 | SKATE, ROSETTTE | 236 | 1,545,623 | 0.02\% | 99.82\% |
| 63 | WHITING, BLACK (HAKE, OFFSHORE) | 214 | 1,545,623 | 0.01\% | 99.84\% |
| 64 | SEA CUCUMBER, NK | 179 | 1,545,623 | 0.01\% | 99.85\% |
| 65 | SHARK, PORBEAGLE (MACKEREL SHARK) | 175 | 1,545,623 | 0.01\% | 99.86\% |
| 66 | RAY, NK | 164 | 1,545,623 | 0.01\% | 99.87\% |
| 67 | SQUID, SHORT-FIN | 154 | 1,545,623 | 0.01\% | 99.88\% |
| 68 | SNAIL, NK | 140 | 1,545,623 | 0.01\% | 99.89\% |
| 69 | MUSSEL, NK | 126 | 1,545,623 | 0.01\% | 99.90\% |
| 70 | HERRING, BLUEBACK | 111 | 1,545,623 | 0.01\% | 99.91\% |
| 71 | WRYMOUTH | 108 | 1,545,623 | 0.01\% | 99.91\% |
| 72 | LUMPSUCKER, ATL SPNY | 100 | 1,545,623 | 0.01\% | 99.92\% |
| 73 | CLAM, NK | 100 | 1,545,623 | 0.01\% | 99.93\% |
| 74 | QUAHOG, OCEAN (BLACK CLAM) | 86 | 1,545,623 | 0.01\% | 99.93\% |
| 75 | SQUID, NK | 82 | 1,545,623 | 0.01\% | 99.94\% |
| 76 | TAUTOG (BLACKFISH) | 77 | 1,545,623 | 0.00\% | 99.94\% |
| 77 | SHAD, AMERICAN | 69 | 1,545,623 | 0.00\% | 99.95\% |
| 78 | HAKE, NK | 67 | 1,545,623 | 0.00\% | 99.95\% |
| 79 | ROSEFISH,BLACK BELLY | 66 | 1,545,623 | 0.00\% | 99.95\% |
| 80 | MACKEREL, ATLANTIC | 62 | 1,545,623 | 0.00\% | 99.96\% |
| 81 | SEA URCHIN, NK | 43 | 1,545,623 | 0.00\% | 99.96\% |
| 82 | WHELK, CHANNELED (SMOOTH) | 43 | 1,545,623 | 0.00\% | 99.96\% |
| 83 | Sturgeon, NK | 40 | 1,545,623 | 0.00\% | 99.97\% |
| 84 | SQUIRRELFISH, NK | 35 | 1,545,623 | 0.00\% | 99.97\% |
| 85 | SHRIMP, NK | 34 | 1,545,623 | 0.00\% | 99.97\% |
| 86 | ALEWIFE | 33 | 1,545,623 | 0.00\% | 99.97\% |
| 87 | HAKE, SPOTTED | 30 | 1,545,623 | 0.00\% | 99.97\% |
| 88 | SQUID, ATL LONG-FIN | 30 | 1,545,623 | 0.00\% | 99.98\% |
| 89 | BUTTERFISH | 29 | 1,545,623 | 0.00\% | 99.98\% |
| 90 | HAKE, RED/WHITE MIX | 29 | 1,545,623 | 0.00\% | 99.98\% |
| 91 | CLAM, SURF | 26 | 1,545,623 | 0.00\% | 99.98\% |
| 92 | WHELK, NK, CONCH | 25 | 1,545,623 | 0.00\% | 99.98\% |
| 93 | CUNNER (YELLOW PERCH) | 21 | 1,545,623 | 0.00\% | 99.99\% |
| 94 | SHARK, ATL SHARPNOSE | 21 | 1,545,623 | 0.00\% | 99.99\% |
| 95 | SEA SQUIRT, NK | 17 | 1,545,623 | 0.00\% | 99.99\% |
| 96 | DOGFISH, NK | 17 | 1,545,623 | 0.00\% | 99.99\% |
| 97 | CUSK-EEL, NK | 16 | 1,545,623 | 0.00\% | 99.99\% |
| 98 | HERRING, NK (SHAD) | 15 | 1,545,623 | 0.00\% | 99.99\% |
| 99 | SHARK, SANDBAR (BROWN SHARK) | 15 | 1,545,623 | 0.00\% | 99.99\% |
| 100 | HAGFISH, ATLANTIC | 13 | 1,545,623 | 0.00\% | 99.99\% |
| 101 | CRAB, SPIDER, PORTLY | 13 | 1,545,623 | 0.00\% | 99.99\% |
| 102 | OCTOPUS, NK | 12 | 1,545,623 | 0.00\% | 99.99\% |
| 103 | EEL, NK | 11 | 1,545,623 | 0.00\% | 99.99\% |
| 104 | EELPOUT, NK | 11 | 1,545,623 | 0.00\% | 100.00\% |
| 105 | CRAB, LADY | 11 | 1,545,623 | 0.00\% | 100.00\% |
| 106 | DORY, BUCKLER (JOHN) | 10 | 1,545,623 | 0.00\% | 100.00\% |
| 107 | SHAD, HICKORY | 7 | 1,545,623 | 0.00\% | 100.00\% |
| 108 | CRAB, BLUE | 5 | 1,545,623 | 0.00\% | 100.00\% |


|  | Species Name | Observed <br> Oiscards (lb) | Ratio of <br> Discards, All <br> Species (lb) | Discards to All <br> Discards | Cumulative Percent <br> of Total Discards |
| :--- | :--- | :---: | :---: | :---: | :---: |
| 109 | MENHADEN, ATLANTIC | 5 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 110 | JELLYFISH, NK | 5 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 111 | FLOUNDER, LEFTEYE, NK | 5 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 112 | WHELK, KNOBBED | 4 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 113 | INVERTEBRATE, NK | 4 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 114 | TRIGGERFISH, NK (LEATHERJACKET) | 3 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 115 | WEAKFISH (SQUETEAGUE SEA TROUT) | 2 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 116 | ROCKLING, FOURBEARD | 2 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 117 | MACKEREL, NK | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 118 | SHRIMP, MANTIS | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 119 | SHRIMP, PANDALID, NK (NORTHERN) | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 120 | TOADFISH, OYSTER | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 121 | STARGAZER, NK | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 122 | GRENADIER, COMMON (MARLINSPIKE) | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 123 | SEA ROBIN, ARMORED | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |
| 124 | SCALLOP, BAY | 1 | $1,545,623$ | $0.00 \%$ | $100.00 \%$ |

Attachment 2: Observed Discards in the NE Extra-Large-Mesh Gillnet

|  | Species Name | Observed Discards <br> (lb) | Observed Discards, All Species (lb) | Ratio of Discards to All Discards | Cumulative Percent of Total Discards |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | DOGFISH, SPINY | 100,388 | 241,610 | 41.55\% | 41.55\% |
| 2 | MONKFISH (ANGLER, GOOSEFISH) | 29,933 | 241,610 | 12.39\% | 53.94\% |
| 3 | LOBSTER, AMERICAN | 22,402 | 241,610 | 9.27\% | 63.21\% |
| 4 | SKATE, WINTER (BIG) | 19,309 | 241,610 | 7.99\% | 71.20\% |
| 5 | COD, ATLANTIC | 13,922 | 241,610 | 5.76\% | 76.96\% |
| 6 | SKATE, BARNDOOR | 7,871 | 241,610 | 3.26\% | 80.22\% |
| 7 | CRAB, JONAH | 7,444 | 241,610 | 3.08\% | 83.30\% |
| 8 | CRAB, ROCK | 4,831 | 241,610 | 2.00\% | 85.30\% |
| 9 | RAVEN, SEA | 4,266 | 241,610 | 1.77\% | 87.07\% |
| 10 | SKATE, LITTLE | 3,768 | 241,610 | 1.56\% | 88.63\% |
| 11 | SKATE, THORNY | 3,167 | 241,610 | 1.31\% | 89.94\% |
| 12 | TUNA, BLUEFIN | 2,875 | 241,610 | 1.19\% | 91.13\% |
| 13 | FLOUNDER, SUMMER (FLUKE) | 2,416 | 241,610 | 1.00\% | 92.13\% |
| 14 | FISH, NK | 2,286 | 241,610 | 0.95\% | 93.07\% |
| 15 | BLUEFISH | 1,935 | 241,610 | 0.80\% | 93.88\% |
| 16 | CRAB, TRUE, NK | 1,577 | 241,610 | 0.65\% | 94.53\% |
| 17 | SKATE, NK | 1,535 | 241,610 | 0.64\% | 95.16\% |
| 18 | POLLOCK | 1,526 | 241,610 | 0.63\% | 95.79\% |
| 19 | BASS, STRIPED | 1,219 | 241,610 | 0.50\% | 96.30\% |
| 20 | STARFISH, SEASTAR,NK | 1,169 | 241,610 | 0.48\% | 96.78\% |
| 21 | SHARK, PORBEAGLE (MACKEREL SHARK) | 721 | 241,610 | 0.30\% | 97.08\% |
| 22 | SPONGE, NK | 631 | 241,610 | 0.26\% | 97.34\% |
| 23 | LUMPFISH | 515 | 241,610 | 0.21\% | 97.56\% |
| 24 | HAKE, WHITE | 437 | 241,610 | 0.18\% | 97.74\% |
| 25 | SHARK, THRESHER | 400 | 241,610 | 0.17\% | 97.90\% |
| 26 | MACKEREL, ATLANTIC | 392 | 241,610 | 0.16\% | 98.06\% |
| 27 | SHARK, MAKO, NK | 300 | 241,610 | 0.12\% | 98.19\% |
| 28 | CRAB, NORTHERN STONE | 294 | 241,610 | 0.12\% | 98.31\% |
| 29 | MUSSEL, NK | 289 | 241,610 | 0.12\% | 98.43\% |
| 30 | RAY, TORPEDO | 282 | 241,610 | 0.12\% | 98.55\% |
| 31 | HAKE, RED (LING) | 277 | 241,610 | 0.11\% | 98.66\% |
| 32 | SKATE, SMOOTH | 258 | 241,610 | 0.11\% | 98.77\% |
| 33 | FLOUNDER, YELLOWTAIL | 200 | 241,610 | 0.08\% | 98.85\% |
| 34 | OCEAN POUT | 176 | 241,610 | 0.07\% | 98.92\% |
| 35 | HADDOCK | 176 | 241,610 | 0.07\% | 98.99\% |
| 36 | FLOUNDER, WINTER (BLACKBACK) | 153 | 241,610 | 0.06\% | 99.06\% |
| 37 | CRAB, SPIDER, NK | 126 | 241,610 | 0.05\% | 99.11\% |
| 38 | SHARK, MAKO, SHORTFIN | 120 | 241,610 | 0.05\% | 99.16\% |
| 39 | CRAB, HORSESHOE | 116 | 241,610 | 0.05\% | 99.21\% |
| 40 | SCULPIN, LONGHORN | 115 | 241,610 | 0.05\% | 99.26\% |
| 41 | Sturgeon, ATLANTIC | 113 | 241,610 | 0.05\% | 99.30\% |
| 42 | SKATE, CLEARNOSE | 107 | 241,610 | 0.04\% | 99.35\% |
| 43 | STURGEON, SHORT-NOSE | 100 | 241,610 | 0.04\% | 99.39\% |
| 44 | DOGFISH, SMOOTH | 99 | 241,610 | 0.04\% | 99.43\% |
| 45 | DORY, BUCKLER (JOHN) | 97 | 241,610 | 0.04\% | 99.47\% |
| 46 | HAKE, SILVER (WHITING) | 97 | 241,610 | 0.04\% | 99.51\% |
| 47 | TUNA, NK | 95 | 241,610 | 0.04\% | 99.55\% |
| 48 | SEA ROBIN, NORTHERN | 88 | 241,610 | 0.04\% | 99.58\% |
| 49 | HALIBUT, ATLANTIC | 82 | 241,610 | 0.03\% | 99.62\% |
| 50 | TUNA, YELLOWFIN | 71 | 241,610 | 0.03\% | 99.65\% |
| 51 | TILEFISH, GOLDEN | 71 | 241,610 | 0.03\% | 99.68\% |
| 52 | DOGFISH, NK | 69 | 241,610 | 0.03\% | 99.71\% |


|  | Species Name | Observed Discards <br> (Ib) | Observed Discards, All Species (lb) | Ratio of Discards to All Discards | Cumulative Percent of Total Discards |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 53 | SEA URCHIN, NK | 69 | 241,610 | 0.03\% | 99.73\% |
| 54 | FLOUNDER, NK | 50 | 241,610 | 0.02\% | 99.75\% |
| 55 | SCALLOP, SEA | 49 | 241,610 | 0.02\% | 99.78\% |
| 56 | SNAIL, NK | 48 | 241,610 | 0.02\% | 99.80\% |
| 57 | HERRING, ATLANTIC | 46 | 241,610 | 0.02\% | 99.81\% |
| 58 | FLOUNDER, FOURSPOT | 43 | 241,610 | 0.02\% | 99.83\% |
| 59 | CRAB, CANCER, NK | 36 | 241,610 | 0.01\% | 99.85\% |
| 60 | SCULPIN, NK | 33 | 241,610 | 0.01\% | 99.86\% |
| 61 | CLAM, NK | 30 | 241,610 | 0.01\% | 99.87\% |
| 62 | CRAB, DEEPSEA, RED | 26 | 241,610 | 0.01\% | 99.88\% |
| 63 | SEA BASS, NK | 24 | 241,610 | 0.01\% | 99.89\% |
| 64 | FLOUNDER, AMERICAN PLAICE | 22 | 241,610 | 0.01\% | 99.90\% |
| 65 | SHARK, NK | 20 | 241,610 | 0.01\% | 99.91\% |
| 66 | STURGEON, NK | 20 | 241,610 | 0.01\% | 99.92\% |
| 67 | CRAB, HERMIT, NK | 19 | 241,610 | 0.01\% | 99.93\% |
| 68 | WHELK, NK, CONCH | 18 | 241,610 | 0.01\% | 99.93\% |
| 69 | SEA CUCUMBER, NK | 18 | 241,610 | 0.01\% | 99.94\% |
| 70 | TAUTOG (BLACKFISH) | 17 | 241,610 | 0.01\% | 99.95\% |
| 71 | SHAD, AMERICAN | 16 | 241,610 | 0.01\% | 99.96\% |
| 72 | SEA ROBIN, STRIPED | 13 | 241,610 | 0.01\% | 99.96\% |
| 73 | FLOUNDER, LEFTEYE, NK | 12 | 241,610 | 0.00\% | 99.97\% |
| 74 | REDFISH, NK (OCEAN PERCH) | 11 | 241,610 | 0.00\% | 99.97\% |
| 75 | CUNNER (YELLOW PERCH) | 9 | 241,610 | 0.00\% | 99.97\% |
| 76 | ANEMONE, NK | 9 | 241,610 | 0.00\% | 99.98\% |
| 77 | SEA SQUIRT, NK | 8 | 241,610 | 0.00\% | 99.98\% |
| 78 | SNAIL, MOONSHELL, NK | 8 | 241,610 | 0.00\% | 99.98\% |
| 79 | WRYMOUTH | 5 | 241,610 | 0.00\% | 99.99\% |
| 80 | HERRING, BLUEBACK | 4 | 241,610 | 0.00\% | 99.99\% |
| 81 | HAKE, NK | 4 | 241,610 | 0.00\% | 99.99\% |
| 82 | JELLYFISH, NK | 3 | 241,610 | 0.00\% | 99.99\% |
| 83 | LAMPREY, NK | 3 | 241,610 | 0.00\% | 99.99\% |
| 84 | CUSK | 2 | 241,610 | 0.00\% | 99.99\% |
| 85 | FLOUNDER, SAND DAB (WINDOWPANE) | 2 | 241,610 | 0.00\% | 99.99\% |
| 86 | SEA ROBIN, NK | 2 | 241,610 | 0.00\% | 99.99\% |
| 87 | DOGFISH, CHAIN | 2 | 241,610 | 0.00\% | 99.99\% |
| 88 | CORAL, STONY, NK | 2 | 241,610 | 0.00\% | 100.00\% |
| 89 | STARFISH, BRITTLE,NK | 2 | 241,610 | 0.00\% | 100.00\% |
| 90 | SEA ROBIN, ARMORED | 2 | 241,610 | 0.00\% | 100.00\% |
| 91 | HAGFISH, ATLANTIC | 1 | 241,610 | 0.00\% | 100.00\% |
| 92 | INVERTEBRATE, NK | 1 | 241,610 | 0.00\% | 100.00\% |
| 93 | BUTTERFISH | 1 | 241,610 | 0.00\% | 100.00\% |
| 94 | FLOUNDER, WITCH (GREY SOLE) | 1 | 241,610 | 0.00\% | 100.00\% |
| 95 | SCUP | 1 | 241,610 | 0.00\% | 100.00\% |
| 96 | SKATE, ROSETTTE | 1 | 241,610 | 0.00\% | 100.00\% |
| 97 | WORM, NK | 1 | 241,610 | 0.00\% | 100.00\% |

Attachment 3: Observed Discards in the MA Extra-Large-Mesh Gillnet

|  | Species Name | Observed Discards (lb) | Observed Discards, All Species (lb) | Ratio of Discards to All Discards | Cumulative Percent of Total Discards |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | DOGFISH, SPINY | 3,620 | 13,386 | 27.05\% | 27.05\% |
| 2 | CRAB, HORSESHOE | 2,107 | 13,386 | 15.74\% | 42.79\% |
| 3 | MONKFISH (ANGLER, GOOSEFISH) | 1,712 | 13,386 | 12.79\% | 55.58\% |
| 4 | SKATE, LITTLE | 1,469 | 13,386 | 10.97\% | 66.55\% |
| 5 | SKATE, WINTER (BIG) | 603 | 13,386 | 4.50\% | 71.05\% |
| 6 | STARFISH, SEASTAR,NK | 600 | 13,386 | 4.48\% | 75.53\% |
| 7 | STURGEON, ATLANTIC | 547 | 13,386 | 4.09\% | 79.62\% |
| 8 | BASS, STRIPED | 453 | 13,386 | 3.38\% | 83.00\% |
| 9 | FISH, NK | 379 | 13,386 | 2.83\% | 85.83\% |
| 10 | BLUEFISH | 328 | 13,386 | 2.45\% | 88.28\% |
| 11 | SKATE, NK | 322 | 13,386 | 2.40\% | 90.68\% |
| 12 | STURGEON, NK | 235 | 13,386 | 1.76\% | 92.44\% |
| 13 | SPONGE, NK | 192 | 13,386 | 1.43\% | 93.87\% |
| 14 | FLOUNDER, SUMMER (FLUKE) | 113 | 13,386 | 0.84\% | 94.71\% |
| 15 | STURGEON, SHORT-NOSE | 110 | 13,386 | 0.82\% | 95.53\% |
| 16 | SKATE, CLEARNOSE | 107 | 13,386 | 0.80\% | 96.33\% |
| 17 | DOGFISH, SMOOTH | 89 | 13,386 | 0.66\% | 97.00\% |
| 18 | CRAB, JONAH | 80 | 13,386 | 0.60\% | 97.59\% |
| 19 | CRAB, ROCK | 60 | 13,386 | 0.45\% | 98.04\% |
| 20 | SCALLOP, SEA | 60 | 13,386 | 0.44\% | 98.49\% |
| 21 | CRAB, TRUE, NK | 27 | 13,386 | 0.20\% | 98.69\% |
| 22 | MENHADEN, ATLANTIC | 23 | 13,386 | 0.17\% | 98.86\% |
| 23 | CRAB, SPIDER, NK | 23 | 13,386 | 0.17\% | 99.03\% |
| 24 | LOBSTER, AMERICAN | 18 | 13,386 | 0.13\% | 99.17\% |
| 25 | CROAKER, ATLANTIC | 18 | 13,386 | 0.13\% | 99.30\% |
| 26 | FLOUNDER, NK | 15 | 13,386 | 0.11\% | 99.41\% |
| 27 | DOGFISH, NK | 15 | 13,386 | 0.11\% | 99.53\% |
| 28 | Stargazer, NK | 14 | 13,386 | 0.10\% | 99.63\% |
| 29 | RAY, TORPEDO | 12 | 13,386 | 0.09\% | 99.72\% |
| 30 | WHELK, NK, CONCH | 8 | 13,386 | 0.06\% | 99.78\% |
| 31 | CRAB, CANCER, NK | 7 | 13,386 | 0.05\% | 99.83\% |
| 32 | ANCHOVY, NK | 5 | 13,386 | 0.04\% | 99.87\% |
| 33 | STARFISH, BRITTLE,NK | 5 | 13,386 | 0.04\% | 99.91\% |
| 34 | WEAKFISH (SQUETEAGUE SEA TROUT) | 4 | 13,386 | 0.03\% | 99.94\% |
| 35 | CRAB, HERMIT, NK | 2 | 13,386 | 0.01\% | 99.95\% |
| 36 | MACKEREL, FRIGATE | 1 | 13,386 | 0.01\% | 99.96\% |
| 37 | HERRING, BLUEBACK | 1 | 13,386 | 0.01\% | 99.97\% |
| 38 | SEA ROBIN, STRIPED | 1 | 13,386 | 0.01\% | 99.98\% |
| 39 | CLAM, NK | 1 | 13,386 | 0.01\% | 99.99\% |
| 40 | MUSSEL, NK | 1 | 13,386 | 0.01\% | 99.99\% |
| 41 | SEA ROBIN, NORTHERN | 1 | 13,386 | 0.00\% | 100.00\% |
| 42 | SEA URCHIN, NK | 1 | 13,386 | 0.00\% | 100.00\% |

## Examples of how observer discard data can be queried and analyzed to support management decisions.

## Example 1

The follow excerpts are from pages 137, 152, and 153 of Framework 40A to the Northeast Multispecies FMP. This example demonstrates the use of observer discard data to make predictions of possible biological impacts of management alternatives. The complete document is available at: http://www.nefmc.org/nemulti/index.html.

## ENVIRONMENTAL CONSEQUENCES - ANALYSIS OF IMPACTS

Proposed Action

## CAII Haddock SAP

An experiment has not been conducted that estimates the incidental catch species that will be taken during the CAII haddock SAP. As a result, this analysis uses recent observer reports from the area and the results of several gear experiments to evaluate the impacts of this SAP on incidental catch species. First examined were observer reports for trawl trips in SA 561 and 562 from calendar years 2001 through 2003. A summary of observed tows by area and quarter is provided in Table 45. The analyses focus on 2002 and 2003 because of the higher level of observer coverage in SA 562. Note that for these tows, there was no requirement to use a haddock separator trawl. Catches of the top fifteen species are shown by statistical area for calendar years 2002 and 2003 in Table 57 and Table 58. Of the regulated groundfish species in this list, the stocks of concern that were caught most frequently in both years were cod, white hake, plaice, and witch flounder. Large quantities of skates were also caught and these catches will be discussed in a following section that analyzes bycatch.

The proposed SAP is allocated a portion of the GB cod incidental catch TAC. The observed trips were examined further to determine catch rates of cod and to estimate the number of days that may be fished before the cod TAC is caught. Cod catches on observed tows in 2002 averaged $109 \mathrm{lbs} . /$ tow for the entire area. The difference between the average cod/tow in SA 561 (166) and SA 562 (75) was statistically significant. Catch per tow on observed tows in 2003 was 245 lbs./tow. Once again, the catch per tow in SA 561 (365) was significantly higher than that in SA 562 (141). Catches for plaice, white hake, and witch flounder were less than 25 lbs./tow. 2003 tows were analyzed to determine the mean catch of cod on tows targeting haddock. For both areas, the average cod catch/tow was 235 lbs for tows targeting haddock. The cod catch/tow in SA 561 ( 457 lbs .) was significantly different than that in SA 562 (110 lbs.). According to the data, catches per tow of cod are higher in SA 561, while catches of haddock are higher in SA 562.

|  | Number of Observed Tows |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathbf{2 0 0 1}$ |  |  | $\mathbf{2 0 0 2}$ |  |  | $\mathbf{5 0 0 3}$ |  |  |  |
| Quarter | Both | $\mathbf{5 6 1}$ | $\mathbf{5 6 2}$ | Both | $\mathbf{5 6 1}$ | $\mathbf{5 6 2}$ | Both | 561 | 562 |  |
| 1 | 68 | 63 | 5 | 29 | 20 | 9 | 192 | 108 | 84 |  |
| 2 | 54 | 52 | 2 | 135 | 41 | 94 | 576 | 321 | 255 |  |
| 3 | 9 | 9 | 0 | 208 | 58 | 150 | 240 | 67 | 173 |  |
| 4 | 30 | 29 | 1 | 72 | 49 | 23 | 189 | 55 | 134 |  |
| Total | 161 | 153 | 8 | 444 | 168 | 276 | 1197 | 551 | 646 |  |

Table 45 - Observed otter trawl tows, calendar years 2001 - 2003, statistical areas 561 and 562 (NMFS OBDBS database)

| S Species | SA 561 |  | SA 562 |  | Grand <br> Total |
| :--- | ---: | ---: | ---: | ---: | ---: |
|  | Discarded |  | Kept | Discarded | Kept |

Table 57 - Top fifteen species caught by otter trawls on observed tows in SAs 561 and 562, 2002 (pounds) (NMFS OBDBS)

| S Species | SA 561 |  | SA 562 |  | Grand <br> Total |
| :--- | ---: | ---: | ---: | ---: | ---: |
|  | Discarded | Kept | Discarded | Kept |  |
| ANGLER | 3,787 | 72,916 | 1,939 | 11,309 | 89,951 |
| COD | 11,210 | 190,872 | 1,412 | 89,895 | 293,388 |
| FLOUNDER, AM. PLAICE | 1,210 | 16,384 | 53 | 1,630 | 19,277 |
| FLOUNDER, WINTER | 1,554 | 85,278 | 432 | 354,303 | 441,566 |
| FLOUNDER, WITCH | 1,304 | 9,192 | 329 | 1,181 | 12,006 |
| FLOUNDER, YELLOWTAIL | 954 | 83,699 | 4,012 | 131,763 | 220,428 |
| HADDOCK | 3,313 | 39,560 | 6,656 | 199,215 | 248,743 |
| HAKE, SILVER | 759 | 243 | 212 | 17,111 | 18,325 |
| LOBSTER | 6,581 | 25,037 | 3,995 | 15,038 | 50,651 |
| POLLOCK | 24 | 19,115 |  | 445 | 19,584 |
| SCALLOP, SEA | 2,554 | 7,268 | 15,794 | 12,745 | 38,360 |
| SEA RAVEN | 5,027 |  | 7,412 |  | 12,439 |
| SKATE, LITTLE | 56,812 |  | 282,885 |  | 339,697 |
| SKATE, WINTER(BIG) | 66,581 | 46,318 | 330,624 | 56,742 | 500,264 |
| SKATES | 16,018 | 14,742 | 87,040 | 20,611 | 138,410 |
| Grand Total | 177,687 | 610,622 | 742,794 | 911,986 | $2,443,089$ |

Table 58 - Top fifteen species caught by otter trawls on observed tows in SAs 561 and 562, 2003 (pounds round weight), 2003 (NMFS OBDBS)

## Example 2

The following excerpt is from page 205 of Framework 42 to the Northeast Multispecies FMP. This is a good example of how observer discard data can be used to examine a specific program in a defined area and time period, in this case, the Yellowtail Flounder Special Access Program in Closed Area II. The complete document is available at: http://www.nefmc.org/nemulti/index.html.

### 6.5.2.4 Closed Area II Yellowtail Flounder Special Access Program

Yellowtail flounder discards in the SAP were reviewed to determine the cause. Thirty-one (out of 319, or 9.7 percent) trawl trips in the CAII Yellowtail Flounder SAP were observed. Yellowtail flounder ( $600,805 \mathrm{lbs}$.), haddock ( $156,378 \mathrm{lbs}$.), sea scallops ( 88,634 lbs.), monkfish ( $68,417 \mathrm{lbs}$.), and winter skates ( $47,517 \mathrm{lbs}$.) were the top five kept species on these observed trips. The top discarded species were skates ( $704,205 \mathrm{lbs}$. , all species), sea scallops ( $32,610 \mathrm{lbs}$.), yellowtail flounder ( $30,290 \mathrm{lbs}$. ), and haddock ( $22,178 \mathrm{lbs}$. ). The primary reason for yellowtail flounder discards on observed trips was that the fish were smaller than the regulatory minimum size ( $21,289 \mathrm{lbs}$., or 70 percent of observed discards). Vessels that had filled their quota discarded another 3,409 lbs. on observed trips, while $4,081 \mathrm{lbs}$. were discarded due to market conditions.

## Example 3

The following excerpts are from page 211-215 of Framework 42 to the Northeast Multispecies FMP. In this example, observer discard data are used to help evaluate the performance of the haddock separator trawl in commercial fishing operations. The complete document is available at: http://www.nefmc.org/nemulti/index.html.

### 6.5.2.8 Haddock Separator Trawl

This action proposes two measures that require use of the haddock separator trawl: an extension of the Eastern U.S./CA Haddock SAP, and a proposal to require the use of the separator trawl when participating in the Category B (regular) DAS Program (which may be renewed). There are a limited number of observed trips by vessels using the separator trawl which can be used to supplement experimental data on the performance of the trawl.

The observer (OBDBS) database was queried to identify trawl trips that used a separator panel (excluder device='3') in CY 2005. A total of 20 observed trips were identified in the database as of December 14, 2005. Additional observed trips may have occurred but may not yet be entered into the database. Fourteen trips were recorded as U.S./CA area trips while six trips were recorded as Category B (regular) DAS trips. This designation is made by the observer, and it is possible that they are not exclusive (e.g. a Category B (regular) program trip may occur in the U.S./CA area). Seven trips made tows both with and without the panel. Most trips used the separator panel in the Eastern U.S./Canada area (SAs 561 and 562).

Catches (kept and discarded) of the top twenty-five species on tows using a separator panel are shown in Table 74. Regulated groundfish accounted for sixty-five percent of the catch, with haddock, yellowtail flounder, cod, and winter flounder as the four largest regulated groundfish components. Combined catches of skates ( $207,136 \mathrm{lbs}$.) exceeded the haddock catch (199,634 lbs.). The overall ratio of haddock to yellowtail flounder was 2.6:1, the ratio
of haddock to cod was 4.2:1, and the ratio of haddock to winter flounder was 3.2:1. Monkfish, witch flounder, and plaice were also caught in substantial quantities.

The ratio of haddock to other species was compared for trips identified as occurring in the Category B (regular) DAS program and trips identified as taking place in the U.S./CA area. With only five observed trips using the separator trawl in the Category B (regular) DAS program these results should not be considered definitive. While the ratio of haddock to winter flounder in both programs was similar (3.1:1 in the U.S./CA area, 3.4:1 in the Category B(regular) DAS program), the ratio of haddock to yellowtail flounder was 4.1:1 in the U.S./CA program but 1.1:1 in the Category B (regular) DAS Pilot Program. The ratio of haddock to cod in the U.S./CA program was 3.8:1, while it was 7:1 in the Category B (regular) DAS program. The ratio of haddock to monkfish was similar in both programs.

Haddock discards accounted for six percent of the haddock catch (12,466 lbs.), with almost all discards due to the fish being smaller than the regulatory minimum. Cod discards accounted for fifty percent ( $21,504 \mathrm{lbs}$.) of the cod catch; sixty-seven percent of these discards were due to a filled vessel quota, twenty-three percent were due to high grading, and various other reasons were given for the remaining discards. Ninety-four percent of the skates caught were discarded, totaling 193,937 pounds. Winter skate ( $49,716 \mathrm{lbs}$.) and little skates ( $54,369 \mathrm{lbs}$.) were the largest components identified by species, but an additional $78,711 \mathrm{lbs}$. was identified as skates (NK). There were also $10,609 \mathrm{lbs}$. of barndoor skates caught, all discarded, and 532 lbs. of smooth skates.

Catch composition on tows using the separator trawl was examined by trip, focusing on regulated groundfish. All twenty trips caught haddock and cod while using a separator trawl, seventeen trips caught yellowtail, winter flounder, or monkfish, fifteen trips caught plaice, and thirteen trips caught grey sole (witch flounder). The ratio of haddock to cod for the twenty trips ranged from $0.2: 1$ to 22.4:1. For the seventeen observed trips that caught winter flounder, the ratio of haddock to winter flounder ranged from 0.1:1 to 186.8:1. For the trips that caught yellowtail flounder, the ratio of haddock to yellowtail flounder ranged from 0.1:1 to 5,230:1.

There were a total of 405 observed tows that used a separator trawl on these fifteen trips. Over these tows, haddock was caught on 370 tows (ninety-one percent), cod on 309 tows (seventy-six percent), yellowtail flounder on 266 tows (sixty-six percent), and winter flounder on 243 tows (sixty percent). The average catch of haddock per tow was 493 lbs., yellowtail flounder was 189 lbs., cod was 117 lbs., and winter flounder was 156 lbs. In comparison to the observed data, FW 40A estimated that the cod catch per tow would be between 47 and 92 lbs. and the haddock catch per tow would be 765 lbs . There was considerable variation in the catch of regulated groundfish between trips and tows. For example, four trips did not have any tows catching yellowtail flounder, four trips had occasional tows that caught small amounts, one trip had yellowtail catches decline as the trip passed, and six trips had frequent tows catching sizeable amounts of yellowtail flounder.

As reported earlier, seven trips made tows both with and without the separator trawl. These trips were examined to contrast the performance of tows using the separator trawl with tows that did not use the separator trawl by vessels that used both on the same trip. While this approach reduces the likelihood that any differences are due to differences between vessels, it does not resolve the issue that catches may be the result not just of the gear used,
but numerous other factors: location, depth fished, etc. Catch composition differed: haddock accounted for twelve percent of the catch on tows without the separator trawl, and thirty-three percent of the catch on tows with the trawl (Table 75). Overall, the ratio of haddock to cod for these trips, while not using the separator trawl, was 1.4:1, the ratio of haddock to yellowtail flounder was 0.7:1, the ratio of haddock to winter flounder was 11.8:1, and the ratio of haddock to monkfish was 1:1. While using a separator trawl, for these vessels the ratio of haddock to cod on the same trip was 2.5:1, the ratio of haddock to yellowtail flounder was 7.4:1, the ratio of haddock to winter flounder was 3.1:1, and the ratio of haddock to monkfish was 6.3:1. In an effort to reduce the influence of tows in different areas, five trips were examined that fished in SA 561 and 562. The results, while not detailed here, were similar.

Table 73 - Observed trips using a separator panel, CY 2005 (OBDBS data available as of December 14, 2005)

| Program | Month | 521 | 522 | 525 | 561 | 562 | Total |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| US/CA | 01 | 0 | 0 | 0 | 0 | 1 | 1 |
|  | 03 | 1 | 0 | 0 | 4 | 3 | 5 |
|  | 05 | 0 | 1 | 0 | 5 | 5 | 5 |
|  | 06 | 0 | 0 | 1 | 0 | 2 | 2 |
|  | 07 | 0 | 0 | 1 | 1 | 1 | 1 |
|  |  | 1 | 1 | 1 | 10 | 10 | 14 |
| Sub-Total |  | 1 | 1 | 0 | 0 | 0 | 1 |
| CAT B | 03 | 0 | 0 | 1 | 0 | 2 | 2 |
| (regular) | 05 | 2 | 2 | 1 | 0 | 0 | 2 |
|  | 06 | 0 | 1 | 0 | 0 | 0 | 1 |
|  | 07 | 3 | 3 | 2 | 0 | 4 | 6 |
| Sub-Total |  | 4 | 4 | 3 | 10 | 14 | 20 |
| Grand   <br> Total   |  |  |  |  |  |  |  |

Table 74 - Catches (pounds, live weight, kept and discarded) by statistical area on observed tows using a haddock separator trawl, CY 2005

| COMNAME | 521 | 522 | 525 | 552 | 561 | 562 | Grand Total |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| HADDOCK | 8,445 | 31,152 | 142 | 18 | 47,946 | 140,234 | 227,937 |
| SKATE, LITTLE | 25 | 83,432 | 1,977 | 500 | 5,975 | 44,916 | 136,825 |
| FLOUNDER, YELLOWTAIL | 1 | 1,375 | 4,633 | 30 | 3,834 | 91,623 | 101,496 |
| MONKFISH (ANGLER, GOOSEFISH) | 9,368 | 43,446 | 341 | 0 | 23,475 | 14,187 | 90,817 |
| SKATE, WINTER (BIG) | 2,105 | 10,700 | 357 | 693 | 21,087 | 51,773 | 86,715 |
| SKATE, NK | 1,770 | 235 | 1,500 | 0 | 8,766 | 70,805 | 83,076 |
| FLOUNDER, WINTER (BLACKBACK) | 5 | 174 | 67 | 420 | 9,461 | 54,546 | 64,673 |
| COD, ATLANTIC | 12,712 | 1,591 | 41 | 339 | 32,955 | 16,339 | 63,977 |
| FLOUNDER, AMERICAN PLAICE | 876 | 2,681 | 54 | 0 | 24,635 | 1,898 | 30,144 |
| FLOUNDER, WITCH (GREY SOLE) | 14,813 | 1,415 | 105 | 0 | 9,583 | 3,331 | 29,247 |
| LOBSTER, AMERICAN | 1,785 | 2,130 | 34 | 0 | 13,902 | 3,776 | 21,627 |
| SKATE, BARNDOOR | 98 | 434 | 306 | 0 | 515 | 10,369 | 11,722 |
| CRAB, JONAH | 11 | 9,310 | 0 | 0 | 24 | 157 | 9,502 |
| POLLOCK | 873 | 1,344 | 0 | 0 | 6,226 | 238 | 8,681 |
| HAKE, WHITE | 191 | 930 | 0 | 0 | 4,400 | 9 | 5,530 |
| FLOUNDER, SAND DAB | 0 | 3 | 136 | 15 | 70 | 3,813 | 4,037 |
| (WINDOWPANE) | 0 | 112 | 1 | 0 | 303 | 3,289 | 3,705 |
| SCALLOP, SEA | 114 | 114 | 217 | 10 | 711 | 2,515 | 3,681 |
| RAVEN, SEA | 185 | 186 | 0 | 0 | 2,895 | 201 | 3,467 |
| DOGFISH, SPINY | 0 | 42 | 210 | 0 | 51 | 2,238 | 2,541 |
| FLOUNDER, FOURSPOT | 8 | 7 | 138 | 0 | 1,393 | 218 | 1,764 |
| HAKE, RED (LING) | 0 | 1,482 | 0 | 0 | 4 | 0 | 1,486 |
| HERRING, ATLANTIC | 6 | 717 | 2 | 0 | 11 | 713 | 1,449 |
| STARFISH, SEASTAR,NK | 0 | 89 | 80 | 10 | 24 | 955 | 1,158 |
| FLOUNDER, SUMMER (FLUKE) | 9 | 41 | 8 | 0 | 128 | 804 | 990 |
| OCEAN POUT | 53,400 | 193,142 | 10,349 | 2,035 | 218,374 | 518,947 | 996,247 |
| Grand Total |  |  |  |  |  |  |  |

Table 75 - Catch composition (pounds, live weight) for seven trips that made tows with and without the separator panel, CY 2005 (Source: NMFS OBDBS as of December 12, 2005)

| COMNAME | Without <br> Separator | With Separator | Grand <br> Total |
| :--- | :---: | :---: | :---: |
| HADDOCK | 17,679 | 40,893 | 58,572 |
| SKATE, WINTER (BIG) | 21,960 | 14,207 | 36,167 |
| FLOUNDER, YELLOWTAIL | 23,750 | 5,560 | 29,310 |
| COD, ATLANTIC | 12,920 | 16,146 | 29,066 |
| MONKFISH (ANGLER, GOOSEFISH) | 17,117 | 6,489 | 23,606 |
| SKATE, LITTLE | 14,346 | 5,754 | 20,100 |
| SKATE, NK | 2,875 | 14,163 | 17,038 |
| FLOUNDER, WINTER (BLACKBACK) | 1,494 | 13,209 | 14,703 |
| FLOUNDER, AMERICAN PLAICE | 10,462 | 1,416 | 11,878 |
| LOBSTER, AMERICAN | 7,109 | 3,359 | 10,468 |
| FLOUNDER, WITCH (GREY SOLE) | 4,135 | 1,715 | 5,850 |
| POLLOCK | 4,300 | 623 | 4,923 |
| HAKE, WHITE | 3,490 | 469 | 3,959 |
| SCALLOP, SEA | 2,766 | 150 | 2,916 |
| DOGFISH, SPINY | 1,893 | 98 | 1,991 |
| HAKE, RED (LING) | 1,410 | 0 | 1,410 |
| SKATE, BARNDOOR | 1,083 | 24 | 1,107 |
| RAVEN, SEA | 365 | 394 | 759 |
| FLOUNDER, FOURSPOT | 618 | 1 | 619 |
| FLOUNDER, SAND DAB (WINDOWPANE) | 48 | 407 | 455 |
| OCEAN POUT | 213 | 101 | 314 |
| LUMPFISH | 276 | 12 | 288 |
| HALIBUT, ATLANTIC | 0 | 263 | 113 |
| FLOUNDER, SUMMER (FLUKE) | 50 | 63 | 58 |
| WOLFFISH, ATLANTIC | 25 | 33 | 275,933 |
| Grand Total | 150,384 | 125,549 |  |

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## Appendix G <br> Example Discard Report

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# 2012 Discard Estimation, Precision, and Sample Size Analyses for 14 Federally Managed Species Groups in the Northeast Region 

# 2012 Discard Estimation, Precision, and Sample Size Analyses for 4 Federally Managed Species Groups in the Northeast Region 

by SE Wigley ${ }^{1}$, J Blaylock², PJ Rago¹, and G Shield ${ }^{1}$

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US DEPARTMENT OF COMMERCE<br>National Oceanic and Atmospheric Administration<br>National Marine Fisheries Service<br>Northeast Fisheries Science Center<br>Woods Hole, MA

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Editorial Treatment: To distribute this report quickly, it has not undergone the normal technical and copy editing by the Northeast Fisheries Science Center's (NEFSC's) Editorial Office as have most other issues in the NOAA Technical Memorandum NMFS-NE series. Other than the four covers and first two preliminary pages, all writing and editing have been performed by the authors listed within. This report was reviewed by the Stock Assessment Review Committee, a panel of assessment experts from the Center for Independent Experts (CIE), University of Miami.

Information Quality Act Compliance: In accordance with section 515 of Public Law 106554, the Northeast Fisheries Science Center completed both technical and policy reviews for this report. These predissemination reviews are on file at the NEFSC Editorial Office.

This document may be cited as:

> Wigley SE, Blaylock J, Rago PJ, Shield G. 2012.2012 Discard estimation, precision, and sample size analyses for 14 federally managed species groups in the northeast region. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 12-17; 146 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 025431026 , or online at http://www.nefsc.noaa.gov/nefsc/publications/

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CV = coefficient of variation<br>d/k = discard/kept<br>FMP = fishery management plan<br>MRIP = Marine Recreational Information Program<br>MRFSS = Marine Recreational Fisheries Statistical Survey<br>NEFOP = Northeast Fisheries Observer Program<br>NEFSC = Northeast Fisheries Science Center<br>NERO = Northeast Regional Office<br>NMFS = National Marine Fisheries Service<br>SBRM = Standardized Bycatch Reporting Methodology<br>VTR = Vessel Trip Report

## EXECUTIVE SUMMARY

This report describes the analysis of the expected coverage needed by at-sea observers for Northeast fisheries for the April 2012 through March 2013 period using the Standardized Bycatch Reporting Methodology. Refinements to the procedure for filtering the needed sea days have been made based on analyses conducted for the 2011 3-year Review Report. The sea days needed to achieve the precision-based performance standard ( $30 \%$ coefficient of variation of the discard estimate) were updated using July 2010 through June 2011 data. To monitor 14 federally managed fish and invertebrate species groups across 55 fleets, a total of 18,822 sea days are needed. The discards reported in this document may not necessarily correspond directly with the discard estimates derived for individual stock assessments due to differences in stratification and data. Hence, the discard estimates are not definitive, but indicative of where discarding is occurring among commercial fleets and for which species groups. Based upon this analysis, the predominant species groups discarded are skates and dogfish. Across all species groups examined, "No Market" is the reason reported for the majority of discards.

## BACKGROUND

The Standardized Bycatch Reporting Methodology (SBRM) Omnibus Amendment (NEFMC 2007; NMFS 2008) was vacated by the US District Court of the District of Columbia on September 15, 2011 and the regulations implementing the SBRM were removed by the National Marine Fisheries Service (NMFS) on December 29, 2011 (NMFS 2011). While an SBRM is not currently required, the need to allocate observer sea days to monitor fisheries prosecuted off the northeast coast of the US remains and thus an analysis to estimate the number of sea days needed by each fleet is needed.

The SBRM discard estimation methods described in Wigley et al. 2007 are still applicable. Refinements to the procedure for filtering the needed sea days have been made based on analyses conducted for the 2011 SBRM 3-year Review Report Part 2 (Wigley et al. forthcoming 2012).

This document presents the estimated discards and associated precision, and the number of sea days needed to obtain a $30 \%$ coefficient of variation (CV) on the discard estimates for the 14 species groups associated with federal fishery management plans (FMPs) in northeast fleets ${ }^{1}$. Additionally, discard reasons associated with the discarded species are summarized. This document differs from previous SBRM documents in that it does not include a sea day prioritization ${ }^{2}$ and focuses on fish and invertebrate species groups; it does not include sea turtles.

## METHODS <br> Data Sources

The data sets used include July 2010 through June 2011 data from the Northeast Fisheries Observer Program ${ }^{3}$ (NEFOP) database, the Vessel Trip Report (VTR; including logbooks from the surfclam and ocean quahog fishery) database, the Northeast Fisheries Science Center (NEFSC) commercial landings database, and the NOAA Fisheries Marine Recreational Fisheries Statistics Survey ${ }^{4}$ (MRFSS) database.

The NEFOP is a comprehensive, multi-purpose program that collects a broad range of data on all species that are encountered during a fishing trip as well as gear characteristics data, economic information, and biological samples (NEFOP, 2010). The NEFOP employs trained sea-going observers and monitors to collect these data that also include weight, by species and disposition (retained and discarded), of the entire catch. Fish and invertebrate species are recorded in weight. Conversion factors were applied to convert any dressed weight data to live weight equivalents.

For this analysis, only observed hauls from NEFOP trips with a "complete" sampling protocol were used. A "complete" sampling protocol includes obtaining species weights for both kept and discarded portions of all species in the catch. NEFOP training trips have been included

[^84]in the analysis. Aborted trips, "set only" trips, and trips associated with a groundfish sentinel fishery (program code =127) were excluded from this analysis. Additionally, hauls with no catch report and species hail weight with discard reason "039" ("previously discarded") were excluded.

The same broad stratification scheme used in SBRM analyses was employed in this analysis, where trips were partitioned into fleets using six classification variables: calendar quarter, geographic region, gear type, mesh, access area, and trip category. Calendar quarter was based on landed date and used to capture seasonal variations in fishing activity and discard rates. Two broad geographical regions were defined: New England (NE) and Mid-Atlantic (MA) based on port of departure ${ }^{5}$; ports from Maine to Rhode Island constituted the NE region, and ports in states from Connecticut southward constituted the MA region. Gear type was based on Northeast gear codes (negear). Some gear codes were combined: sink, anchored, and drift gillnets, and single and paired mid-water trawls. Trips for which gear was unknown were excluded. Mesh size groups were formed for otter trawl and gillnet gear types. For otter trawls, two mesh groups were formed: small (mesh less than 5.5 inches) and large ( 5.5 inch mesh and greater). For gillnets, three mesh groups were formed: small (mesh less than 5.5 inches), large (mesh between 5.5 and 7.99 inches), and extra large (mesh 8 inches and greater). Two access area categories were formed: access area (AA) and open (OPEN). The sea scallop fishery was divided into General (GEN) and Limited (LIM) category trips. All other fisheries were combined into a category called "all."

Stratification abbreviations used are given below.

| Abbreviation | Definition |
| :--- | :--- |
| MA | Mid-Atlantic ports (CT and southward) |
| NE | New England ports (RI and northward) |
| sm | Small mesh (less than 5.5 inches) |
| $\lg$ | Large mesh (5.5 to 7.99 inches) |
| xlg | Extra large mesh (8 inches and greater) |
| LIM | Limited access category |
| GEN | General category |
| OPEN | Non-access area |
| AA | Access area |

The VTR data are used as a basis for defining the sampling frame, since all federally permitted vessels are required to file a VTR for each fishing trip (See NMFS-Northeast Regional Office http://www.nero.noaa.gov/ro/fso/vtr_inst.pdf ). These self-reported data ${ }^{6}$ constitute the basis of the fishing activity of the commercial fleets. Because Dealer data do not contain mesh size and area fished information, the Dealer data ${ }^{7}$ could not be used to expand discard ratios by

[^85]fleet for the annual analyses. The VTR data were used as a surrogate for Dealer data and were used to expand the NEFOP discard ratios to total discards. For this analysis, the commercial VTR trips [excluding NY state (non-federal) vessels] were used. Conversion factors were applied to convert various units of measure to pounds and all weight to live weight. VTR trip data were collapsed into fleets as defined above. Trips participating in the US/Canada access area, B-day category programs and other special access programs could not be identified in the VTR data. These trips have been grouped by the other stratification variables and have not been partitioned separately.

The clam fishery has a separate logbook system from the VTR logbook. The commercial clam logbook data were used to augment the VTR data for the clam dredge fishery. The commercial and recreational landings (in live weight) for the federally managed species were used only in sample size analysis.

A list of the 14 federally managed fish and invertebrate species groups analyzed, and the individual species comprising each species group, is given in Table 1. This analysis does not include sea turtles. Summaries of the data used, in terms of number of trips and number of sea days, by fleet, calendar quarter, and data source (NEFOP and VTR), are given in Tables 2 and 3, respectively.

## Discard Estimation

Total discards of each of the 14 federally managed species groups were estimated for the July 2010 through June 2011 time period using a combined discard/kept ( $\mathrm{d} / \mathrm{k}$ ) ratio estimator (Cochran 1963), where $\mathrm{d}=$ discarded pounds of a given species group, and $\mathrm{k}=$ the kept pounds of all species. Total discards (in weight for fish) were derived by multiplying the estimated discard rate of each fleet by the corresponding fleet landings in the VTR database, and then summing over fleets.

Simple imputation methods were used to fill quarterly cells for which there were one or no observed trips. Data from adjoining strata were pooled to impute estimates for cells with zero or one trip. In this imputation only the temporal stratification, calendar quarter, was relaxed to half year (or annual) recognizing that seasonal variation can occur for some species. This simple imputation could not be applied to fleets where observer coverage was low or missing throughout the year (i.e., too few data to support the simple imputation approach). In these cases, imputed values were not used, and the fleet was designated as a fleet in need of pilot coverage. If some data were available, then discard estimates were derived, but these results were not used in sample size analyses.

The variances of the discard estimates were also derived. In this document, CV is defined as the ratio of the standard error of the total discards divided by the total discards. The appendix presents the equations used in the analysis.

For each species/species group and fleet, the landings from the VTR and clam logbook are presented to provide perspective for the discard estimates.

## Discard Reasons

For each species group and fleet, the fish dispositions associated with discarding (as reported by the at-sea observer) have been grouped into the following six discard reason categories: no market, regulation (size), regulation (quota), regulation (other), poor quality, and
other. The discard reason categories and the associated fish dispositions are summarized in Appendix Table 1. The discard reasons "No Market" and "Poor Quality" would be considered economic discards and not regulatory discards.

The observed (non-extrapolated) discards associated with each of the six discard reason categories were summed for each species group/species for the fleets where discards could be estimated. For individual fleets, the percentage of observed discards by discard reason category was derived by dividing the sum of the observed discards for each discard reason category by the sum of the total observed discards for each species group/species and fleet. The discard reason category percentages were taken from the observed discard reason category percentages. For the "Other fleets filtered out" (an aggregated fleet that represents fleets where the variance of the discard estimate was not used in the annual sample size analysis), the observed discard reason category percentages were then multiplied by the total estimated (extrapolated) discards for each species group/species and fleet to derive the estimated discards by discard reason category for each species group/species and fleet for each of the fleets associated with the aggregated fleet. For each "Other fleets filtered out," the total estimated discards by discard reason category were summed over the fleets that comprise the fleet aggregation for each species group/species. The estimated discard reason category percentage was derived by dividing the estimated discards for each discard reason category by the sum of the total estimated discards for each species group/species and fleet.

## Sample Size Analysis

The sample size analysis (also referred to as sea day analysis) was conducted to estimate the number of baseline trips and sea days needed to monitor the 14 federally managed species groups in each fleet. As described in Wigley et al. 2007 (and given in the appendix), the number of trips and sea days needed to achieve a given precision level was based on the variance of the total discard estimate for a species group. Sample size (trips and sea days) associated with the precision standard for discard estimates ( $30 \% \mathrm{CV}$ ) were derived. The sample size analysis was performed using trips as the sampling unit, and then converting the number of trips to sea days by multiplying by the weighted mean trip length, where the weighting factor was the quarterly number of VTR trips. The percentage of trips was derived by dividing the number of trips needed by the number of VTR trips that occurred in the fleet.

When total discards could not be estimated due to little or no observer coverage (no data), or when total discards were zero (no variance), the sample size (number of trips) was determined using a pilot coverage level set to $2 \%$ of the quarterly VTR trips for a fleet, with a minimum of 3 trips per quarter ( 12 trips per year) and a maximum of 100 trips per quarter ( 400 trips per year). The $2 \%$ pilot coverage level ${ }^{8}$ was the same as was used in SBRM analyses (Wigley et al. 2007; Wigley et al. 2011). The quarterly trips were then multiplied by the quarterly mean VTR trip length to derive quarterly sea days. The quarterly trips and quarterly sea days were then summed for annual number of trips and sea days. It is recognized that pilot coverage may result in too much coverage in cases where little or no observer coverage may actually be needed.

Some fleet/species combinations contribute very little to the total mortality or discard of the species, but may require significant resources to characterize the precision of the estimate.

[^86]For example, a high variance estimate for a rare event within a fleet would require high levels of sampling, even though the total discard in that fleet was unimportant with respect to either the total discard or total mortality on the resource. To address this, a modification of the filtering approach developed for SBRM was employed. Similar to the SBRM analyses (Wigley et al. 2007), importance filters were used to provide a standardized protocol to further refine the number of baseline sea days based on: (a) the importance of the discarded species relative to the total amount of discards by a fleet, and (b) the total fishing mortality due to the discards. In the SBRM analyses, the importance filter was comprised of three filters (i.e., unlikely cell filter, fraction of discard filter, and fraction of total mortality due to discards filter) that were applied simultaneously. However, based on an evaluation of the use of the unlikely filter over a threeyear period, it was found that no substantive changes in the determination of sea days would have resulted had the unlikely filter been removed from the importance filter (Wigley et al. forthcoming 2012). Thus, in this analysis, all cells in the unlikely filter were set to 1 (all cells are likely).

The 2012 baseline sea days were filtered using a 95\% cut-point in the discard filter, and a $98 \%$ cut-point for the total mortality filter due to discards. In other words, estimates of sea day coverage for a given species or species group were derived for those fleets where discards constituted $95 \%$ of the discard mortality and $98 \%$ of the total mortality.

To determine the number of sea days (referred to as the "2012 sea days needed") and trips needed to achieve a $30 \%$ CV on the estimates of discards for each of the 14 species groups within a fleet, the maximum number of sea days for the 14 species groups (i.e., the maximum number of sea days in a row) was used. This ensures that all species groups will have a $30 \% \mathrm{CV}$ or less. In the event that sea days for each species group within a fleet are filtered out, then the number of sea days for the fleet will be based on pilot coverage to maintain monitoring coverage for that fleet. If the fleet was designated as a pilot fleet, then pilot sea days were used. These fleets are indicated with a "P." The fleets with sufficient data to estimate sample size are referred to as non-pilot fleets.

## RESULTS

There were 55 fleets identified during the July 2010 through June 2011 period (Tables 2 and 3). There were three new fleets compared to the 2011 sea day analysis (NEFSC 2011b, NEFSC and NERO 2011): MA large mesh Ruhle trawl (Row 13), NE small mesh Ruhle trawl (Row 14), and MA large mesh haddock separator trawl (Row 16). New fleets, those that have not been identified in previous analyses, have been identified with a plus (+).

Of the 55 fleets examined, 29 fleets had little or no observer data: 6 fleets had sparse observer data across all quarters, while 23 fleets were missing observer data in all quarterly cells. The fleets with no observer coverage were primarily pot and trap fisheries targeting particular species (e.g., lobster, crab, conch, shrimp, and hagfish). No discard estimation was performed for the 23 fleets with no observer coverage and they were designated as fleets in need of pilot coverage (Tables 2 and 3). The 6 fleets with sparse observer coverage were also designated as fleets in need of pilot coverage for the sample size analysis; however, discard estimation was performed using the sparse observer data. For the 26 remaining fleets (non-pilot fleets), estimates of discards and their associated variance were derived and used to determine the sample sizes needed for a $30 \%$ CV. Of the 26 fleets, there were 9 fleets (Rows 11, 15, 19, 22, 23, 24, 29, 31, and 35 ) where the simple imputation was applied.

Thus, for discard estimation and precision analysis, 23 fleets had no discard estimation and 32 fleets had discards estimated. For the sample size analysis, 26 fleets had sample sizes derived from the discard variances and 29 fleets had sample sizes based upon pilot coverage.

A total of 5,444 trips (14,174 days) was observed during July 2010 through July 2011. When these trips were stratified, some trips were partitioned between strata resulting in 5,558 trips (15,018 days; Tables 2 and 3 ) in the VTR. There appears to be minor misreporting of gear type associated with trips in the NE Ruhle trawl fleet (Row 15) and MA Mid-water trawl (Row 38; Tables 2 and 3; Quarter 3). For Ruhle trawl, the incidence of misreporting gear (bottom otter trawl versus Ruhle trawl) is less than in previous years.

The percentages of observed trips varied by fleet and calendar quarter. On an annual basis, the percentage of observed trips by fleet ranged between $0.1 \%$ (MA handline fleet, Row 3 ) to 72\% (MA Mid-water trawl fleet, Row 38; Table 2). Over all fleets, the percentage of observed trips was $5.5 \%$.

Annual VTR landings and estimated discards (live pounds) with associated precision are summarized for 53 fleets (Rows 1-19, 21-43, 45-55 and "Other fleets" with landings only) for each of the 14 species groups and the individual species that comprise those species groups (Tables 4A and 4B; Figures 1A and 1B). The landings associated with the "minor" fleets not uniquely identified in this analysis have been aggregated into a single fleet labeled "Other fleets." Due to confidentially rules, the landings associated with MA Floating Trap (Row 20) and MA Hagfish Pots and Traps (Row 44) have been combined with the landings of other minor fleets (labeled as "Other fleets") that have not been not uniquely identified within this analysis. As a consequence, the fleet row numbers within Tables 4A and 4B are sequential but there are gaps in the row numbers. The landings associated with the various minor fleets aggregated into "Other fleets" generally contribute less than $0.5 \%$ of the total landings across all fleets for each of the 14 species groups (Table 4A). As mentioned above, there are 23 fleets (Rows 10, 13, 14, 20, 21, 25, 28, 40-55) that have no discard estimation due to no NEFOP coverage (dark shaded fleets in Tables 4A and 4B, with Rows 20 and 44 included in "Other fleets"). In Table 4A, the CVs associated with the cells (species group and fleet) that were not used in the sample size analysis (i.e. cells filtered out via the importance filter) are indicated in light shading. Precision of discards of individual species (Table 4B) were not used in the sample size analysis.

Based upon this analysis, over $71,000 \mathrm{mt}$ (live wt) of discards of the 14 species groups occurred during the July 2010 through June 2011 period. The majority ( $77 \%$ ) of the discards were comprised of three species groups: skates (49\%), scallops (16\%), and dogfish (12\%); the remaining species groups comprised less than or equal to 5\% (Table 4A).

The percentage of discards to total catch varied among the 14 species groups (Table 4A; Figure 1A) and individual species (Table 4B; Figure 1B). There was one species group (SAL) with zero discards (this species group is not presented in Figure 1A); two species groups (HERR and SCOQ) where discards were less than $1 \%$ total catch; three species groups (SCAL, SBM, and TILE) where percentages of discards ranged between $1 \%$ and $10 \%$ of total catch; three species groups (BLUE, FSB, and GFL) where discards ranged between $11 \%$ and $25 \%$ of total catch; and five species groups (MONK, RCRAB, SKATE, GFS, and DOG) where discards were greater than $26 \%$ of total catch. The species groups with the highest percentage of total discards relative to total catch were: skates (75\%), dogfish (62\%), and red crab (62\%; Figure 1A). For individual species, most notable are the high percentages of discards to total catch of wolffish (99\%) and ocean pout (99\%) due to the no possession regulations for these two species.

The reasons for discarding varied among the 14 species groups (Appendix Table 2A) and individual species (Appendix Table 2B). Overall, for the 14 species groups, the majority (74\%) of discards occurred due to "No Market," "Regulation" (due to size, quota, and other), "Poor Quality," and "Other" contributed 21\%, 3\%, and 1\%, respectively (Appendix Table 2A).

The percentages of discard to total catch were also summarized by fleet for 26 fleets (Figure 2). Discards of one or more of the 14 species groups that were filtered out via the importance filter have been aggregated into a species group labeled "Other FMP." Discards of non-federally managed species have been aggregated into a species group labeled "Non-FMP." The percentages of discard to total catch varied by fleet (Figure 2). There was one fleet (Row 29) where discards were less than $1 \%$ of the total catch in the fleet; four fleets (Rows 4, 23, 38, and 39) where the percentages of discards ranged between $1 \%$ and $10 \%$; 13 fleets (Rows $2,7,15,19$, $22,24,26,27,32,33,35,36$, and 37 ) where the percentages of discards ranged between $11 \%$ and $25 \%$ of total catch; five fleets (Rows $5,8,17,31$, and 34 ) where the percentages of discards ranged between $26 \%$ and $50 \%$ of the total catch; and three fleets where discards were greater than $50 \%$ of the total catch (Row 6,11 , and 16).

The number of species groups discarded within a fleet also varied among fleets. The majority of fleets ( 17 of the 26 fleets) were comprised of two or three discarded species groups. Eight of these fleets (Rows 2, 4, 15, 16, 31, 33, 35, and 38) had the "Other FMP" species group comprised the majority of the discards. This indicates that the majority of discards were filtered out via the importance filter. There were another five fleets (Rows 22, 29, 32, 34, and 39) where the "Non-FMP" species group comprised the majority of the discards. There was one fleet (Row 23) where discards were evenly split between with "Other FMP" and "Non-FMP" species groups. There were three fleets where two of the three discarded species groups were "Other FMP" and "Non-FMP" and the other was the dominant species group of skate, small mesh groundfish, and dogfish (Rows 11, 19, and 26 respectively).

The remaining fleets ( 9 of the 26 fleets) had between four and nine discarded species groups. The skate species group dominated the discards in five of these fleets (Rows 6, 8, 17, 24, and 27) while "Non-FMP" species group dominated the discards in two fleets (Rows 36 and 37). Two fleets (Rows 5 and 7) had a mix of discarded species groups.

The dominant "Non-FMP" species in the scallop dredge fleets (Rows 32, 33, 34, 35, and 36) were: sand dollar, sponge, and starfish. Menhaden and jellyfish were the dominant "NonFMP" species in the MA small mesh gillnet fleet (Row 22). "Fish, not known" was the dominant species in the NE purse seine fleet (Row 29).

The precision of the discard estimates varied by species group and fleet (Tables 4A and 4B). Of the 14 species groups, 11 species groups had an overall CV that was less than $30 \%$, two species groups (BLUE and SCOQ) had an overall CV that was greater than $30 \% \mathrm{CV}$, and one species group (SAL) had zero discards and consequently no CV. The discards of four species groups (BLUE, HERR, SCOQ, and TILE) were filtered out in all fleets indicating the discards of these species groups were a minor component of the total catch of these species (Table 4A; Figure 1A).

The numbers of sea days needed for each species group and fleet, as well of the number of sea days needed for the fleet (referred to as "2012 Sea Days Needed"), are summarized in Table 5. A total of 18,822 days are needed for all fleets. As mentioned previously, 29 fleets had insufficient observer information to estimate discards and the sea days for these fleets have sea days based on pilot coverage. The number of sea days needed associated with fleets with the pilot coverage designation was 1,638 days ( $9 \%$ of 18,822 ; Table 5 ). There are 10 fleets where the
sea days for all species groups were filtered out via the importance filter and pilot days was used to maintain some coverage (Rows $2,4,15,16,22,23,29,31,35$, and 38 ; Table 5). The sea days needed associated with these fleets was 377 days ( $2 \%$ of 18,822 ; Table 5 ). The sea days needed for the remaining 16 fleets ( 16,807 days representing $89 \%$ of the total sea days needed) were derived using the variance of the discard estimate (Tables 5). Of the 16,807 days, 12,661 days (75\%) were associated with three fleets (Rows 5, 6, and 8).

The sample size (in terms of number of sea days, number of trips, and percentage of trips based upon the VTR trips in July 2010 through June 201) needed to achieve a $30 \%$ CV of the discard estimate in these 16 fleets is given in Table 6. The relationship between sample size and precision, over a range of sample sizes, is shown in Figure 3 for species groups and fleets. If the precision standard ( $30 \% \mathrm{CV}$ ) was relaxed for the red crab species group in three fleets (Rows 5 , 6 , and 8 ) and the penultimate (next largest) value was used in each of the three fleets, then the total number of sea days needed across all fleets would be 7,827 days (a $42 \%$ decrease from the 18,822 days). Using the penultimate value, the expected achieved precision of red crab discards in Rows 5, 6, and 8 would be $92 \%$ CV, $140 \%$ CV, and $72 \%$ CV respectively.

## DISCUSSION

A broad stratification was used to support the deployment of observers on commercial fishing trips among various fleets using attributes known prior to the trip departure. As discussed in previous discard estimation analyses (Wigley et al. 2011), species-specific stock assessment discard estimation may differ from this report due to differences in stratification and data used [calendar year versus 12 -month (July to June) time period; area fished versus region (port of departure); and VTR landings versus Dealer landings]. Region, based on port of departure, was used for the deployment of observers. It is recognized that area fished would provide a better stratification for discard estimation. It is expected, however, that estimates would be in the same order of magnitude. The discard estimates presented here are not definitive estimates, but rather are indicative of where discarding occurred among the commercial fleets for the 14 federally managed species groups.

We have assumed $100 \%$ discard mortality, i.e. we do not account for potential survival of organisms returned to the water. When comparing discard estimates from this study with those from stock assessments, it is usefully to note that survival ratios are applied in stock assessments for spiny dogfish, summer flounder, southern New England and Gulf of Maine stocks of winter flounder, and southern New England yellowtail flounder.

These analyses have used VTR data. Dealer (CFDERSyyyy) data do not contain mesh or area fished information until the trip-based allocation is performed. The trip-based allocation of Dealer (CFDETT/SyyyyAA) data is conducted annually and was not available when this analysis was initiated. Given that the VTR landings estimates are usually less (VTR reports the good faith hails) than the dealer records for a given fleet, the corresponding estimates of discards will also be underestimated. The magnitude of the underestimation will vary by fleet and year.

New fleets were added in response to VTR activity in the time period examined. The Ruhle Trawl (negear code 054) and Haddock Separator Trawl (negear code 057) were used by vessels departing from the MA region. These gear types are required in the US/Canada resource sharing area and their use is expected in both access and non-access areas to reduce discards of New England groundfish under sector management. Due to the low number of VTR trips reported for these fleets in the July 2010 through June 2011 period, the number of sea days
needed is lower than what may be realized. Additional outreach and education via permit holder letters to industry members have emphasized the proper use of these two gear codes.

There are several fleets with high sea day requirements (> 3,000 sea days). The Northeast Fisheries Observer Program data associated with the trips within these fleets were reviewed to rule out any data "irregularities." The high coverage for New England and Mid-Atlantic otter trawl fleets (Rows 5, 6, and 8; Table 5) was due to high variability associated with red crab discards. In this analysis, as well as in the 2011 SBRM analysis (NEFSC 2011a; NEFSC 2011b; NEFSC and NERO 2011; Wigley et al. 2011), the high variability arises from observing some trips that are fishing in deep-water portions of statistical areas as well as observing other trips that are fishing in shallower portions of the same statistical areas. Red crabs were encountered during trips fishing in deep water. Although the discard reason reported for three fleets was "No Market" (Appendix Table 2A), these vessels do not generally have permits to land red crab, thus the red crabs must be discarded. Currently, the analysis does not stratify these fleets further to account for depth because statistical area is the finest spatial resolution that defines a subtrip within the Vessel Trip Report (a subtrip within the VTR is a unique gear, mesh, and statistical area). While depth is a data element in the VTR, depth is not always reported and there are few QA/QC checks on this data element.

Fish may be discarded for economic reasons (e.g., "No Market" or "Poor Quality") or for regulatory reasons (size, quota, or other). When considering mechanisms to reduce discards, it may be useful to know why discarding is occurring. It is important to note that large discard percentages may be associated with a small quantity of discards. Additionally, it is important to note that for many species, the discards are associated with fleets that have been filtered out by the importance filter. Observers classify the discards by fish disposition based upon the NEFOP protocol (NEFOP 2010; NEFOP 2011) where the observer asks the captain/crew why species are being discarded. Thus, these data should be considered a form of self-reported data and as such these data are difficult to verify and should be interpreted cautiously.

This analysis does not address the coverage needed for individual sectors or multiple stock components of a species. The analytical basis for the allocation of future sea day coverage in this analysis is a specified level of precision (i.e., $30 \% \mathrm{CV}$ ) and an expectation that the pattern of fishing activity observed in the prior year will be similar to that in the upcoming year.

## ACKNOWLEDGEMENTS

We thank all the NEFOP observers for their diligent efforts to collect the data used in this report. We thank Jiachen Tang for her assistance with the figures. We thank our reviewers for their helpful comments on this report.

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Table 1. List of the 14 fish and invertebrate species groups (in bold), with species group abbreviations in parentheses, and the species comprising these groups, corresponding to the $\mathbf{1 3}$ federal fishery management plans in the Northeast region.

| ATLANTIC SALMON (SAL) |
| :--- |
| BLUEFISH (BLUE) |
| FLUKE - SCUP - BLACK SEA BASS (FSB) |
| Black Sea Bass |
| Fluke |
| Scup |
| HERRING, ATLANTIC (HERR) |
| LARGE MESH GROUNDFISH (GFL) |
| American Plaice |
| Atlantic Cod |
| Atlantic Halibut |
| Atlantic Wolffish |
| Haddock |
| Ocean Pout |
| Pollock |
| Redfish |
| White Hake |
| Windowpane Flounder |
| Winter Flounder |
| Witch Flounder |
| Yellowtail Flounder |
| MONKFISH (MONK) |
| RED CRAB (RCRAB) |
| SEA SCALLOP (SCAL) |
| SKATE COMPLEX (SKATE) |
| Barndoor Skate |
| Clearnose Skate |
| Little Skate |
| Rosette Skate |
| Smooth Skate |
| Thorny Skate |
| Winter Skate |
| SMALL MESH GROUNDFISH (GFS) |
| Offshore Hake |
| Red Hake |
| Silver Hake |
| SPINY DOGFISH (DOG) |
| SQUID - BUTTERFISH - MACKEREL (SBM) |
| Atlantic Mackerel |
| Butterfish |
| Illex Squid |
| Loligo Squid |
| SURFCLAM - OCEAN QUAHOG (SCOQ) |
| Surfclam |
| Ocean Quahog |
| TILEFISH (TILE) |

Table 2. Number of Northeast Fisheries Observer Program (NEFOP) and Vessel Trip Report (VTR) trips, by fleet and calendar quarter (Q) from July 2010 through June 2011. "P" indicates fleets with "pilot" designation.

| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \hline \text { Mesh } \\ & \text { Group } \\ & \hline \end{aligned}$ | NEFOP |  |  |  |  | VTR |  |  |  |  | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | Q3 | Q4 | Q1 | Q2 | TOTAL | Q3 | Q4 | Q1 | Q2 | TOTAL |  |
| 1 | Longline | OPEN | all | MA | all |  |  |  | 1 | 1 | 50 | 32 | 43 | 37 | 162 | P |
| 2 | Longline | OPEN | all | NE | all | 83 | 29 | 46 | 30 | 188 | 429 | 86 | 166 | 186 | 867 |  |
| 3 | Hand Line | OPEN | all | MA | all |  | 1 |  | 1 | 2 | 1,885 | 786 | 123 | 963 | 3,757 | P |
| 4 | Hand Line | OPEN | all | NE | all | 46 | 10 | 24 | 7 | 87 | 1,763 | 241 | 57 | 491 | 2,552 |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 56 | 48 | 53 | 57 | 214 | 1,156 | 799 | 582 | 831 | 3,368 |  |
| 6 | Otter Trawl | OPEN | all | MA | 1 g | 63 | 24 | 41 | 28 | 156 | 1,799 | 1,335 | 1,234 | 1,901 | 6,269 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 86 | 72 | 40 | 60 | 258 | 1,208 | 825 | 544 | 1,063 | 3,640 |  |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 341 | 319 | 402 | 376 | 1,438 | 2,217 | 1,560 | 1,559 | 1,962 | 7,298 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 6 | 1 |  | 1 | 8 | 53 |  | 2 | 13 | 68 | $P$ |
| 10 | Scallop Trawl | AA | LIM | MA | all |  |  |  |  |  | 1 | 2 | 4 | 1 | 8 | $P$ |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 10 | 3 | 2 |  | 15 | 94 | 32 | 35 | 213 | 374 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all |  |  | 1 |  | 1 | 4 | 6 | 11 | 2 | 23 | P |
| $13+$ | Otter Trawl, Ruhle | OPEN | all | MA | 1 g |  |  |  |  |  |  | 2 | 1 | 4 | 7 | $P$ |
| $14+$ | Otter Trawl, Ruhle | OPEN | all | NE | sm |  |  |  |  |  |  | 1 |  | 3 | 4 | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 l | 7 |  | 1 | 6 | 14 | 4 |  | 1 | 44 | 49 |  |
| $16+$ | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 g |  |  | 3 | 3 | 6 |  |  | 4 | 6 | 10 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 31 | 26 | 14 | 50 | 121 | 61 | 77 | 35 | 84 | 257 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 1 |  |  |  | 1 | 251 | 122 | 5 | 10 | 388 | $P$ |
| 19 | Shrimp Trawl | OPEN | all | NE | all |  | 4 | 1 |  | 5 | 158 | 559 | 2,307 | 41 | 3,065 |  |
| 20 | Floating Trap | OPEN | all | MA | all |  |  |  |  |  | 25 |  |  | 38 | 63 | $P$ |
| 21 | Floating Trap | OPEN | all | NE | all |  |  |  |  |  | 40 |  |  | 35 | 75 | P |
| 22 | Sink, Anchor, Dritt Gillnet | OPEN | all | MA | sm | 4 | 4 | 7 |  | 15 | 615 | 359 | 543 | 301 | 1,818 |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 g | 3 | 26 | 14 |  | 43 | 455 | 644 | 521 | 372 | 1,992 |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg |  | 49 | 28 | 27 | 104 | 109 | 606 | 580 | 1,132 | 2,427 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm |  |  |  |  |  | 13 | 2 | 1 | 2 | 18 | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 655 | 384 | 250 | 269 | 1,558 | 2,579 | 1,075 | 706 | 1,293 | 5,653 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | x 19 | 372 | 206 | 52 | 145 | 775 | 1,113 | 718 | 275 | 1,119 | 3,225 |  |
| 28 | Purse Seine | OPEN | all | MA | all |  |  |  |  |  | 160 | 5 | 1 | 82 | 248 | P |
| 29 | Purse Seine | OPEN | all | NE | all | 13 | 1 |  | 5 | 19 | 166 | 41 |  | 35 | 242 |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 6 |  |  |  | 6 | 14 | 17 | 10 | 3 | 44 | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 18 | 7 | 1 |  | 26 | 62 | 13 | 2 |  | 77 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 20 | 7 | 12 | 18 | 57 | 116 | 43 | 60 | 44 | 263 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 34 | 13 | 8 | 8 | 63 | 86 | 27 | 23 | 25 | 161 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 12 | 5 | 11 | 15 | 43 | 945 | 657 | 732 | 1,094 | 3,428 |  |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 6 | 4 |  | 18 | 28 | 617 | 520 | 1,026 | 994 | 3,157 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 17 | 11 | 6 | 27 | 61 | 357 | 208 | 259 | 468 | 1,292 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 18 | 14 | 8 | 40 | 80 | 495 | 245 | 201 | 394 | 1,335 |  |
| 38 | Mid-water Paired \& Single Trawl | OPEN | all | MA | all | 1 |  | 4 |  | 5 |  |  | 7 |  | 7 |  |
| 39 | Mid-water Paired \& Single Trawl | OPEN | all | NE | all | 65 | 42 | 27 | 26 | 160 | 96 | 122 | 51 | 59 | 328 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all |  |  |  |  |  | 350 | 342 | 33 | 346 | 1,071 | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all |  |  |  |  |  | 423 | 71 |  | 124 | 618 | $P$ |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all |  |  |  |  |  | 195 | 569 | 14 | 418 | 1,196 | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all |  |  |  |  |  | 351 | 222 | 4 | 261 | 838 | P |
| 44 | Pots and Traps, Hagfish | OPEN | all | MA | all |  |  |  |  |  |  |  |  | 3 | 3 | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all |  |  |  |  |  | 43 | 6 | 8 | 18 | 75 | $P$ |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all |  |  |  |  |  | 3 |  | 151 |  | 154 | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all |  |  |  |  |  | 1,196 | 539 | 196 | 569 | 2,500 | $P$ |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all |  |  |  |  |  | 14,215 | 9,340 | 1,968 | 4,369 | 29,892 | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all |  |  |  |  |  | 8 | 32 | 15 | 28 | 83 | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all |  |  |  |  |  | 120 | 63 | 5 | 41 | 229 | P |
| 51 | Beam Trawl | OPEN | all | MA | all |  |  |  |  |  | 31 | 27 | 34 | 71 | 163 | P |
| 52 | Beam Trawl | OPEN | all | NE | all |  |  |  |  |  | 87 | 1 | 29 | 10 | 127 | P |
| 53 | Dredge, Other | OPEN | all | MA | all |  |  |  |  |  | 2 | 97 | 199 | 8 | 306 | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all |  |  |  |  |  | 785 | 641 | 258 | 213 | 1,897 | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all |  |  |  |  |  | 736 | 535 | 101 | 83 | 1,455 | P |
|  |  |  |  |  | Total | 1,974 | 1,310 | 1,056 | 1,218 | 5,558 | 37,741 | 24,252 | 14,726 | 21,907 | 98,626 |  |

Table 3. Number of Northeast Fisheries Observer Program (NEFOP) and Vessel Trip Report (VTR) sea days, by fleet and calendar quarter $(Q)$ from July 2010 through June 2011. "P" indicates fleets with "pilot" designation.

|  |  | Access |  |  | Mesh | NEFOP |  |  |  |  | VTR |  |  |  |  | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Area | Category | Region | Group | Q3 | Q4 | Q1 | Q2 | TOTAL | Q3 | Q4 | Q1 | Q2 | TOTAL |  |
| 1 | Longline | OPEN | all | MA | all |  |  |  | 1 | 1 | 235 | 198 | 208 | 244 | 885 | P |
| 2 | Longline | OPEN | all | NE | all | 105 | 60 | 56 | 46 | 267 | 497 | 143 | 202 | 271 | 1,113 |  |
| 3 | Hand Line | OPEN | all | MA | all |  | 5 |  | 1 | 6 | 2,076 | 804 | 139 | 978 | 3,997 | P |
| 4 | Hand Line | OPEN | all | NE | all | 49 | 12 | 24 | 16 | 101 | 1,971 | 350 | 99 | 512 | 2,932 |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 128 | 159 | 320 | 190 | 797 | 2,330 | 1,723 | 2,274 | 1,667 | 7,994 |  |
| 6 | Otter Trawl | OPEN | all | MA | lg | 93 | 92 | 175 | 60 | 420 | 2,755 | 2,785 | 4,594 | 3,187 | 13,321 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 259 | 200 | 232 | 121 | 812 | 2,668 | 2,059 | 1,831 | 1,863 | 8,421 |  |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 1,025 | 1,036 | 1,313 | 1,447 | 4,821 | 4,942 | 4,742 | 5,306 | 5,769 | 20,759 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 12 | 2 |  | 3 | 17 | 101 |  | 6 | 26 | 133 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all |  |  |  |  |  | 7 | 18 | 35 | 8 | 68 | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 18 | 3 | 4 |  | 25 | 175 | 62 | 65 | 378 | 680 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all |  |  | 6 |  | 6 | 35 | 102 | 90 | 41 | 268 | P |
| $13+$ | Otter Trawl, Ruhle | OPEN | all | MA | lg |  |  |  |  |  |  | 2 | 1 | 4 | 7 | P |
| $14+$ | Otter Traw, Ruhle | OPEN | all | NE | sm |  |  |  |  |  |  | 1 |  | 24 | 25 | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | lg | 54 |  | 5 | 51 | 110 | 26 |  | 5 | 358 | 389 |  |
| $16+$ | Otter Trawl, Haddock Separator | OPEN | all | MA | $\lg$ |  |  | 3 | 3 | 6 |  |  | 6 | 6 | 12 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | $\lg$ | 243 | 225 | 127 | 366 | 961 | 487 | 635 | 315 | 688 | 2,125 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 5 |  |  |  | 5 | 1,333 | 836 | 87 | 105 | 2,361 | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all |  | 4 | 1 |  | 5 | 160 | 574 | 2,332 | 52 | 3,118 |  |
| 20 | Floating Trap | OPEN | all | MA | all |  |  |  |  |  | 25 |  |  | 38 | 63 | P |
| 21 | Floating Trap | OPEN | all | NE | all |  |  |  |  |  | 40 |  |  | 35 | 75 | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 4 | 4 | 7 |  | 15 | 685 | 373 | 548 | 374 | 1,980 |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 lg | 3 | 27 | 14 |  | 44 | 492 | 678 | 566 | 430 | 2,166 |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg |  | 59 | 47 | 37 | 143 | 114 | 781 | 822 | 1,287 | 3,004 |  |
| 25 | Sink, Anchor, Dritt Gillnet | OPEN | all | NE | sm |  |  |  |  |  | 13 | 2 | 10 | 3 | 28 | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 804 | 478 | 325 | 354 | 1,961 | 2,921 | 1,346 | 870 | 1,568 | 6,705 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 453 | 232 | 111 | 245 | 1,041 | 1,326 | 842 | 670 | 1,877 | 4,715 |  |
| 28 | Purse Seine | OPEN | all | MA | all |  |  |  |  |  | 164 | 5 | 2 | 82 | 253 | P |
| 29 | Purse Seine | OPEN | all | NE | all | 31 | 2 |  | 15 | 48 | 395 | 101 |  | 85 | 581 |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 11 |  |  |  | 11 | 32 | 42 | 27 | 9 | 110 | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 31 | 18 | 3 |  | 52 | 95 | 16 | 4 |  | 115 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 174 | 58 | 78 | 152 | 462 | 1,087 | 340 | 477 | 392 | 2,296 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 311 | 131 | 78 | 89 | 609 | 741 | 264 | 246 | 279 | 1,530 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 17 | 7 | 17 | 18 | 59 | 1,299 | 944 | 1,052 | 1,432 | 4,727 |  |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 7 | 6 |  | 22 | 35 | 935 | 812 | 1,299 | 1,291 | 4,337 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 145 | 95 | 59 | 303 | 602 | 3,279 | 1,794 | 2,198 | 4,635 | 11,906 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 203 | 132 | 87 | 489 | 911 | 4,880 | 2,494 | 2,023 | 4,461 | 13,858 |  |
| 38 | Mid-water Paired \& Single Trawl | OPEN | all | MA | all | 5 |  | 16 |  | 21 |  |  | 40 |  | 40 |  |
| 39 | Mid-water Paired \& Single Trawl | OPEN | all | NE | all | 292 | 157 | 91 | 104 | 644 | 366 | 405 | 170 | 229 | 1,170 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all |  |  |  |  |  | 362 | 356 | 39 | 363 | 1,120 | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all |  |  |  |  |  | 423 | 71 |  | 125 | 619 | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all |  |  |  |  |  | 196 | 570 | 15 | 419 | 1,200 | $P$ |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all |  |  |  |  |  | 351 | 230 | 12 | 261 | 854 | P |
| 44 | Pots and Traps, Hagfish | OPEN | all | MA | all |  |  |  |  |  |  |  |  | 3 | 3 | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all |  |  |  |  |  | 165 | 57 | 43 | 104 | 369 | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all |  |  |  |  |  | 3 |  | 151 |  | 154 | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all |  |  |  |  |  | 1,476 | 734 | 300 | 732 | 3,242 | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all |  |  |  |  |  | 16,554 | 11,350 | 3,508 | 6,044 | 37,456 | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all |  |  |  |  |  | 8 | 32 | 15 | 28 | 83 | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all |  |  |  |  |  | 212 | 190 | 68 | 160 | 630 | $P$ |
| 51 | Beam Trawl | OPEN | all | MA | all |  |  |  |  |  | 82 | 84 | 97 | 128 | 391 | P |
| 52 | Beam Trawl | OPEN | all | NE | all |  |  |  |  |  | 94 | 1 | 29 | 21 | 145 | P |
| 53 | Dredge, Other | OPEN | all | MA | all |  |  |  |  |  | 19 | 115 | 199 | 14 | 347 | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all |  |  |  |  |  | 1,176 | 1,092 | 557 | 546 | 3,371 | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all |  |  |  |  |  | 776 | 642 | 166 | 132 | 1,717 | P |
|  |  |  |  |  | Total | 4,482 | 3,204 | 3,199 | 4,133 | 15,018 | 60,584 | 41,797 | 33,818 | 43,768 | 179,968 |  |

Table 4A. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0 . " $P$ " indicates fleets with "pilot" designation.

Species Group: ATLANTIC SALMON

| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 0 | 0 | 0 |  |  |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 0 | 0 | 0 |  |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 0 | 0 | 0 |  |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 0 | 0 | 0 |  |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 g | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 19$ | 0 | 0 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 0 | 0 | 0 |  |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 0 | 0 | 0 |  |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 0 | 0 | 0 |  |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: ATLANTIC SALMON

| 33 | Scallop Dredge | AA | LIM | NE | all | 0 | 0 | 0 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 |  |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 0 | 0 | 0 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 0 | 0 | 0 |  |
| 38 | Mid-water Paired \& Single Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  |
| 39 | Mid-water Paired \& Single Trawl | OPEN | all | NE | all | 0 | 0 | 0 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |
| TOTAL |  |  |  |  |  | 0 | 0 | 0 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: BLUEFISH

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 53 | 53 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 2,084 | 2,034 | 50 | 0.897 |  |
| 3 | Hand Line | OPEN | all | MA | all | 89,237 | 89,237 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 80,664 | 76,855 | 3,809 | 0.454 |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 228,440 | 202,337 | 26,103 | 0.556 |  |
| 6 | Otter Trawl | OPEN | all | MA | 1 g | 135,441 | 126,463 | 8,978 | 0.471 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 262,663 | 160,908 | 101,755 | 1.228 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 97,532 | 62,771 | 34,761 | 0.622 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 500 | 500 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 145 | 145 | 0 |  |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 70 | 70 | 0 |  |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 g | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 4,330 | 445 | 3,885 | 0.735 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 162 | 162 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 640 | 640 | 0 |  |  |
| 21 | Floating Trap | OPEN | all | NE | all | 3,421 | 3,421 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 748,869 | 714,437 | 34,432 | 0.603 |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 g | 1,320,752 | 1,201,723 | 119,029 | 0.682 |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 22,892 | 15,593 | 7,299 | 0.306 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 525 | 525 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 132,813 | 128,424 | 4,389 | 0.145 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 51,800 | 21,596 | 30,204 | 0.232 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 4 | 0 | 4 | 0.939 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 0 | 0 | 0 |  |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 18 | 18 | 0 |  |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: BLUEFISH

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 353 | 0 | 353 | 0.786 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 76 | 0 | 76 | 1.038 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 244 | 0 | 244 | 0.356 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 1,470 | 1,470 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 44 | 44 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 42 | 42 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 17 | 17 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 72 | 72 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 9,633 | 9,633 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 39 | 39 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 26,585 | 26,585 |  |  |  |
| total |  |  |  |  |  | 3,221,630 | 2,846,259 | 375,371 | 0.408 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: FLUKE - SCUP - BLACK SEA BASS

|  | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 9,586 | 9,586 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 274,188 | 274,188 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 40,891 | 40,891 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 4,870,770 | 3,781,875 | 1,088,895 | 0.302 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 14,143,686 | 13,102,065 | 1,041,621 | 0.216 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 3,292,244 | 2,460,146 | 832,098 | 0.270 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 4,084,969 | 3,459,194 | 625,775 | 0.122 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 2,165 | 1,000 | 1,165 | 0.338 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 19,583 | 19,583 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 78,058 | 54,333 | 23,725 | 0.522 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 47,525 | 46,221 | 1,304 | 0.000 | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 1,865 | 1,865 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 1 | 1 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 669 | 318 | 351 | 0.470 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 445 | 429 | 16 | 0.537 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 17,572 | 730 | 16,842 | 0.302 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 2,455 | 2,455 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 10,125 | 9,735 | 390 | 0.185 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 147, 815 | 147, 815 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 2,765 | 1,998 | 767 | 0.581 |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 g | 16,931 | 16,247 | 684 | 0.729 |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 36,104 | 25,767 | 10,337 | 0.345 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 625 | 625 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 70,406 | 68,041 | 2,365 | 0.364 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 137,799 | 37,792 | 100, 007 | 0.140 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 334 | 334 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 69 | 0 | 69 | 0.396 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 104,493 | 8,667 | 95,826 | 0.226 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 93,086 | 0 | 93,086 | 0.158 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 124,425 | 30,294 | 94,131 | 0.748 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: FLUKE - SCUP - BLACK SEA BASS

| Row | Gear Type A | Access Area | Trip Category | Region | $\begin{gathered} \text { Mesh } \\ \text { Group } \end{gathered}$ | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 14,303 | 0 | 14,303 | 0.635 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 531,347 | 29,161 | 502,186 | 0.193 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 838,985 | 185 | 838,800 | 0.255 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 7,478 | 0 | 7,478 | 1.103 |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 16 | 0 | 16 | 0.461 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 372,068 | 372,068 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 311,361 | 311,361 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 183 | 183 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 330 | 330 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 791 | 791 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 34,590 | 34,590 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 15,642 | 15,642 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 838 | 838 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 46,258 | 46,258 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 25,112 | 25,112 |  |  | P |
| 53 | Dredge, other | OPEN | all | MA | all | 90 | 90 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 271 | 271 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 55,889 | 55,889 |  |  |  |
| TOTAL |  |  |  |  |  | 29,887,199 | 24,494,964 | 5,392,235 | 0.097 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: HERRING, ATLANTIC

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 28 | 28 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 58 | 58 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 49 | 49 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 587,539 | 525,168 | 62,371 | 0.444 |  |
| 6 | Otter Trawl | OPEN | all | MA | 1 g | 11,928 | 4,652 | 7,276 | 1.212 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 10,047,331 | 9,890,924 | 156,407 | 0.337 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 22,662 | 3,415 | 19,247 | 0.213 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 33 | 0 | 33 | 1.890 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 400 | 400 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 559 | 0 | 559 | 0.756 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 g | 2 | 0 | 2 | 0.787 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 1,129 | 0 | 1,129 | 0.209 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 641,550 | 614,020 | 27,530 | 0.988 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 412 | 412 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 5,170 | 5,170 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 192 | 192 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 1 \mathrm{~g}$ | 76 | 76 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 380 | 380 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 4,954 | 373 | 4,581 | 0.305 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 612 | 300 | 312 | 0.255 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 21,542,761 | 21,514,860 | 27,901 | 1.094 |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 0 | 0 | 0 |  |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 0 | 0 | 0 |  |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 8 | 8 | 0 |  |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: HERRING, ATLANTIC

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 99 | 0 | 99 | 0.742 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 35 | 0 | 35 | 0.780 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 2,004,114 | 2,004,000 | 114 | 0.574 |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 117,086, 289 | 117,006,373 | 79,916 | 0.513 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 1,800 | 1,800 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 1,495,914 | 1,495,914 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 630 | 630 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 138 | 138 |  |  |  |
| TOTAL |  |  |  |  |  | 153,456,851 | 153, 069,340 | 387,511 | 0.216 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: LARGE MESH GROUNDFISH

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 208,634 | 11,623 | 197,011 | 0.000 | P |
| 2 | Longline | OPEN | all | NE | all | 1,013,974 | 946,295 | 67,679 | 0.132 |  |
| 3 | Hand Line | OPEN | all | MA | all | 29,384 | 8,150 | 21,234 | 0.000 | P |
| 4 | Hand Line | OPEN | all | NE | all | 135,293 | 124,430 | 10,863 | 0.291 |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 837,968 | 13,925 | 824,043 | 0.297 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 937,267 | 157,731 | 779,536 | 0.195 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 518,757 | 118,357 | 400,400 | 0.261 |  |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 42,091,761 | 39,877,275 | 2,214,486 | 0.036 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 48 | 0 | 48 | 0.394 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 69,719 | 0 | 69,719 | 0.646 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 160 | 160 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | otter Trawl, Ruhle | OPEN | all | NE | 19 | 1,066,369 | 1,059,622 | 6,747 | 0.588 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 14,119 | 10,496 | 3,623 | 0.135 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 6,361,835 | 6,207,219 | 154,616 | 0.118 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 795,226 | 268 | 794,958 | 0.000 | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 207,183 | 295 | 206,888 | 0.470 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 3,373 | 1,445 | 1,928 | 1.969 |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 822 | 367 | 455 | 0.490 |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 4,473 | 3,953 | 520 | 0.326 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 2,931 | 2,931 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 7,684,208 | 7,376,489 | 307,719 | 0.072 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 655,801 | 605,427 | 50,374 | 0.181 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 61 | 0 | 61 | 0.247 | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 609 | 0 | 609 | 0.252 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 18,300 | 363 | 17,937 | 0.277 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 29,323 | 892 | 28,431 | 0.185 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 43,405 | 20 | 43,385 | 0.370 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: LARGE MESH GROUNDFISH

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 71,354 | 23 | 71,331 | 0.539 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 216,570 | 852 | 215,718 | 0.198 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 847,387 | 5,401 | 841,986 | 0.104 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 1 | 0 | 1 | 0.857 |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 61,217 | 55,987 | 5,230 | 0.227 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 4,203 | 4,203 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 252 | 252 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 3,150 | 3,150 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 656 | 656 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 1,807 | 1,807 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 4,106 | 4,106 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 7,543 | 7,543 |  |  |  |
| total |  |  |  |  |  | 63,949,248 | 56,611,713 | 7,337,535 | 0.048 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

## Species Group: MONKFISH

|  | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | $\bigcirc$ | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 949 | 943 | 7 | 0.888 |  |
| 3 | Hand Line | OPEN | all | MA | all | 3,463 | 3,463 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 25 | 25 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 262,396 | 96,970 | 165,426 | 0.281 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 447, 227 | 246,200 | 201, 027 | 0.210 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 145,738 | 108,535 | 37,203 | 0.287 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 5,345,394 | 4,711,328 | 634,066 | 0.101 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 1,285 | 157 | 1,128 | 0.250 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 1,013 | 1,013 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 4,589 | 676 | 3,914 | 0.413 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 506 | 506 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 27 | 27 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 25 | 25 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 652 | 469 | 183 | 0.266 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 66 | 66 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 46,196 | 41,879 | 4,317 | 0.168 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 115,273 | 269 | 115,004 | 0.000 | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 182 | 125 | 57 | 1.053 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 4,067 | 4,067 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 g | 19,042 | 19,042 | ${ }^{0}$ |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 3,168,068 | 2,968,306 | 199,762 | 0.203 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 4,476 | 4,476 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 190, 281 | 180,952 | 9,330 | 0.071 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 3,877,307 | 3,593,705 | 283,601 | 0.094 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 2,300 | 493 | 1,807 | 0.203 | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 1,017 | 0 | 1,017 | 0.219 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 209,599 | 21,401 | 188,197 | 0.216 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 196,868 | 18,319 | 178,549 | 0.144 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 90,424 | 47,983 | 42,442 | 0.348 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: MONKFISH

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 29,471 | 8,186 | 21,285 | 0.544 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 1,865,862 | 168,313 | 1,697,549 | 0.221 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 1,919,990 | 312,774 | 1,607,216 | 0.155 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 272 | 0 | 272 | 0.282 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 564 | 564 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 17 | 17 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 227 | 227 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 110 | 110 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 2,079 | 2,079 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 10 | 10 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 20,605 | 20,605 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 3,195 | 3,195 |  |  | P |
| Other fleets |  |  |  |  |  | 330 | 330 |  |  |  |
| TOTAL |  |  |  |  |  | 17,981,186 | 12,587,830 | 5,393,356 | 0.086 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: RED CRAB

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 335,300 | 0 | 335,300 | 0.971 |  |
| 6 | Otter Trawl | OPEN | all | MA | 1 g | 222,747 | 0 | 222,747 | 1.405 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 750 | 0 | 750 | 1.291 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 318,214 | 0 | 318,214 | 0.291 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 0 | 0 | 0 |  |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 53 | 0 | 53 | 0.323 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 2,584,938 | 0 | 2,584,938 | 0.000 | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 g | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 0 | 0 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 370 | 0 | 370 | 0.202 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 1 \mathrm{~g}$ | 81 | 0 | 81 | 0.298 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 0 | 0 | 0 |  |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 0 | 0 | 0 |  |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: RED CRAB

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 0 | 0 | 0 |  |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 0 | 0 | 0 |  |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 1,400 | 1,400 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 2,285 | 2,285 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 2,138,429 | 2,138,429 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |  |
| total |  |  |  |  |  | 5,604,567 | 2,142,114 | 3,462,453 | 0.133 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: SEA SCALLOP

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 463 | 0 | 463 | 0.792 |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 636,337 | 103,750 | 532,587 | 0.512 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 2,644,970 | 2,352,490 | 292,480 | 0.626 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 38,121 | 13,336 | 24,785 | 0.583 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 89,331 | 44,516 | 44,816 | 0.185 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 234,372 | 228,875 | 5,497 | 0.397 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 232,574 | 232,574 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 1,143,528 | 986,233 | 157,295 | 0.416 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 81,226 | 30,946 | 50,280 | 0.000 | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 25 | 25 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 20 | 0 | 20 | 0.916 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 7 | 0 | 7 | 0.512 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 5,078 | 392 | 4,686 | 0.280 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 106 | 0 | 106 | 0.674 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 489 | 8 | 480 | 0.638 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 149,940 | 149,940 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 1,732 | 0 | 1,732 | 0.754 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 1,235 | 0 | 1,235 | 0.700 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 476,763 | 466, 205 | 10,558 | 0.260 | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 365,090 | 256,445 | 108,645 | 0.185 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 24,051,111 | 23,381,156 | 669,956 | 0.244 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 22,503,246 | 20,841,843 | 1,661,403 | 0.182 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 13,619,011 | 12,333,798 | 1,285,213 | 0.507 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: SEA SCALLOP

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 9,997,595 | 9,592,338 | 405,257 | 0.289 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 167,812,239 | 164,954,002 | 2,858,237 | 0.225 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 249, 854,484 | 232,526,675 | 17,327,809 | 0.231 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 8 | 8 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 48,037 | 48,037 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 15,785 | 15,785 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 360,689 | 360,689 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 1,034,378 | 1,034,378 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 538,518 | 538,518 |  |  | P |
| Other fleets |  |  |  |  |  | 1,101,543 | 1,101,543 |  |  |  |
| TOTAL |  |  |  |  |  | 497, 038,051 | 471,594,505 | 25,443,546 | 0.162 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: SKATE COMPLEX

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 11,879 | 370 | 11,509 | 0.000 | P |
| 2 | Longline | OPEN | all | NE | all | 239,609 | 10,756 | 228,853 | 0.219 |  |
| 3 | Hand Line | OPEN | all | MA | all | 8,580 | 8,580 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 249 | 174 | 75 | 0.870 |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 4,596,262 | 229,350 | 4,366,912 | 0.263 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 13,112,884 | 2,065,203 | 11,047,681 | 0.170 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 1,855,210 | 269,428 | 1,585,782 | 0.282 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 39,215,287 | 10,675,996 | 28,539, 292 | 0.069 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 2,852 | 0 | 2,852 | 0.330 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 1,209,464 | 18,955 | 1,190,509 | 0.366 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 208,815 | 0 | 208,815 | 0.000 | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 2,817 | 2,817 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 166,986 | 9,678 | 157,308 | 0.887 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 34,936 | 4,230 | 30,705 | 0.258 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 2,487,743 | 114,393 | 2,373,349 | 0.121 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 57,369 | 0 | 57,369 | 0.000 | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 851 | 0 | 851 | 0.951 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 45 | 45 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 23,818 | 23,818 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 104,970 | 96,077 | 8,893 | 0.532 |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 4,099,717 | 2,999,305 | 1,100,411 | 0.221 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 8,301 | 8,301 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 796,287 | 568,411 | 227,875 | 0.087 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 10,763,896 | 8,028,634 | 2,735,262 | 0.089 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 1,273 | 0 | 1,273 | 0.266 | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 5,563 | 0 | 5,563 | 0.118 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 780,526 | 0 | 780,526 | 0.181 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 691,550 | 0 | 691,550 | 0.131 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 871,979 | 13,814 | 858,165 | 0.276 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0 . " $P$ " indicates fleets with "pilot" designation.

Species Group: SKATE COMPLEX

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 837,889 | 15 | 837,874 | 0.312 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 7,701,133 | 0 | 7,701,133 | 0.159 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 11,746,489 | 0 | 11,746,489 | 0.130 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 766 | 0 | 766 | 0.239 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 16 | 16 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 5,559 | 5,559 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 29,308 | 29,308 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 57 | 57 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 105 | 105 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 1,000 | 1,000 |  |  |  |
| TOTAL |  |  |  |  |  | 101,682,039 | 25,184,395 | 76,497,644 | 0.048 |  |

Table 4A continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0 . " $P$ " indicates fleets with "pilot" designation.

Species Group: SMALL MESH GROUNDFISH

| Row | Gear Type A | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 24 | 24 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 9,759 | 118 | 9,641 | 0.141 |  |
| 3 | Hand Line | OPEN | all | MA | all | 2,490 | 2,490 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 65 | 65 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 7,744,537 | 5,828,237 | 1,916,300 | 0.311 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 467,565 | 252,777 | 214,788 | 1.050 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 13,833,698 | 10,680, 062 | 3,153,636 | 0.258 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 515,781 | 288,349 | 227,432 | 0.071 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 19 | 0 | 19 | 0.679 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 15,244 | 4 | 15,240 | 0.738 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 186 | 0 | 186 | 0.000 | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 300 | 300 |  |  | P |
| 15 | otter Trawl, Ruhle | OPEN | all | NE | 1 g | 976 | 230 | 746 | 0.505 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 1 | 0 | 1 | 0.430 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 9,886 | 2 | 9,884 | 0.167 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 968,524 | 0 | 968,524 | 0.000 | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 977,113 | 27,890 | 949,223 | 0.463 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 599 | 599 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 5 | 5 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times \mathrm{lg}$ | 17 | 14 | 3 | 0.851 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 18,214 | 8,099 | 10,115 | 0.075 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 2,061 | 1,060 | 1,001 | 0.210 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 34 | 0 | 34 | 0.259 | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 35 | 0 | 35 | 0.352 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 17,796 | 0 | 17,796 | 0.614 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 8,312 | 0 | 8,312 | 0.256 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 13,992 | 3,000 | 10,992 | 0.707 |  |

Table 4A continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: SMALL MESH GROUNDFISH

| Row | Gear Type | Access Area | Trip Category | Region | $\begin{array}{r} \text { Mesh } \\ \text { Group } \end{array}$ | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 4,482 | 0 | 4,482 | 1.460 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 46,981 | 0 | 46,981 | 0.188 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 105,094 | 0 | 105,094 | 0.257 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 10,560 | 10,373 | 187 | 0.383 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 2,075 | 2,075 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 10,072 | 10,072 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 10 | 10 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 18,927 | 18,927 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 5,371 | 5,371 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 40 | 40 |  |  |  |
| TOTAL |  |  |  |  |  | 24,810, 844 | 17,140,193 | 7,670,651 | 0.147 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: SPINY DOGFISH

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 3,343 | 3,343 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 1,247,949 | 1,087,614 | 160,335 | 0.177 |  |
| 3 | Hand Line | OPEN | all | MA | all | 8,215 | 8,215 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 240,736 | 199,812 | 40,924 | 0.273 |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 4,649,829 | 612,700 | 4,037,129 | 0.237 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 5,644,030 | 1,138,666 | 4,505,364 | 0.301 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 2,187,077 | 397,606 | 1,789,471 | 0.430 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 3,721,470 | 254,057 | 3,467,413 | 0.065 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 288 | 0 | 288 | 0.340 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 87,810 | 6,000 | 81,810 | 1.117 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 134,327 | 0 | 134,327 | 0.000 | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 6,000 | 6,000 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 33,571 | 0 | 33,571 | 0.740 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 215,130 | 1,250 | 213,880 | 0.196 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 31,801 | 22,850 | 8,951 | 1.326 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 10 | 10 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 583,728 | 509,659 | 74,069 | 1.523 |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 1,692,147 | 1,645,948 | 46,199 | 0.687 |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 210,787 | 105,258 | 105,529 | 0.177 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 4,000 | 4,000 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 7,390,864 | 4,448, 353 | 2,942,511 | 0.060 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 860,585 | 626,861 | 233,724 | 0.101 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 1,800 | 1,800 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 3,445 | 0 | 3,445 | 1.198 |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 10 | 0 | 10 | 0.450 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 31,468 | 0 | 31,468 | 0.340 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 22,072 | 0 | 22,072 | 0.187 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 3,520 | 2,090 | 1,430 | 0.528 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: SPINY DOGFISH

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 468 | 0 | 468 | 1.538 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 137,627 | 0 | 137,627 | 0.317 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 211,272 | 0 | 211,272 | 0.232 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 2,511 | 0 | 2,511 | 0.190 |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 219,300 | 7,326 | 211,974 | 0.300 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 3,045 | 3,045 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 28,000 | 28,000 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 54,704 | 54,704 |  |  |  |
| TOTAL |  |  |  |  |  | 29,672,939 | 11,175,167 | 18,497,772 | 0.101 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: SQUID - BUTTERFISH - MACKEREL

| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 1,726 | 1,726 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 2,761 | 2,761 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 37,113,836 | 34,753,341 | 2,360,495 | 0.252 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 673,616 | 606,919 | 66,697 | 1.107 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 29,464,630 | 26,060,728 | 3,403,902 | 0.246 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 597,629 | 548,610 | 49,019 | 0.107 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 10 | 0 | 10 | 0.796 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 2,047 | 523 | 1,524 | 0.552 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 358 | 358 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 207 | 207 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 168,500 | 168,500 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 771 | 0 | 771 | 0.673 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 4,234 | 2,600 | 1,634 | 0.149 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 180,853 | 45,710 | 135,143 | 0.000 | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 73,967 | 71,250 | 2,717 | 0.467 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 31,125 | 31,125 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 14,486 | 14,373 | 113 | 0.606 |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 389 | 389 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 3,040 | 2,544 | 496 | 0.505 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 3,534 | 1,485 | 2,049 | 0.167 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 1 \mathrm{~g}$ | 552 | 401 | 151 | 0.465 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 2 | 0 | 2 | 1.193 |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 7,713 | 7,208 | 505 | 0.245 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 609 | 0 | 609 | 0.274 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 2,251 | 2,002 | 249 | 0.691 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: SQUID - BUTTERFISH - MACKEREL

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 831 | 0 | 831 | 0.929 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 27,450 | 21,152 | 6,298 | 0.277 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 2,118 | 0 | 2,118 | 0.452 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 47,147 | 47,132 | 15 | 1.086 |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 412,600 | 402,323 | 10,277 | 0.615 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 457 | 457 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 79,500 | 79,500 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 4,512 | 4,512 |  |  |  |
| TOTAL |  |  |  |  |  | 68,923,460 | 62,877,836 | 6,045,624 | 0.170 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: SURFCLAM - OCEAN QUAHOG

| Row | Gear Type A | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 5,321 | 0 | 5,321 | 0.679 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 37,222 | 0 | 37,222 | 0.978 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 0 | 0 | 0 |  |  |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 1,269 | 0 | 1,269 | 0.559 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 780 | 0 | 780 | 0.807 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | otter Trawl, Ruhle | OPEN | all | NE | 1 g | 0 | 0 | 0 |  |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 19 | 0 | 19 | 0.519 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 0 | 0 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 3 | 0 | 3 | 0.957 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 20 | 0 | 20 | 1.062 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 1,224 | 0 | 1,224 | 0.619 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 824 | 0 | 824 | 0.374 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 65,957 | 65,563 | 394 | 1.291 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: SURFCLAM - OCEAN QUAHOG

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 179, 802 | 179,802 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 7,490 | 0 | 7,490 | 0.785 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 1,585 | 0 | 1,585 | 0.666 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 39,908 | 39,908 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 148,223, 092 | 148,223,092 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 96, 871,763 | 96, 871, 763 |  |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |  |
| TOTAL |  |  |  |  |  | 245,436, 279 | 245,380,128 | 56,151 | 0.661 |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

## Species Group: TILEFISH

| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 1,758,696 | 1,758,696 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 1,711 | 1,711 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 11,585 | 9,376 | 2,209 | 0.472 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 3,605 | 2,697 | 908 | 1.048 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 14,806 | 11,833 | 2,973 | 0.487 |  |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 8,401 | 8,103 | 298 | 0.920 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 65 | 65 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 0 | 0 | 0 |  |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 g | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 15 | 0 | 15 | 0.767 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 29 | 29 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 75 | 75 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 10 | 10 | 0 |  |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 1 \mathrm{~g}$ | 8,440 | 4,439 | 4,001 | 0.247 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 0 | 0 | 0 |  |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 0 | 0 | 0 |  |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |

Table 4A, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for 14 fish and invertebrate species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species Group: TILEFISH

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 0 | 0 | 0 |  |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 0 | 0 | 0 |  |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 2 | 2 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 175 | 175 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 104 | 104 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 78 | 78 |  |  |  |
| total |  |  |  |  |  | 1,807,798 | 1,797,393 | 10,405 | 0.218 |  |

Table 4B. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.
Species: BLACK SEA BASS

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 191 | 191 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 61,809 | 61,809 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 5,648 | 5,648 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 380,791 | 235,020 | 145,771 | 0.339 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 505,296 | 323,019 | 182,277 | 0.851 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 118,824 | 48,673 | 70,151 | 0.612 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 40,329 | 33,310 | 7,019 | 0.255 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 941 | 0 | 941 | 0.340 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 333 | 333 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 781 | 17 | 764 | 1.191 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 1,750 | 1,750 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 5 | 5 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 0 | 0 | 0 |  |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 13 | 0 | 13 | 0.576 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 640 | 640 | 0 |  |  |
| 21 | Floating Trap | OPEN | all | NE | all | 815 | 815 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 26 | 26 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 813 | 813 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 661 | 661 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 140 | 140 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 5,001 | 4,990 | 11 | 0.502 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 1 \mathrm{~g}$ | 853 | 850 | 3 | 0.798 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 859 | 0 | 859 | 0.391 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 1,052 | 0 | 1,052 | 0.294 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.
Species: BLACK SEA BASS

| Row | Gear Type | Access Area | Trip <br> Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 1,418 | 123 | 1,295 | 0.585 |  |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 142 | 0 | 142 | 0.693 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 8,249 | 53 | 8,196 | 0.337 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 12,752 | 15 | 12,737 | 0.346 |  |
| 38 | Mid-water Paired \& Single Trawl | l OPEN | all | MA | all | 572 | 0 | 572 | 1.103 |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 6 | 0 | 6 | 0.543 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 355, 259 | 355, 259 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 50,413 | 50,413 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 145 | 145 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 310 | 310 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 53 | 53 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 27,871 | 27,871 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 8,543 | 8,543 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 575 | 575 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 1,538 | 1,538 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 37 | 37 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 1,896 | 1,896 |  |  |  |
| TOTAL |  |  |  |  |  | 1,597,349 | 1,165,541 | 431,808 | 0.390 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: FLUKE

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 9,395 | 9,395 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 111,878 | 111,878 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 19,590 | 19,590 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 1,075,637 | 614,546 | 461,091 | 0.248 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 11,221,557 | 10,607,722 | 613,835 | 0.215 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 808,359 | 687,410 | 120,949 | 0.261 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 2,619,318 | 2,044,953 | 574,365 | 0.128 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 1,224 | 1,000 | 224 | 0.329 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 19,150 | 19,150 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 75,621 | 52,954 | 22,667 | 0.550 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 45,725 | 44,421 | 1,304 | 0.000 | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 1,860 | 1,860 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 669 | 318 | 351 | 0.470 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 445 | 429 | 16 | 0.537 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 17,559 | 730 | 16,829 | 0.302 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 2,455 | 2,455 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 1,000 | 1,000 | 0 |  |  |
| 21 | Floating Trap | OPEN | all | NE | all | 1,566 | 1,566 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 1,048 | 281 | 767 | 0.581 |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 14,992 | 14,308 | 684 | 0.729 |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 19$ | 35,252 | 24,940 | 10,312 | 0.346 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 31,469 | 29,119 | 2,350 | 0.365 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 134,367 | 34,364 | 100,003 | 0.140 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 334 | 334 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 69 | 0 | 69 | 0.396 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 103,527 | 8,667 | 94,860 | 0.228 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 91,922 | 0 | 91,922 | 0.159 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 102,937 | 10,171 | 92,766 | 0.758 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: FLUKE

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 14,161 | 0 | 14,161 | 0.636 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 522,589 | 29,106 | 493,483 | 0.197 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 825,075 | 170 | 824,905 | 0.259 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 3 | 0 | 3 | 0.788 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 410 | 410 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 1,680 | 1,680 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 41 | 41 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 87 | 87 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 44,035 | 44,035 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 21,254 | 21,254 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 90 | 90 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 271 | 271 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 5,658 | 5,658 |  |  |  |
| total |  |  |  |  |  | 17,984,280 | 14,446,363 | 3,537,917 | 0.088 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

## Species: SCUP

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 100,501 | 100,501 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 15,653 | 15,653 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 3,414,343 | 2,932,309 | 482,034 | 0.461 |  |
| 6 | Otter Trawl | OPEN | all | MA | 1 g | 2,416,833 | 2,171,324 | 245,509 | 0.466 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 2,365,062 | 1,724,063 | 640,999 | 0.282 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 1,425,322 | 1,380,931 | 44,391 | 0.430 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 | 0.340 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 100 | 100 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 1,655 | 1,362 | 293 | 1.091 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 50 | 50 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 1 | 1 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 0 | 0 | 0 |  |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 0 | 0 | 0 |  |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 8,485 | 8,095 | 390 | 0.185 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 145,434 | 145,434 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 1,691 | 1,691 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 g | 1,126 | 1,126 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 1 \mathrm{~g}$ | 191 | 166 | 25 | 0.851 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 485 | 485 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 33,937 | 33,932 | 5 | 0.736 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 2,578 | 2,578 | 0 |  |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 107 | 0 | 107 | 0.710 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 112 | 0 | 112 | 0.681 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 20,070 | 20,000 | 70 | 0.593 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: SCUP

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 509 | 2 | 507 | 0.521 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 1,157 | 0 | 1,157 | 0.478 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 6,905 | 0 | 6,905 | 1.103 |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 7 | 0 | 7 | 0.543 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 16,399 | 16,399 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 259,268 | 259,268 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 38 | 38 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 20 | 20 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 738 | 738 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 6,678 | 6,678 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 7,012 | 7,012 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 263 | 263 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 685 | 685 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 3,821 | 3,821 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 48,335 | 48,335 |  |  |  |
| total |  |  |  |  |  | 10,305,570 | 8,883,060 | 1,422,510 | 0.217 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: AMERICAN PLAICE

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 237 | 196 | 41 | 0.269 |  |
| 3 | Hand Line | OPEN | all | MA | all | 54 | 54 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 759 | 0 | 759 | 0.946 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 1,903 | 1,865 | 38 | 0.928 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 77,687 | 1,797 | 75,890 | 0.499 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 3,117,034 | 2,759,681 | 357,353 | 0.053 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 2,938 | 2,650 | 288 | 0.977 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 35,623 | 28,122 | 7,501 | 0.163 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 139,623 | 25 | 139,598 | 0.601 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 28 | 28 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 1 \mathrm{~g}$ | 200 | 200 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 5 | 5 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 19,787 | 12,879 | 6,908 | 0.080 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 1 \mathrm{~g}$ | 3,347 | 2,964 | 383 | 0.241 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 4 | 0 | 4 | 0.616 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 66 | 0 | 66 | 0.597 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 12 | 0 | 12 | 0.569 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 32 | 0 | 32 | 0.793 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: AMERICAN PLAICE

| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 769 | 0 | 769 | 0.740 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 614 | 0 | 614 | 0.894 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 1,115 | 0 | 1,115 | 0.613 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 12 | 0 | 12 | 0.398 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 38 | 38 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |  |
| total |  |  |  |  |  | 3,401,888 | 2,810,504 | 591,384 | 0.159 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: ATLANTIC COD

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | CV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 196,737 | 11,574 | 185,163 | 0.000 | P |
| 2 | Longline | OPEN | all | NE | all | 437,927 | 391,663 | 46,264 | 0.165 |  |
| 3 | Hand Line | OPEN | all | MA | all | 28,704 | 7,470 | 21,234 | 0.000 | P |
| 4 | Hand Line | OPEN | all | NE | all | 102,810 | 92,254 | 10,556 | 0.286 |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 1,776 | 851 | 925 | 0.511 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 60,433 | 46,610 | 13,823 | 0.766 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 14,449 | 6,656 | 7,793 | 0.428 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 8,465,309 | 8,143,083 | 322,226 | 0.078 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 785 | 0 | 785 | 1.663 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 35 | 35 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 23,028 | 22,007 | 1,021 | 0.835 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 8,323 | 7,927 | 396 | 0.562 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 345,605 | 327,015 | 18,590 | 0.145 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 130 | 130 | 0 |  |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 3,047 | 1,213 | 1,834 | 2.070 |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 21 | 21 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 558 | 122 | 436 | 0.371 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 2,911 | 2,911 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 3,052,849 | 2,958,863 | 93,986 | 0.115 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 298,276 | 279,153 | 19,123 | 0.127 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 105 | 0 | 105 | 0.873 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 335 | 0 | 335 | 0.359 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 741 | 0 | 741 | 0.588 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0 . " $P$ " indicates fleets with "pilot" designation.

Species: ATLANTIC COD

| Row | Gear Type A | Access Area | Trip Category | Region | $\begin{gathered} \text { Mesh } \\ \text { Group } \end{gathered}$ | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 444 | 25 | 419 | 0.924 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 6,771 | 70 | 6,701 | 0.197 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 2,788 | 651 | 2,137 | 0.339 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 3,905 | 3,905 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 255 | 255 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 1,525 | 1,525 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 17 | 17 |  |  | P |
| 53 | Dredge, other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 80 | 80 |  |  |  |
| total |  |  |  |  |  | 13,060,680 | 12,306,086 | 754,594 | 0.041 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

## Species: ATLANTIC HALIBUT

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 1,872 | 808 | 1,064 | 0.521 |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 488 | 488 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 6 | Otter Trawl | OPEN | all | MA | $1 g$ | 30 | 30 | 0 |  |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 100 | 0 | 100 | 0.793 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 37,614 | 7,103 | 30,511 | 0.073 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 109 | 0 | 109 | 0.640 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 2,395 | 659 | 1,736 | 0.194 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 57 | 0 | 57 | 1.053 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 g | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 1 \mathrm{~g}$ | 97 | 97 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 5,263 | 982 | 4,281 | 0.152 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 15,488 | 1,106 | 14,382 | 0.568 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 0 | 0 | 0 |  |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 0 | 0 | 0 |  |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: ATLANTIC HALIBUT

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 49 | 0 | 49 | 0.914 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 308 | 0 | 308 | 0.772 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 57 | 57 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |  |
| TOTAL |  |  |  |  |  | 63,927 | 11,330 | 52,597 | 0.162 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

## Species: ATLANTIC WOLFFISH

|  | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 1,777 | 4 | 1,773 | 0.202 |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 204 | 0 | 204 | 1.031 |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 6 | Otter Trawl | OPEN | all | MA | 1 g | 0 | 0 | 0 |  |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 0 | 0 | 0 |  |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 52,322 | 409 | 51,913 | 0.092 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 0 | 0 | 0 |  |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 g | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 1,154 | 0 | 1,154 | 0.407 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 1 \mathrm{~g}$ | 0 | 0 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 7,243 | 8 | 7,235 | 0.118 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 1,749 | 0 | 1,749 | 0.236 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 0 | 0 | 0 |  |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 0 | 0 | 0 |  |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: ATLANTIC WOLFFISH

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 0 | 0 | 0 |  |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 0 | 0 | 0 |  |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |  |
| TOTAL |  |  |  |  |  | 64,449 | 421 | 64,028 | 0.077 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: HADDOCK

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 544,171 | 531,968 | 12,203 | 0.308 |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 1,308 | 1,308 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 44,636 | 0 | 44,636 | 0.448 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 13 | 0 | 13 | 1.217 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 41,388 | 2,861 | 38,527 | 0.358 |  |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 8,212,882 | 8,169,761 | 43,121 | 0.131 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 926,280 | 923,883 | 2,397 | 0.358 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 4,951,997 | 4,927,034 | 24,963 | 0.137 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 3,794 | 0 | 3,794 | 0.403 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 1 \mathrm{~g}$ | 2,724 | 2,724 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 128,876 | 124,405 | 4,471 | 0.126 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 3,983 | 3,440 | 543 | 0.250 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 10 | 0 | 10 | 0.941 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 923 | 0 | 923 | 0.777 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0 . " $P$ " indicates fleets with "pilot" designation.

Species: HADDOCK

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 122 | 0 | 122 | 0.889 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 1,564 | 0 | 1,564 | 0.582 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 56,231 | 54,916 | 1,315 | 0.313 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 459 | 459 |  |  | P |
| 53 | Dredge, other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 7,089 | 7,089 |  |  |  |
| TOTAL |  |  |  |  |  | 14,928,450 | 14,749,848 | 178,602 | 0.143 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: OCEAN POUT

| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 11,848 | 0 | 11,848 | 0.000 | P |
| 2 | Longline | OPEN | all | NE | all | 3,735 | 10 | 3,725 | 0.264 |  |
| 3 | Hand Line | OPEN | all | MA | all | 166 | 166 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 30,880 | 0 | 30,880 | 0.705 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 44,303 | 0 | 44,303 | 0.514 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 20,426 | 150 | 20,276 | 0.389 |  |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 87,384 | 60 | 87,324 | 0.087 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 8,671 | 0 | 8,671 | 1.524 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | $\bigcirc$ | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 121 | 0 | 121 | 0.810 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 g | 70 | 0 | 70 | 0.385 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 5,106 | 0 | 5,106 | 0.307 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | ${ }^{0}$ |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 6 | 6 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 g | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 0 | 0 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 406 | 0 | 406 | 0.189 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 204 | 0 | 204 | 0.501 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 14 | 0 | 14 | 0.343 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 220 | 0 | 220 | 0.590 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 536 | 0 | 536 | 0.251 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 406 | 0 | 406 | 0.588 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0 . " $P$ " indicates fleets with "pilot" designation.

Species: OCEAN POUT

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 1,508 | 0 | 1,508 | 0.406 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 7,771 | 0 | 7,771 | 0.263 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 11 | 0 | 11 | 0.790 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 249 | 249 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 400 | 400 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |  |
| TOTAL |  |  |  |  |  | 224,443 | 1,041 | 223,402 | 0.161 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: POLLOCK

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 4,832 | 4,723 | 109 | 0.345 |  |
| 3 | Hand Line | OPEN | all | MA | all | 400 | 400 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 30,273 | 30,208 | 65 | 0.728 |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 20 | 0 | 20 | 0.736 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 4,085 | 3,841 | 244 | 0.478 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 7,312,322 | 7,253,773 | 58,549 | 0.151 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 11,936 | 11,878 | 58 | 0.641 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 437,126 | 430,624 | 6,502 | 0.329 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 1,134 | 0 | 1,134 | 0.417 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 20 | 20 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 24 | 24 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 0 | 0 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 15 | 15 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 3,570,387 | 3,441,229 | 129,158 | 0.125 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 234,819 | 226,030 | 8,789 | 0.216 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 0 | 0 | 0 |  |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 0 | 0 | 0 |  |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0 . " $P$ " indicates fleets with "pilot" designation.

Species: POLLOCK

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 0 | 0 | 0 |  |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 0 | 0 | 0 |  |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 1,573 | 370 | 1,203 | 0.391 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 39 | 39 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |  |
| TOTAL |  |  |  |  |  | 11,609,006 | 11,403,174 | 205,832 | 0.091 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: REDFISH

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 2,875 | 2,733 | 142 | 0.347 |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 119 | 82 | 37 | 0.942 |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 4,392 | 10 | 4,382 | 0.571 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 37,985 | 35,080 | 2,905 | 0.456 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 4,011,074 | 3,754,576 | 256,498 | 0.109 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 66,090 | 66,090 | 0 |  |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 202,042 | 170,136 | 31,906 | 0.409 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 28,484 | 0 | 28,484 | 0.459 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 45 | 45 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 0 | 0 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 132,822 | 125,494 | 7,328 | 0.177 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 3,766 | 3,687 | 79 | 0.328 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 0 | 0 | 0 |  |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 0 | 0 | 0 |  |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: REDFISH

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 0 | 0 | 0 |  |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 4 | 0 | 4 | 1.037 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 542 | 50 | 492 | 0.717 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |  |
| TOTAL |  |  |  |  |  | 4,490,241 | 4,157,983 | 332, 258 | 0.101 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: WHITE HAKE

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 12,082 | 9,890 | 2,192 | 0.232 |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 82 | 82 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 2,394 | 1,040 | 1,354 | 0.938 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 1,736 | 1,187 | 549 | 0.707 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 64,314 | 55,925 | 8,389 | 1.105 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 2,582,062 | 2,538,816 | 43,246 | 0.149 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 3,437 | 3,433 | 4 | 0.690 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 61,251 | 59,845 | 1,406 | 0.200 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 268 | 268 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 90 | 90 | 0 |  |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 1 \mathrm{~g}$ | 0 | 0 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 454,197 | 430,826 | 23,371 | 0.175 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 45,319 | 43,389 | 1,930 | 0.254 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 44 | 0 | 44 | 0.364 | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 100 | 0 | 100 | 0.585 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 175 | 0 | 175 | 0.442 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0 . " $P$ " indicates fleets with "pilot" designation.

Species: WHITE HAKE

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 3,212 | 0 | 3,212 | 1.448 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 2,771 | 10 | 2,761 | 0.495 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 3,150 | 3,150 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 196 | 196 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |  |
| TOTAL |  |  |  |  |  | 3,236,880 | 3,148,147 | 88,733 | 0.147 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: WINDOWPANE FLOUNDER

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | CV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 32 | 24 | 8 | 1.120 |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 195,393 | 9,101 | 186,292 | 0.318 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 506,347 | 37,040 | 469,307 | 0.220 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 17,689 | 0 | 17,689 | 0.292 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 413,469 | 276 | 413,193 | 0.098 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 19 | 0 | 19 | 0.846 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 22,776 | 0 | 22,776 | 0.972 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 2,052 | 0 | 2,052 | 0.991 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 g | 2,127 | 0 | 2,127 | 0.239 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 21,033 | 0 | 21,033 | 0.156 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 6,241 | 0 | 6,241 | 0.686 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 227 | 133 | 94 | 0.679 |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 663 | 208 | 455 | 0.490 |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 663 | 620 | 43 | 0.816 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 1,844 | 150 | 1,694 | 0.168 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 240 | 0 | 240 | 0.354 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 8 | 0 | 8 | 0.136 | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 157 | 0 | 157 | 0.315 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 12,751 | 0 | 12,751 | 0.363 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 7,995 | 0 | 7,995 | 0.208 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 35,073 | 0 | 35,073 | 0.414 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: WINDOWPANE FLOUNDER

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 24,210 | 0 | 24,210 | 0.761 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 124,924 | 0 | 124,924 | 0.239 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 279,310 | 0 | 279,310 | 0.199 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 1 | 0 | 1 | 0.857 |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 13 | 0 | 13 | 0.429 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 7 | 7 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |  |
| TOTAL |  |  |  |  |  | 1,675,265 | 47,559 | 1,627,706 | 0.089 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: WINTER FLOUNDER

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 3,242 | 3,119 | 123 | 0.444 |  |
| 3 | Hand Line | OPEN | all | MA | all | 60 | 60 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 8 | 8 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 297,988 | 2,898 | 295,090 | 0.492 |  |
| 6 | Otter Trawl | OPEN | all | MA | 1 g | 196,769 | 12,313 | 184,456 | 0.304 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 157,589 | 7,615 | 149,974 | 0.318 |  |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 3,581,933 | 3,382,764 | 199,169 | 0.081 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 16,887 | 0 | 16,887 | 0.667 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 6,145 | 6,126 | 19 | 0.871 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 g | 471 | 0 | 471 | 0.204 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 151,325 | 144,179 | 7,146 | 0.450 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 11,337 | 0 | 11,337 | 0.557 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 g | 50 | 50 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 19$ | 168 | 168 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 59,219 | 50,336 | 8,883 | 0.111 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 1 \mathrm{~g}$ | 4,914 | 3,062 | 1,852 | 0.660 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 257 | 0 | 257 | 0.437 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 1,558 | 20 | 1,538 | 0.337 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 12,323 | 0 | 12,323 | 0.224 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 2,768 | 0 | 2,768 | 0.642 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: WINTER FLOUNDER

| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 11,293 | 7 | 11,286 | 0.516 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 15,430 | 0 | 15,430 | 0.283 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 323,989 | 1,192 | 322,797 | 0.179 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 35 | 0 | 35 | 0.429 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 10 | 10 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 245 | 245 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 1 | 1 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 24 | 24 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 1,810 | 1,810 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 40 | 40 |  |  |  |
| TOTAL |  |  |  |  |  | 4,857,891 | 3,616,047 | 1,241,844 | 0.140 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: WITCH FLOUNDER

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 212,170 | 25 | 212,145 | 0.426 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 31,671 | 908 | 30,763 | 1.047 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 27,589 | 4,034 | 23,555 | 0.416 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 1,559,952 | 1,436,420 | 123,532 | 0.062 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 29 | 0 | 29 | 0.340 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 50 | 0 | 50 | 1.890 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 652 | 606 | 46 | 0.618 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 26,710 | 23,325 | 3,385 | 0.267 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 794,958 | 0 | 794,958 | 0.000 | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 15,297 | 50 | 15,247 | 0.508 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 3 | 3 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 9,059 | 8,294 | 765 | 0.103 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 26,122 | 25,963 | 159 | 0.270 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 8 | 0 | 8 | 0.136 | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 4 | 0 | 4 | 0.917 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 1,108 | 0 | 1,108 | 0.494 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 974 | 0 | 974 | 0.407 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 376 | 0 | 376 | 0.674 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: WITCH FLOUNDER

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 321 | 0 | 321 | 0.736 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 7,933 | 0 | 7,933 | 0.313 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 11,895 | 0 | 11,895 | 0.306 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 7 | 0 | 7 | 0.386 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 15 | 15 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 4 | 4 |  |  |  |
| total |  |  |  |  |  | 2,726,908 | 1,499,647 | 1,227,261 | 0.079 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: YELLOWTAIL FLOUNDER

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 49 | 49 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 1,191 | 1,157 | 34 | 0.594 |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 47,559 | 0 | 47,559 | 0.694 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 94,061 | 57,778 | 36,283 | 0.645 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 55,455 | 398 | 55,057 | 0.312 |  |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 2,658,403 | 2,430,553 | 227,850 | 0.088 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 20,550 | 0 | 20,550 | 0.619 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 125 | 125 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 23,581 | 22,949 | 632 | 0.837 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 g | 3,127 | 2,569 | 558 | 0.295 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 120,468 | 96,280 | 24,188 | 0.170 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 995 | 0 | 995 | 0.996 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 64 | 64 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 59 | 19 | 40 | 0.763 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 242,257 | 223,023 | 19,234 | 0.099 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 17,574 | 16,633 | 941 | 0.346 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 172 | 0 | 172 | 0.215 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 2,383 | 343 | 2,040 | 0.483 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 6,049 | 892 | 5,157 | 0.272 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 4,009 | 20 | 3,989 | 0.269 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: YELLOWTAIL FLOUNDER

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 34,761 | 16 | 34,745 | 0.824 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 62,334 | 827 | 61,507 | 0.332 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 211,889 | 4,129 | 207,760 | 0.207 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 4 | 0 | 4 | 0.559 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 5 | 5 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 1,767 | 1,767 |  |  | P |
| 53 | Dredge, other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 330 | 330 |  |  |  |
| TOTAL |  |  |  |  |  | 3,609,221 | 2,859,926 | 749,295 | 0.100 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0 . " $P$ " indicates fleets with "pilot" designation.

## Species: OFFSHORE HAKE

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 24 | 24 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 5 | 0 | 5 | 0.894 |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 45 | 45 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 32,878 | 31,816 | 1,062 | 0.483 |  |
| 6 | Otter Trawl | OPEN | all | MA | 1 g | 11,256 | 1,243 | 10,013 | 1.405 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 157,526 | 151,547 | 5,979 | 0.467 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 3,756 | 1,367 | 2,389 | 0.372 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 0 | 0 | 0 |  |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 16 | 0 | 16 | 0.639 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 6 | 6 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 g | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 1 \mathrm{~g}$ | 0 | 0 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 39 | 5 | 34 | 0.413 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 0 | 0 | 0 |  |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 26 | 0 | 26 | 0.703 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 59 | 0 | 59 | 0.581 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 64 | 0 | 64 | 0.841 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: OFFSHORE HAKE

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 3,925 | 0 | 3,925 | 0.909 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 777 | 0 | 777 | 0.926 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |  |
| total |  |  |  |  |  | 210,403 | 186,053 | 24,350 | 0.609 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: RED HAKE

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 9,615 | 12 | 9,603 | 0.140 |  |
| 3 | Hand Line | OPEN | all | MA | all | 2,485 | 2,485 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 13 | 13 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 1,417,845 | 571,479 | 846,366 | 0.342 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 48,114 | 31,927 | 16,187 | 0.946 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 1,820,131 | 684,643 | 1,135,488 | 0.278 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 119,777 | 32,815 | 86,962 | 0.084 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 | 0.340 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 2,195 | 0 | 2,195 | 0.600 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 142 | 0 | 142 | 0.244 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 5,112 | 0 | 5,112 | 0.215 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 36,715 | 1,300 | 35,415 | 0.333 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 350 | 350 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 5 | 2 | 3 | 0.851 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 3,152 | 988 | 2,164 | 0.079 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 386 | 245 | 141 | 0.328 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 8 | 0 | 8 | 0.381 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 16,871 | 0 | 16,871 | 0.643 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 6,212 | 0 | 6,212 | 0.331 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 3,361 | 0 | 3,361 | 0.610 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: RED HAKE

| Row | Gear Type A | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 4,262 | 0 | 4,262 | 1.538 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 25,392 | 0 | 25,392 | 0.232 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 59,591 | 0 | 59,591 | 0.376 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 13 | 0 | 13 | 0.539 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 2,018 | 2,018 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 72 | 72 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 10 | 10 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 18,927 | 18,927 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 5,371 | 5,371 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |  |
| TOTAL |  |  |  |  |  | 3,608,145 | 1,352,657 | 2,255,488 | 0.191 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: SILVER HAKE

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 139 | 106 | 33 | 0.516 |  |
| 3 | Hand Line | OPEN | all | MA | all | 5 | 5 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 7 | 7 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 6,293,813 | 5,224,942 | 1,068,871 | 0.329 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 408,196 | 219,607 | 188,589 | 1.043 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 11,856, 041 | 9,843,872 | 2,012,169 | 0.271 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 392,247 | 254,167 | 138,080 | 0.084 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 19 | 0 | 19 | 0.684 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 13,049 | 4 | 13,045 | 0.776 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 186 | 0 | 186 | 0.000 | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 300 | 300 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 834 | 230 | 604 | 0.594 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 g | 1 | 0 | 1 | 0.430 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 4,758 | 2 | 4,756 | 0.153 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 968,524 | 0 | 968,524 | 0.000 | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 940,398 | 26,590 | 913,808 | 0.469 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 243 | 243 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 g | 5 | 5 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 19$ | 12 | 12 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 15,023 | 7,106 | 7,917 | 0.088 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 1,674 | 815 | 859 | 0.231 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 34 | 0 | 34 | 0.259 | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 27 | 0 | 27 | 0.459 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 899 | 0 | 899 | 0.241 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 2,041 | 0 | 2,041 | 0.205 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 10,568 | 3,000 | 7,568 | 0.760 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: SILVER HAKE

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 220 | 0 | 220 | 0.563 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 17,664 | 0 | 17,664 | 0.271 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 44,725 | 0 | 44,725 | 0.217 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 10,548 | 10,373 | 175 | 0.409 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 57 | 57 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 10,000 | 10,000 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 40 | 40 |  |  |  |
| TOTAL |  |  |  |  |  | 20,992,296 | 15,601,483 | 5,390,813 | 0.149 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011 Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: ATLANTIC MACKEREL

| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 1,462 | 1,462 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 1,822 | 1,822 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 410,346 | 382,736 | 27,610 | 0.448 |  |
| 6 | Otter Trawl | OPEN | all | MA | 1 g | 11,447 | 7,996 | 3,451 | 1.159 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 308, 257 | 228,221 | 80,036 | 0.415 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 3,049 | 1,893 | 1,156 | 0.234 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 337 | 0 | 337 | 0.647 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 37 | 0 | 37 | 0.461 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 638 | 25 | 613 | 0.646 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 29,357 | 29,357 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 5,241 | 5,241 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 279 | 279 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 2,913 | 2,432 | 481 | 0.520 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 3,418 | 1,438 | 1,980 | 0.172 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 476 | 401 | 75 | 0.331 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 2 | 0 | 2 | 0.933 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 22 | 0 | 22 | 0.497 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011 Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: ATLANTIC MACKEREL

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 26 | 0 | 26 | 0.703 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 1 | 0 | 1 | 1.030 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 47,132 | 47,132 | 0 | 1.103 |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 412,191 | 402,103 | 10,088 | 0.626 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 0 | 0 |  |  |  |
| TOTAL |  |  |  |  |  | 1,238,454 | 1,112,538 | 125,916 | 0.288 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011 Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

## Species: BUTTERFISH

| Row | Gear Type | Access Area | Trip Category | Region | $\begin{gathered} \text { Mesh } \\ \text { Group } \end{gathered}$ | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 251 | 251 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 2 | 2 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 1,495,697 | 482,965 | 1,012,732 | 0.289 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 107,474 | 59,016 | 48,458 | 1.277 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 2,566,142 | 630,111 | 1,936,031 | 0.246 |  |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 104,096 | 100,830 | 3,266 | 0.142 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 1,451 | 3 | 1,448 | 0.581 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 19 | 19 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 4 | 0 | 4 | 0.651 |  |
| 16 | Otter Trawl, Haddock Separator | $r$ OPEN | all | MA | 1 g | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 126 | 0 | 126 | 0.315 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 1,074 | 1, 074 | $\bigcirc$ |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 2,492 | 1,050 | 1,442 | 0.513 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 1,208 | 1,208 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 9,245 | 9,132 | 113 | 0.606 |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 1 g | 110 | 110 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 127 | 112 | 15 | 0.855 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 109 | 47 | 62 | 0.631 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 1 \mathrm{~g}$ | 76 | 0 | 76 | 0.865 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 2 | 0 | 2 | 1.193 |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 53 | 8 | 45 | 0.737 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 153 | 0 | 153 | 0.771 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011 Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: BUTTERFISH

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 71 | 0 | 71 | 0.522 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 157 | 0 | 157 | 0.594 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 15 | 0 | 15 | 1.103 |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 278 | 220 | 58 | 0.440 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 90 | 90 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 3,670 | 3,670 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 89 | 89 |  |  |  |
| TOTAL |  |  |  |  |  | 4,294,282 | 1,290,007 | 3,004,275 | 0.187 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: ILLEX SQUID

| Row | Gear Type A | Access Area | Trip Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 1 | 1 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 26,362,878 | 25,134,844 | 1,228,034 | 0.296 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 4,270 | 748 | 3,522 | 1.405 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 14,578,134 | 13,487,820 | 1,090,314 | 0.331 |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 265,418 | 225,381 | 40,037 | 0.126 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 7 | 0 | 7 | 0.809 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 9 | 0 | 9 | 0.756 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 0 | 0 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 19 | 0 | 0 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 166,500 | 166,500 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 406 | 0 | 406 | 0.712 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 1,220 | 0 | 1,220 | 0.184 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 160,143 | 25,000 | 135,143 | 0.000 | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 21 | Floating Trap | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 1 \mathrm{~g}$ | 0 | 0 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 6 | 0 | 6 | 0.635 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 1 \mathrm{~g}$ | 0 | 0 | 0 |  |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 37 | 0 | 37 | 0.407 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 24 | 0 | 24 | 0.477 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 |  |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.

Species: ILLEX SQUID

| Row | Gear Type | Access Area | Trip <br> Category | Region | Mesh Group | Total | Kept | Discarded | cV | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 831 | 0 | 831 | 0.929 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 1,114 | 0 | 1,114 | 0.562 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 1,000 | 0 | 1,000 | 0.903 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 122 | 0 | 122 | 0.340 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | ${ }^{0}$ | ${ }^{0}$ |  |  |  |
| TOTAL |  |  |  |  |  | 41,542,119 | 39,040,294 | 2,501,825 | 0.205 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis.
Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.
Species: LOLIGO SQUID

| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 0 | 0 | 0 |  | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 |  |  |
| 3 | Hand Line | OPEN | all | MA | all | 13 | 13 | 0 |  | P |
| 4 | Hand Line | OPEN | all | NE | all | 936 | 936 | 0 |  |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 8,844,914 | 8,752,796 | 92,118 | 0.421 |  |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 550,178 | 538,919 | 11,259 | 0.634 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 11,980,896 | 11,714,576 | 266,320 | 0.316 |  |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 224,990 | 220,500 | 4,490 | 0.231 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 3 | 0 | 3 | 0.772 | P |
| 10 | Scallop Trawl | AA | LIM | MA | all | 0 | 0 |  |  | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 587 | 520 | 67 | 0.792 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 339 | 339 | 0 |  | P |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 207 | 207 |  |  | P |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | 2,000 | 2,000 |  |  | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 19 | 24 | 0 | 24 | 0.486 |  |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 g | 0 | 0 | 0 |  |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 2,850 | 2,600 | 250 | 0.227 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 19,636 | 19,636 | 0 |  | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 70,837 | 70,175 | 662 | 0.257 |  |
| 21 | Floating Trap | OPEN | all | NE | all | 560 | 560 |  |  | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 |  |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | 19 | 0 | 0 | 0 |  |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 1 \mathrm{~g}$ | 0 | 0 | 0 |  |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 0 | 0 |  |  | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 1 g | 1 | 0 | 1 | 0.958 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 0 | 0 | 0 |  |  |
| 28 | Purse Seine | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | ${ }^{0}$ |  |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 0 | 0 | 0 |  | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 7,621 | 7,200 | 421 | 0.254 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 389 | 0 | 389 | 0.245 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 2,251 | 2,002 | 249 | 0.691 |  |

Table 4B, continued. Total catch (live pounds), Vessel Trip Report landings (kept; live pounds), estimated discards (live pounds) and associated coefficient of variation (CV) for the 23 individual species that comprise the 14 species groups, by fleet for July 2010 through June 2011. Dark shading indicates fleets with no NEFOP trips in the annual analysis. Light shading indicates that the variance of the discard estimate was not used in the annual sample size analysis. Blank CV indicates either no discards or discards equal 0. "P" indicates fleets with "pilot" designation.
Species: LOLIGO SQUID

| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Total | Kept | Discarded | cv | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 |  |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 26,240 | 21,152 | 5,088 | 0.325 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 945 | 0 | 945 | 0.324 |  |
| 38 | Mid-water Paired \& Single Trawl | 1 OPEN | all | MA | all | 0 | 0 | 0 |  |  |
| 39 | Mid-water Paired \& Single Trawl | 1 OPEN | all | NE | all | 9 | 0 | 9 | 0.732 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 367 | 367 |  |  | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 75,830 | 75,830 |  |  | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 0 | 0 |  |  | P |
| 53 | Dredge, Other | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 0 | 0 |  |  | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 0 | 0 |  |  | P |
| Other fleets |  |  |  |  |  | 4,423 | 4,423 |  |  |  |
| total |  |  |  |  |  | 21,817, 046 | 21,434,751 | 382,295 | 0.243 |  |

Table 5. The number of sea days needed to achieve a $30 \%$ CV of the discard estimate for each the 14 fish and invertebrate species groups, the number of pilot sea days, and the maximum number of sea days needed for each fleet ( 2012 Sea Days Needed) for fish and invertebrate species groups based on July 2010 through June 2011 data. Red font indicates basis for fleet sea days; species group abbreviation are given in Table 1.

| Row | Gear Type | Access <br> Area | Trip Category | Region | Mesh Group | BLUE | HERR | SAL | RCRAB | SCAL | SBM | MONK | GFL | GFS | SKATE | DOG | FSB | SCOQ | TILE | Pilot days | 2012 Sea Days Needed | Pilot |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | P |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 24 |  |
| 3 | Hand Line | OPEN | all | MA | all | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | P |
| 4 | Hand Line | OPEN | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 | 62 |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 0 | 0 | 0 | 3,231 | 0 | 364 | 0 | 497 | 545 | 397 | 325 | 513 | 0 | 0 | 160 | 3,231 |  |
| 6 | Otter Trawl | OPEN | all | MA | lg | 0 | 0 | 0 | 5,551 | 0 | 0 | 164 | 141 | 0 | 107 | 333 | 173 | 0 | 0 | 266 | 5,551 |  |
| 7 | Otter Trawl | OPEN | all | NE | sm | 0 | 0 | 0 | 0 | 0 | 411 | 0 | 461 | 451 | 531 | 1,151 | 489 | 0 | 0 | 168 | 1,151 |  |
| 8 | Otter Trawl | OPEN | all | NE | lg | - | 0 | 0 | 3,879 | 0 | 0 | 568 | 76 | 280 | 261 | 229 | 788 | 0 | 0 | 415 | 3,879 |  |
| 9 | Scallop Trawl | AA | GEN | MA | all | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | $P$ |
| 10 | Scallop Trawl | AA | LIM | MA | all | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | P |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 25 | 32 |  |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | $P$ |
| $13+$ | Otter Trawl, Ruhle | OPEN | all | MA | 1 g | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | P |
| 14 + | Otter Trawl, Ruhle | OPEN | all | NE | sm | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | P |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 l | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 59 | 59 |  |
| $16+$ | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 l |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 8 |  |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 257 | 567 | 0 | 0 | 0 | 100 | 567 |  |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | P |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 65 | 34 |  |
| 20 | Floating Trap | OPEN | all | MA | all | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | P |
| 21 | Floating Trap | OPEN | all | NE | all | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | P |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 40 |  |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | lg | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 43 |  |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 0 | 0 | 0 | 0 | 0 | 0 | 70 | 0 | 0 | 83 | 0 | 0 | 0 | 0 | 61 | 83 |  |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | P |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | lg | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 97 | 0 | 0 | 0 | 134 | 97 |  |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 0 | 0 | 0 | 0 | 0 | 0 | 132 | 0 | 0 | 118 | 171 | 0 | 0 | 0 | 94 | 171 |  |
| 28 | Purse Seine | OPEN | all | MA | all | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | P |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 23 |  |
| 30 | Scallop Dredge | AA | GEN | MA | all | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | P |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 14 |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 282 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 102 | 282 |  |
| 33 | Scallop Dredge | AA | LIM | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 189 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 121 | 189 |  |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 95 | 50 |  |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 87 | 87 |  |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | , | 0 | 0 | 0 | 0 | 0 | 312 | 0 | 0 | 164 | 0 | 0 | 0 | 0 | 238 | 312 |  |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 0 | 0 | 0 | 0 | 500 | 0 | 234 | 107 | 0 | 163 | 505 | 607 | 0 | 0 | 277 | 607 |  |
| 38 | Mid-water Paired \& Single Trawl | OPEN | all | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 17 |  |
| 39 | Mid-water Paired \& Single Trawl | OPEN | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 571 | 0 | 0 | 0 | 43 | 571 |  |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | P |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | P |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | P |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | P |
| 44 | Pots and Traps, Hagfish | OPEN | all | MA | all | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | P |
| 45 | Pots and Traps, Hagish | OPEN | all | NE | all | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | P |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |  | $P$ |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | P |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | P |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | P |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | P |
| 51 | Beam Trawl | OPEN | all | MA | all | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | P |
| 52 | Beam Trawl | OPEN | all | NE | all | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | $P$ |
| 53 | Dredge, Other | OPEN | all | MA | all | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | P |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | P |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | P |
|  |  |  |  |  | Totals | 1,638 | 1,638 | 1,638 | 14,299 | 2,138 | 2,413 | 3,589 | 2,920 | 2,948 | 3,801 | 5,587 | 4,208 | 1,638 | 1,638 | 4,379 | 18,822 |  |

See supporting text for abbreviations; + indicates new fleet in 2012; "P" indicates fleets with "pilot" designation

Table 6. Number of sea days, trips, and percentage of trips (based upon previous industry activity) needed to achieve a 30\% CV of the discard estimate, by fleet and species group, based on July 2010 through June 2011 data. See Table 1 and Appendix Table 3 for species group and fleet abbreviations, respectively.

| Row | FIEET | Species Group | Sea Days | Trips | \% of Trips |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 5 | OT sm MA | RCRAB | 3,231 | 1,361 | 40 |
|  |  | GFS | 545 | 230 | 7 |
|  |  | FSB | 513 | 216 | 6 |
|  |  | GFL | 497 | 209 | 6 |
|  |  | SKATE | 397 | 167 | 5 |
|  |  | SBM | 364 | 154 | 5 |
|  |  | DOG | 325 | 137 | 4 |
| 6 | OT lg MA | RCRAB | 5,551 | 2,612 | 42 |
|  |  | DOG | 333 | 157 | 3 |
|  |  | FSB | 173 | 81 | 1 |
|  |  | MONK | 164 | 77 | 1 |
|  |  | GFL | 141 | 66 | 1 |
|  |  | SKATE | 107 | 50 | 1 |
| 7 | OT sm NE | DOG | 1,151 | 498 | 14 |
|  |  | SKATE | 531 | 230 | 6 |
|  |  | FSB | 489 | 212 | 6 |
|  |  | GFL | 461 | 199 | 5 |
|  |  | GFS | 451 | 195 | 5 |
|  |  | SBM | 411 | 177 | 5 |
| 8 | OT lg NE | RCRAB | 3,879 | 1,364 | 19 |
|  |  | FSB | 788 | 277 | 4 |
|  |  | MONK | 568 | 200 | 3 |
|  |  | GFS | 280 | 98 | 1 |
|  |  | SKATE | 261 | 92 | 1 |
|  |  | DOG | 229 | 81 | 1 |
|  |  | GFL | 76 | 27 | <1 |
| 11 | SCT OPEN GEN MA | SKATE | 32 | 17 | 5 |
| 17 | OTH Ig NE | DOG | 567 | 69 | 27 |
|  |  | SKATE | 257 | 31 | 12 |
| 19 | SHT NE | GFS | 34 | 33 | 1 |
| 24 | GN xlg MA | SKATE | 83 | 67 | 3 |
|  |  | MONK | 70 | 56 | 2 |
| 26 | GN Ig NE | DOG | 97 | 82 | 1 |
| 27 | GN xlg NE | DOG | 171 | 117 | 4 |
|  |  | MONK | 132 | 90 | 3 |
|  |  | SKATE | 118 | 81 | 2 |
| 32 | SCD AA LIM MA | MONK | 282 | 32 | 12 |
| 33 | SCD AA LIM NE | MONK | 189 | 20 | 12 |
| 34 | SCD OPEN GEN MA | SKATE | 50 | 36 | 1 |
| 36 | SCD OPEN LIM MA | MONK | 312 | 34 | 3 |
|  |  | SKATE | 164 | 18 | 1 |
| 37 | SCD OPEN LIM NE | FSB | 607 | 58 | 4 |
|  |  | DOG | 505 | 49 | 4 |
|  |  | SCAL | 500 | 48 | 4 |
|  |  | MONK | 234 | 23 | 2 |
|  |  | SKATE | 163 | 16 | 1 |
|  |  | GFL | 107 | 10 | 1 |
| 39 | MWT NE | DOG | 571 | 160 | 49 |

Figure 1A. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for each of the 14 species groups (except Atlantic Salmon) for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: BLUEFISH



Total
Discards

## SPECIES: FLUKE - SCUP - BLACK SEA BASS



Total
Discards

Figure 1A continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for each of the 14 species groups (except Atlantic Salmon) for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: HERRING, ATLANTIC



Total
Discards

## SPECIES: LARGE MESH GROUNDFISH



Total
Discards

Figure 1A continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for each of the 14 species groups (except Atlantic Salmon) for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: MONKFISH



Total Discards

## SPECIES: RED CRAB



Total
Discards

Figure 1A continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for each of the 14 species groups (except Atlantic Salmon) for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: SEA SCALLOP



## SPECIES: SKATE COMPLEX



Total
Discards

Figure 1A continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for each of the 14 species groups (except Atlantic Salmon) for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: SMALL MESH GROUNDFISH



Total
Discards

## SPECIES: SPINY DOGFISH



Figure 1A continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for each of the 14 species groups (except Atlantic Salmon) for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: SQUID - BUTTERFISH - MACKEREL



Total
Discards

## SPECIES: SURFCLAM - OCEAN QUAHOG



Total
Discards

Figure 1A continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for each of the 14 species groups (except Atlantic Salmon) for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: TILEFISH



Total
Discards

Figure 1B. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: BLACK SEA BASS



## SPECIES: FLUKE



Total

Discards

Figure 1B, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: SCUP



## SPECIES: AMERICAN PLAICE



Total
Discards

Figure 1B, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: ATLANTIC COD



Total
Discards

## SPECIES: ATLANTIC HALIBUT



Total
Discards

Figure 1B, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: ATLANTIC WOLFFISH



## SPECIES: HADDOCK



Total
Discards

Figure 1B, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: OCEAN POUT



Total
Discards

## SPECIES: POLLOCK



Total
Discards

Figure 1B, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: REDFISH



## SPECIES: WHITE HAKE



Total
Discards

Figure 1B, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: WINDOWPANE FLOUNDER



## SPECIES: WINTER FLOUNDER



Total
Discards

Figure 1B, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: WITCH FLOUNDER



Total
Discards

## SPECIES: YELLOWTAIL FLOUNDER



Figure 1B, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: OFFSHORE HAKE



## SPECIES: RED HAKE



Total
Discards

Figure 1B, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: SILVER HAKE



Total
Discards

## SPECIES: ATLANTIC MACKEREL



Total
Discards

Figure 1B, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: BUTTERFISH



## SPECIES: ILLEX SQUID



Figure 1B, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by fleet (Discards, right pie) for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011. See Appendix Table 3 for fleet abbreviations.

## SPECIES: LOLIGO SQUID



Figure 2. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by FMP and non-FMP species groups (Discards, right pie) for 26 selected fleets for July 2010 through June 2011. See Table 1 for species group abbreviations; FMP species groups that were filtered out through the importance filter have been aggregated and labeled "Other FMP" species groups; nonFMP species have been grouped and labeled "Non-FMP."
Note: Selected fleets include Rows 2, 4-8, 11, 15-17, 19, 22-24, 26-27, 29, and 31-39; these represent fleets where discards were estimated in 2012.

## FLEET: Longline OPEN all NE all (Row 2)



Total
Discards

## FLEET: Hand Line OPEN all NE all (Row 4)



Total
Discards

Figure 2, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by FMP and non-FMP species groups (Discards, right pie) for 26 selected fleets for July 2010 through June 2011. See Table 1 for species group abbreviations; FMP species groups that were filtered out through the importance filter have been aggregated and labeled "Other FMP" species groups; non-FMP species have been grouped and labeled "Non-FMP."
Note: Selected fleets include Rows 2, 4-8, 11, 15-17, 19, 22-24, 26-27, 29, and 31-39; these represent fleets where discards were estimated in 2012.

## FLEET: Otter Trawl OPEN all MA sm (Row 5)



Total
Discards

## FLEET: Otter Trawl OPEN all MA Ig (Row 6)



Figure 2, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by FMP and non-FMP species groups (Discards, right pie) for 26 selected fleets for July 2010 through June 2011. See Table 1 for species group abbreviations; FMP species groups that were filtered out through the importance filter have been aggregated and labeled "Other FMP" species groups; non-FMP species have been grouped and labeled "Non-FMP."
Note: Selected fleets include Rows 2, 4-8, 11, 15-17, 19, 22-24, 26-27, 29, and 31-39; these represent fleets where discards were estimated in 2012.

## FLEET: Otter Trawl OPEN all NE sm (Row 7)



Total
Discards

## FLEET: Otter Trawl OPEN all NE Ig (Row 8)



Total
Discards

Figure 2, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by FMP and non-FMP species groups (Discards, right pie) for 26 selected fleets for July 2010 through June 2011. See Table 1 for species group abbreviations; FMP species groups that were filtered out through the importance filter have been aggregated and labeled "Other FMP" species groups; non-FMP species have been grouped and labeled "Non-FMP."
Note: Selected fleets include Rows 2, 4-8, 11, 15-17, 19, 22-24, 26-27, 29, and 31-39; these represent fleets where discards were estimated in 2012.

# FLEET: Scallop Trawl OPEN GEN MA all (Row 11) 



Total
Discards

FLEET: Otter Trawl, Ruhle OPEN all NE Ig (Row 15)


Total
Discards

Figure 2, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by FMP and non-FMP species groups (Discards, right pie) for 26 selected fleets for July 2010 through June 2011. See Table 1 for species group abbreviations; FMP species groups that were filtered out through the importance filter have been aggregated and labeled "Other FMP" species groups; non-FMP species have been grouped and labeled "Non-FMP." Note: Selected fleets include Rows 2, 4-8, 11, 15-17, 19, 22-24, 26-27, 29, and 31-39; these represent fleets where discards were estimated in 2012.

## FLEET: Otter Trawl, Haddock Separator OPEN all MAIg (Row 16)



Total
Discards

## FLEET: Otter Trawl, Haddock Separator OPEN all NE Ig (Row 17)



Figure 2, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by FMP and non-FMP species groups (Discards, right pie) for 26 selected fleets for July 2010 through June 2011. See Table 1 for species group abbreviations; FMP species groups that were filtered out through the importance filter have been aggregated and labeled "Other FMP" species groups; non-FMP species have been grouped and labeled "Non-FMP." Note: Selected fleets include Rows 2, 4-8, 11, 15-17, 19, 22-24, 26-27, 29, and 31-39; these represent fleets where discards were estimated in 2012.

## FLEET: Shrimp Trawl OPEN all NE all (Row 19)



Total
Discards

## FLEET: Gillnet OPEN all MA sm (Row 22)



Total
Discards

Figure 2, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by FMP and non-FMP species groups (Discards, right pie) for 26 selected fleets for July 2010 through June 2011. See Table 1 for species group abbreviations; FMP species groups that were filtered out through the importance filter have been aggregated and labeled "Other FMP" species groups; non-FMP species have been grouped and labeled "Non-FMP."
Note: Selected fleets include Rows 2, 4-8, 11, 15-17, 19, 22-24, 26-27, 29, and 31-39; these represent fleets where discards were estimated in 2012.

## FLEET: Gillnet OPEN all MA Ig (Row 23)



Total
Discards

## FLEET: Gillnet OPEN all MA xlg (Row 24)



Total
Discards

Figure 2, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by FMP and non-FMP species groups (Discards, right pie) for 26 selected fleets for July 2010 through June 2011. See Table 1 for species group abbreviations; FMP species groups that were filtered out through the importance filter have been aggregated and labeled "Other FMP" species groups; non-FMP species have been grouped and labeled "Non-FMP."
Note: Selected fleets include Rows 2, 4-8, 11, 15-17, 19, 22-24, 26-27, 29, and 31-39; these represent fleets where discards were estimated in 2012.

## FLEET: Gillnet OPEN all NE Ig (Row 26)



Total
Discards

## FLEET: Gillnet OPEN all NE xlg (Row 27)



Total
Discards

Figure 2, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by FMP and non-FMP species groups (Discards, right pie) for 26 selected fleets for July 2010 through June 2011. See Table 1 for species group abbreviations; FMP species groups that were filtered out through the importance filter have been aggregated and labeled "Other FMP" species groups; non-FMP species have been grouped and labeled "Non-FMP." Note: Selected fleets include Rows 2, 4-8, 11, 15-17, 19, 22-24, 26-27, 29, and 31-39; these represent fleets where discards were estimated in 2012.

## FLEET: Purse Seine OPEN all NE all (Row 29)



Total
Discards

## FLEET: Scallop Dredge AA GEN NE all (Row 31)



Total
Discards

Figure 2, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by FMP and non-FMP species groups (Discards, right pie) for 26 selected fleets for July 2010 through June 2011. See Table 1 for species group abbreviations; FMP species groups that were filtered out through the importance filter have been aggregated and labeled "Other FMP" species groups; non-FMP species have been grouped and labeled "Non-FMP." Note: Selected fleets include Rows 2, 4-8, 11, 15-17, 19, 22-24, 26-27, 29, and 31-39; these represent fleets where discards were estimated in 2012.

## FLEET: Scallop Dredge AA LIM MA all (Row 32)



Total
Discards

## FLEET: Scallop Dredge AA LIM NE all (Row 33)



Total
Discards

Figure 2, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by FMP and non-FMP species groups (Discards, right pie) for 26 selected fleets for July 2010 through June 2011. See Table 1 for species group abbreviations; FMP species groups that were filtered out through the importance filter have been aggregated and labeled "Other FMP" species groups; non-FMP species have been grouped and labeled "Non-FMP." Note: Selected fleets include Rows 2, 4-8, 11, 15-17, 19, 22-24, 26-27, 29, and 31-39; these represent fleets where discards were estimated in 2012.

# FLEET: Scallop Dredge OPEN GEN MA all (Row 34) 



Total
Discards

## FLEET: Scallop Dredge OPEN GEN NE all (Row 35)



Total
Discards

Figure 2, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by FMP and non-FMP species groups (Discards, right pie) for 26 selected fleets for July 2010 through June 2011. See Table 1 for species group abbreviations; FMP species groups that were filtered out through the importance filter have been aggregated and labeled "Other FMP" species groups; non-FMP species have been grouped and labeled "Non-FMP." Note: Selected fleets include Rows 2, 4-8, 11, 15-17, 19, 22-24, 26-27, 29, and 31-39; these represent fleets where discards were estimated in 2012.

# FLEET: Scallop Dredge OPEN LIM MA all (Row 36) 



Total
Discards

## FLEET: Scallop Dredge OPEN LIM NE all (Row 37)



Total
Discards

Figure 2, continued. Percentage of Vessel Trip Report landings (kept) and estimated discards (Total, left pie) and the percentage of estimated discards by FMP and non-FMP species groups (Discards, right pie) for 26 selected fleets for July 2010 through June 2011. See Table 1 for species group abbreviations; FMP species groups that were filtered out through the importance filter have been aggregated and labeled "Other FMP" species groups; non-FMP species have been grouped and labeled "Non-FMP."
Note: Selected fleets include Rows 2, 4-8, 11, 15-17, 19, 22-24, 26-27, 29, and 31-39; these represent fleets where discards were estimated in 2012.

## FLEET: Mid-water Trawl OPEN all MA all (Row 38)



FLEET: Mid-water Trawl OPEN all NE all (Row 39)


Figure 3. Results from the $\mathbf{2 0 1 2}$ sample size analysis conducted for $\mathbf{1 6}$ selected fleets. The curves represent the relationship between the coefficient of variance (CV) and the sample size (sea days, trips, and percent of trips) for each of the species groups that were not filtered out. The dash line is the $30 \%$ CV. For species group and fleet abbreviations, see Table 1 and Appendix Table 3, respectively.


Figure 3, continued. Results from the 2012 sample size analysis conducted for 16 selected fleets. The curves represent the relationship between the coefficient of variance (CV) and the sample size (sea days, trips, and percent of trips) for each of the species groups that were not filtered out. The dash line is the $30 \%$ CV. For species group and fleet abbreviations, see Table 1 and Appendix Table 3 , respectively.


Figure 3, continued. Results from the 2012 sample size analysis conducted for 16 selected fleets. The curves represent the relationship between the coefficient of variance (CV) and the sample size (sea days, trips, and percent of trips) for each of the species groups that were not filtered out. The dash line is the $30 \%$ CV. For species group and fleet abbreviations, see Table 1 and Appendix Table 3 , respectively.

SCT OPEN GEN MA (Row 11)



OTH Ig NE (Row 17)


Figure 3, continued. Results from the 2012 sample size analysis conducted for 16 selected fleets. The curves represent the relationship between the coefficient of variance (CV) and the sample size (sea days, trips, and percent of trips) for each of the species groups that were not filtered out. The dash line is the $30 \%$ CV. For species group and fleet abbreviations, see Table 1 and Appendix Table 3 , respectively.


Figure 3, continued. Results from the 2012 sample size analysis conducted for 16 selected fleets. The curves represent the relationship between the coefficient of variance (CV) and the sample size (sea days, trips, and percent of trips) for each of the species groups that were not filtered out. The dash line is the $30 \%$ CV. For species group and fleet abbreviations, see Table 1 and Appendix Table 3 , respectively.

GN Ig NE (Row 26)



GN xlg NE (Row 27)



Figure 3, continued. Results from the 2012 sample size analysis conducted for 16 selected fleets. The curves represent the relationship between the coefficient of variance (CV) and the sample size (sea days, trips, and percent of trips) for each of the species groups that were not filtered out. The dash line is the $30 \%$ CV. For species group and fleet abbreviations, see Table 1 and Appendix Table 3 , respectively.

SCD AA LIM MA (Row 32)



SCD AA LIM NE (Row 33)



Figure 3, continued. Results from the 2012 sample size analysis conducted for 16 selected fleets. The curves represent the relationship between the coefficient of variance (CV) and the sample size (sea days, trips, and percent of trips) for each of the species groups that were not filtered out. The dash line is the $30 \%$ CV. For species group and fleet abbreviations, see Table 1 and Appendix Table 3 , respectively.

SCD OPEN GEN MA (Row 34)


SCD OPEN LIM MA (Row 36)


Figure 3, continued. Results from the 2012 sample size analysis conducted for 16 selected fleets. The curves represent the relationship between the coefficient of variance (CV) and the sample size (sea days, trips, and percent of trips) for each of the species groups that were not filtered out. The dash line is the $30 \% \mathrm{CV}$. For species group and fleet abbreviations, see Table 1 and Appendix Table 3, respectively.



## APPENDIX

Equations used in discard estimation and sample size analysis.
Total discarded pounds for species $j$ is defined as:
(1) $\hat{D}_{j}=\sum_{h=1}^{Q} K_{h} r_{c, j}$
where
(2) $r_{c, j}=\frac{\sum_{h=1}^{Q} N_{h} \sum_{i=1}^{n_{h}} \frac{d_{j i h}}{n_{h}}}{\sum_{h=1}^{Q} N_{h} \sum_{i=1}^{n_{h}} \frac{k_{i h}}{n_{h}}}$

Where $\hat{D}_{j}$ is total discarded pounds for species $j$; $\mathrm{K}_{\mathrm{h}}$ is VTR total kept pounds in stratum $h ; \mathrm{r}_{\mathrm{c}, \mathrm{j}}$ is the combined ratio of species $j$; $\mathrm{d}_{\mathrm{jih}}$ is discards of species $j$ from trip $i$ in stratum $h ; \mathrm{k}_{\mathrm{ih}}$ is kept pounds of all species on trip $i$ in stratum $h ; \mathrm{N}_{\mathrm{h}}$ is the number of VTR trips in stratum $h ; \mathrm{n}_{\mathrm{h}}$ is the number of observed trips in stratum $h$. In Eq. 2 the summation over strata $h=1$ to $Q$ is over calendar quarters and the other strata values are held constant. Equation 3 (below) requires a more explicit definition of the stratum designation since the summation over quarter relies on an annual average ratio defined in Eq. 2.

Variance of $\hat{D}_{j}$ for species $j$ is defined as:
(3) $V\left(\hat{D}_{j}\right)=\sum_{q=1}^{4} K_{q h}^{2}\left(\frac{N_{q h}-n_{q h}}{n_{q h} N_{q h}}\right) \frac{1}{\left(\frac{\sum_{i=1}^{n_{h}} k_{i q h}}{n_{q h}}\right)^{2}}\left[\frac{\sum_{i=1}^{n_{c h}}\left(d_{j i q h}^{2}+\left(r_{c, j}\right)^{2} k_{i q h}^{2}-2 r_{c, j} d_{j i q h} k_{i q h}\right)}{n_{q h}-1}\right]$
where $\hat{D}_{j}$ is total discarded pounds for species $j$; $\mathrm{K}_{\mathrm{qh}}$ is VTR total kept pounds in quarter $q$ and stratum $h ; \mathrm{r}_{\mathrm{c}, \mathrm{j}}$ is the combined ratio of species $j$; $\mathrm{d}_{\mathrm{jiqh}}$ is discards of species $j$ from trip $i$ in quarter $q$ and stratum $h ; \mathrm{k}_{\mathrm{iqh}}$ is kept pounds of all species on trip $i$ in quarter $q$ and stratum $h ; \mathrm{N}_{\mathrm{qh}}$ is the number of VTR trips in quarter $q$ and stratum $h ; \mathrm{n}_{\mathrm{qh}}$ is the number of observed trips in quarter $q$ and stratum $h$.

Coefficient of variation (CV) of $\hat{D}_{j}$ is defined as:
(4) $C V\left(\hat{D}_{j}\right)=\frac{\sqrt{V\left(\hat{D}_{j}\right)}}{\hat{D}_{j}}$

The number of sea days and trips needed to achieve a $30 \%$ CV are derived based on the variance of the total discards using the combined ratio method and the $\mathrm{d} / \mathrm{k}$ discard ratio (Eq. 3).

From Eq. 3, let
(5) $\hat{S}_{j q h}^{2}=\left[\frac{\sum_{i=1}^{n_{\text {gh }}}\left(d_{j i q h}^{2}+\left(r_{c, j h}\right)^{2} k_{i q h}^{2}-2 r_{c, j} d_{j i q h} k_{i q h}\right)}{n_{q h}-1}\right]$ and
(6) $\delta_{q h}=\frac{n_{q h}}{\sum_{q=1}^{4} n_{q h}}$
where $\delta_{\mathrm{qh}}$ is the fraction of the trips in quarter $q$ in stratum $h ; \mathrm{r}_{\mathrm{c}, \mathrm{jh}}$ is the combined annual ratio of species $j$ in stratum $h ; \mathrm{d}_{\mathrm{jiqh}}$ is discards of species $j$ from trip $i$ in stratum $h$ in quarter $q$; $\mathrm{k}_{\mathrm{iqh}}$ is kept pounds of all species on trip $i$ in stratum $h$ in quarter $q$; and $\mathrm{n}_{\mathrm{qh}}$ is the number of observed trips in stratum $h$ in quarter $q$. The $r_{c, j h}$ in Eq. 5 is defined in Eq. 2 where the summation is over quarters within a given strata defined by gear, region, access area, trip type and so forth.

The number of trips necessary to achieve a $30 \%$ CV based on the variance of the composite annual total discards for species group $j$ in stratum $h$ is defined as
(7) $\hat{T} D_{30 j h}=\frac{\sum_{q=1}^{4}\left(\frac{K_{q h}^{2}}{\bar{k}_{q h}^{2}} \hat{S}_{j q h}^{2} \frac{1}{\delta_{q h}}\right)}{(0.09) \hat{D}_{j h}{ }^{2}+\frac{\sum_{q=1}^{4} \frac{K_{q h}^{2}}{\bar{k}_{q h}^{2}} \hat{S}_{j q h}^{2}}{N_{h}}}$
where $0.09=0.30^{2}$, the square of the $30 \% \mathrm{CV}$, the given target precision level.
The number of sea days necessary to achieve a $30 \%$ CV based on the variance of the composite annual total discards for species group $j$ in stratum $h$ is defined as
(8) $\hat{S} D_{30 j h}=\hat{T D} D_{30 j h} * \overline{D A_{h}}$
where $\bar{D}_{h}$ is the weighted average trip length of VTR trips in stratum $h$ (weighted by the number of VTR trips in each quarter).

When total discards could not be estimated due to little or no observer coverage (no data) or when total discards are zero (no variance), sample size was determined by pilot cover, where $2 \%$ of the quarterly VTR trips for a fleet were multiplied by the quarterly mean VTR trip length.
(9) $\hat{S}_{30, j h q}=\hat{T}_{h q} * \overline{D A_{h q}}$
where $\hat{T}_{h q}$ is $2 \%$ of the VTR trips in stratum $h$ and quarter $q$, and $3<=\hat{T}_{h q}<=100$ trips; $\bar{D} \bar{A}_{h q}$ is the average trip length of VTR trips in stratum $h$ and quarter $q$. The quarterly trips and sea days were then summed for annual number of trips and sea days.

The achieved precision resulting from the number of funded sea days can be derived by converting funded sea days into funded trips. The number of funded trips, $\hat{T} F_{h}$ for stratum $h$ is defined as:
(10) $\hat{T} F_{h}=\hat{S} F_{h} / \overline{D A_{h}}$
where $\hat{S} F_{h}$ is the number of funded sea days in stratum $h$ and $\overline{D A}_{h}$ is the weighted average trip length of VTR trips in stratum $h$ (weighted by the number of VTR trips in each quarter).

The achieved coefficient of variation (CV) of $\hat{D}_{j}$ is based on the variance of the composite annual total discards for species group $j$ in stratum $h$ and the number of funded trips in stratum $h$ and re-writing Eq. 7.

From Eq. 7, let
(11)

$$
C V\left(\hat{D}_{j h}\right)=\sqrt{\left.\frac{\sum_{q=1}^{4}\left(\frac{K_{q h}^{2}}{\bar{k}_{q h}^{2}} \hat{S}_{j q h}^{2} \frac{1}{\delta_{q h}}\right)-\hat{T} F_{h}\left[\frac{\sum_{q=1}^{4}\left(\frac{K_{q h}^{2}}{\bar{k}_{q h}^{2}} \hat{S}_{j q h}^{2}\right)}{N_{h}}\right]}{\hat{T} F_{h} * \hat{D}_{j h}{ }^{2}}\right]}
$$

Appendix Table 1. Discard reason categories used in Appendix Tables 2A and 2B.

| Discard Reason <br> Category | FISH <br> DISPOSITION <br> Code | FISH DISPOSITION Description |
| :---: | :---: | :--- |
|  | 001 | NO MARKET, REASON NOT SPECIFIED. |
| No Market | 002 | NO MARKET, TOO SMALL |
|  | 003 | NO MARKET, TOO LARGE |
|  | 005 | NO MARKET, WONT KEEP UNTIL TRIP END. |
|  | 006 | NO MARKET, BUT RETAINED BY VESSEL FOR ALTERNATE PROGRAM. |
|  | 007 | NO MARKET, BUT RETAINED FOR OBSERVER FOR SCIENTIFIC PURPOSES |
|  | 031 | POOR QUALITY, REASON NOT SPECIFIED |
|  | 032 | POOR QUALITY, SANDFLEA DAMAGE |
|  | 033 | POOR QUALITY, SEAL DAMAGE |
|  | 034 | POOR QUALITY, SHARK DAMAGE |
|  | 035 | POOR QUALITY, CETACEAN DAMAGE |
|  | 036 | POOR QUALITY, HAGFISH DAMAGE |
|  | 037 | POOR QUALITY, SHALL DISEASE |
|  | 038 | POOR QUALITY, GEAR DAMAGE |
| Regulation (Size) | 012 | REGULATIONS PROHIBIT RETENTION, TOO SMALL |
|  | 013 | REGULATIONS PROHIBIT RETENTION, TOO LARGE |
|  | 004 | NO MARKET, QUOTA FILLED |
|  | 014 | REGULATIONS PROHIBIT RETENTION, QUOTA FILLED. |
|  | 015 | REGULATIONS PROHIBIT RETENTION, NO QUOTA IN AREA. |
|  | 025 | REGULATIONS PROHIBIT ANY RETENTION. |
|  | 011 | REGULATIONS PROHIBIT RETENTION, REASON NOT SPECIFIED. |
| Regulation (Other) | 022 | REGULATIONS PROHIBIT RETENTION, V-NOTCHED |
|  | 023 | REGULATIONS PROHIBIT RETENTION, SOFT-SHELL |
|  | 024 | REGULATIONS PROHIBIT RETENTION, WITH EGGS. |
|  | 000 | DISCARDED GENERAL, UNKNOWN DISCARD REASON |
|  | 041 | NOT BROUGHT ON BOARD, REASON NOT SPECIFIED |
|  | 042 | NOT BROUGHT ON BOARD, GEAR DAMAGE PREVENTED CAPTURE |
|  | 043 | NOT BROUGHT ON BOARD, FELL OUT/OFF OF GEAR |
|  | 044 | NOT BROUGHT ON BOARD, CONSIDERED TO HAVE NO MARKET VALUE. |
|  | 048 | NOT BROUGHT ON BOARD, VESSEL CAPACITY FILLED |
|  | 049 | NOT BROUGHT ON BOARD, NOT ENOUGH FISH TO PUMP ABOARD |
|  | 052 | INCIDENTAL TAKE (MAMMAL, SEA TURTLE, SEA BIRD) |
|  | 053 | DEBRIS |
|  | 054 | EMPTY SHELLS |
|  | 062 | UPGRADED |
|  | 063 | RETAINING ONLY CERTAIN SIZE BETTER PRICE TRIP QUOTA IN EFFECT. |
|  | 099 | OTHER, DISCARDED |
|  |  |  |

[^87]Appendix Table 2A. Estimated discards (live pounds) and percentage by discard reason category for the 14 species for July 2010 through June 2011. Note: Salmon is not presented due to no discards.

Species Group: BLUEFISH

|  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row Gear Type | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | $\begin{gathered} \text { Regulation } \\ \text { (Size) } \end{gathered}$ | Regulation (Quota) | $\begin{gathered} \text { Regulation } \\ \text { (Other) } \end{gathered}$ | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 32 Other fleets filtered out |  |  |  |  | 375,371 | 44.3 | 0.9 | 17.3 | 21.0 | 5.8 | 10.7 | 100.0 |

Species Group: FLUKE - SCUP - BLACK SEA BASS

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | $\begin{aligned} & \text { Trip } \\ & \text { Category } \end{aligned}$ | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | $\begin{aligned} & \text { Regulation } \\ & \text { (Quota) } \end{aligned}$ | Regulation (Other) | $\begin{gathered} \text { Poor } \\ \text { Quality } \end{gathered}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 1,088,895 | 4.6 | 71.2 | 20.6 | 0.7 | 0.0 | 2.7 | 100.0 |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 1,041,621 | 2.1 | 63.5 | 31.4 | 0.0 | 0.0 | 3.0 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 832,098 | 10.9 | 62.6 | 22.2 | 0.8 | 0.1 | 3.4 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 625,775 | 3.0 | 8.1 | 78.6 | 1.7 | 0.6 | 7.9 | 100.0 |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 838,800 | 74.5 | 0.0 | 24.5 | 0.9 | 0.1 | 0.0 | 100.0 |
| 27 Other fleets filtered out |  |  |  |  |  | 965,046 | 49.0 | 6.9 | 39.5 | 1.0 | 2.6 | 1.2 | 100.0 |

Species Group: HERRING, ATLANTIC


Species Group: LARGE MESH GROUNDFISH

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | Regulation (Quota) | Regulation (Other) (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 824,043 | 31.1 | 3.4 | 64.4 | 1.1 | 0.0 | 0.0 | 100.0 |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 779,536 | 29.1 | 3.1 | 56.4 | 11.4 | 0.0 | 0.0 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 400,400 | 10.7 | 3.2 | 85.9 | 0.1 | 0.0 | 0.0 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 2,214,486 | 6.4 | 62.7 | 29.7 | 0.0 | 0.8 | 0.4 | 100.0 |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 841,986 | 76.5 | 0.6 | 22.8 | 0.1 | 0.0 | 0.0 | 100.0 |
| 27 Other fleets filtered out |  |  |  |  |  | 2,277,083 | 13.7 | 24.3 | 53.5 | 1.2 | 6.2 | 1.1 | 100.0 |

Appendix Table 2A, continued. Estimated discards (live pounds) and percentage by discard reason category for the 14 species groups for July 2010 through June 2011. Note: Salmon is not presented due to no discards.

Species Group: MONKFISH

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | $\begin{gathered} \text { Regulation } \\ \text { (Size) } \end{gathered}$ | $\begin{aligned} & \text { Regulation } \\ & \text { (Quota) } \end{aligned}$ | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 201, 027 | 27.3 | 54.6 | 18.0 | 0.0 | 0.0 | 0.0 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 634,066 | 1.5 | 75.0 | 16.2 | 0.0 | 0.1 | 7.2 | 100.0 |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 1 \mathrm{~g}$ | 199, 762 | 0.4 | 7.0 | 3.1 | 0.0 | 89.5 | 0.0 | 100.0 |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 283,601 | 1.0 | 6.3 | 2.0 | 0.0 | 87.2 | 3.5 | 100.0 |
| 32 | Scallop Dredge | AA | LIM | MA | all | 188,197 | 76.6 | 18.5 | 3.2 | 0.0 | 0.0 | 1.6 | 100.0 |
| 33 | Scallop Dredge | AA | LIM | NE | all | 178,549 | 75.7 | 22.6 | 0.2 | 0.0 | 0.2 | 1.4 | 100.0 |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 1,697,549 | 79.5 | 12.1 | 7.2 | 0.0 | 0.0 | 1.1 | 100.0 |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 1,607,216 | 68.9 | 30.3 | 0.0 | 0.1 | 0.0 | 0.7 | 100.0 |
|  | 24 Other | leets fil | tered out |  |  | 403,389 | 26.6 | 53.3 | 17.0 | 1.8 | 0.5 | 0.7 | 100.0 |

Species Group: RED CRAB

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | Regulation (Quota) | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 335,300 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 222,747 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 318, 214 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 |
| 29 Other fleets filtered out |  |  |  |  |  | 2,586,192 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 |

## Species Group: SEA SCALLOP



Appendix Table 2A, continued. Estimated discards (live pounds) and percentage by discard reason category for the 14 species groups for July 2010 through June 2011. Note: Salmon is not presented due to no discards.

Species Group: SKATE COMPLEX

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | $\begin{gathered} \text { Regulation } \\ \text { (Size) } \end{gathered}$ | Regulation (Ouota) (Quota) | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 4,366,912 | 95.1 | 0.0 | 4.8 | 0.1 | 0.0 | 0.0 | 100.0 |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 11,047,681 | 88.2 | 0.0 | 10.0 | 0.0 | 0.0 | 1.7 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 1,585,782 | 64.9 | 0.0 | 35.0 | 0.0 | 0.0 | 0.0 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 28,539, 292 | 71.0 | 0.1 | 25.7 | 0.0 | 0.0 | 3.1 | 100.0 |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 1,190,509 | 99.8 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 100.0 |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 2,373,349 | 74.5 | 0.1 | 22.8 | 0.0 | 0.0 | 2.6 | 100.0 |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | $\times 19$ | 1,100,411 | 18.1 | 0.1 | 73.6 | 0.0 | 2.9 | 5.4 | 100.0 |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | $\times 19$ | 2,735,262 | 20.3 | 0.4 | 52.4 | 0.1 | 16.1 | 10.6 | 100.0 |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 858,165 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 7,701,133 | 99.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 100.0 |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 11,746, 489 | 99.6 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 100.0 |
| 21 Other fleets filtered out |  |  |  |  |  | 3,252,659 | 94.4 | 0.0 | 5.0 | 0.0 | 0.0 | 0.5 | 100.0 |

Species Group: SMALL MESH GROUNDFISH

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | ```Regulation (Quota)``` | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 1,916,300 | 98.9 | 0.3 | 0.0 | 0.0 | 0.7 | 0.1 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 3,153,636 | 95.4 | 0.3 | 3.4 | 0.0 | 0.9 | 0.0 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 227,432 | 97.8 | 0.9 | 0.9 | 0.0 | 0.2 | 0.1 | 100.0 |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 949,223 | 52.5 | 0.0 | 47.5 | 0.0 | 0.0 | 0.0 | 100.0 |
|  |  | eets fi | tered out |  |  | 1,424,060 | 98.1 | 0.0 | 0.0 | 0.0 | 1.8 | 0.0 | 100.0 |

Appendix Table 2A, continued. Estimated discards (live pounds) and percentage by discard reason category for the 14 species groups for July 2010 through June 2011. Note: Salmon is not presented due to no discards.

Species Group: SPINY DOGFISH

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | $\begin{gathered} \text { Regulation } \\ \text { (Size) } \end{gathered}$ | $\begin{aligned} & \text { Regulation } \\ & \text { (Quota) } \end{aligned}$ | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 4,037,129 | 79.6 | 0.0 | 19.7 | 0.6 | 0.0 | 0.0 | 100.0 |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 4,505,364 | 55.2 | 0.2 | 40.1 | 1.6 | 0.0 | 2.9 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 1,789,471 | 43.7 | 0.0 | 56.1 | 0.2 | 0.0 | 0.0 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 3,467,413 | 60.8 | 0.0 | 38.5 | 0.5 | 0.0 | 0.1 | 100.0 |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 19 | 213,880 | 91.9 | 0.0 | 8.1 | 0.0 | 0.0 | 0.0 | 100.0 |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 2,942,511 | 56.7 | 0.5 | 40.3 | 0.0 | 1.6 | 0.9 | 100.0 |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 233,724 | 45.9 | 0.1 | 46.1 | 0.0 | 7.6 | 0.3 | 100.0 |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 211, 272 | 93.1 | 0.0 | 6.9 | 0.0 | 0.0 | 0.0 | 100.0 |
| 39 | Mid-water paired \& single Trawl | 1 OPEN | all | NE | all | 211,974 | 94.2 | 0.0 | 5.8 | 0.0 | 0.0 | 0.0 | 100.0 |
|  | 23 other fle | eets fil | tered out |  |  | 885,034 | 63.1 | 0.2 | 25.9 | 0.4 | 5.4 | 5.1 | 100.0 |

Species Group: SQUID - BUTTERFISH - MACKEREL

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  | Total \% |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | Regulation (Quota) | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 2,360,495 | 90.2 | 0.4 | 5.0 | 0.0 | 1.2 | 3.2 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 3,403,902 | 76.9 | 0.2 | 9.4 | 0.4 | 2.1 | 11.1 | 100.0 |
| 30 Other fleets filtered out |  |  |  |  |  | 281, 226 | 99.1 | 0.3 | 0.4 | 0.0 | 0.1 | 0.1 | 100.0 |

Species Group: SURFCLAM - OCEAN QUAHOG


Species Group: TILEFISH

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  | Total \% |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | Regulation (Quota) | Regulation (Other) | $\begin{gathered} \text { Poor } \\ \text { Quality } \end{gathered}$ | Other |  |
| 32 Other fleets filtered out |  |  |  |  |  | 10,405 | 58.9 | 9.6 | 7.8 | 0.0 | 23.7 | 0.0 | 100.0 |

Appendix Table 2B. Estimated discards (live pounds) and percentage by discard reason category for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011.

Species Group: BLACK SEA BASS

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  | Total \% |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | $\begin{gathered} \text { Regulation } \\ \text { (Size) } \end{gathered}$ | Regulation (Quota) | Regulation (Other) | $\begin{gathered} \text { Poor } \\ \text { Quality } \end{gathered}$ | Other |  |
| 5 | Otter Trawl | OPEN | all | MA | sm | 145,771 | 1.9 | 56.5 | 35.5 | 0.1 | 0.0 | 6.0 | 100.0 |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 182, 277 | 1.5 | 76.8 | 18.7 | 0.0 | 0.0 | 3.1 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 70,151 | 12.5 | 54.0 | 32.5 | 0.0 | 0.0 | 1.0 | 100.0 |
| 29 Other fleets filtered out |  |  |  |  |  | 33,609 | 70.4 | 0.5 | 28.8 | 0.2 | 0.0 | 0.0 | 100.0 |

Species Group: FLUKE

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Discarded | No Market | $\begin{gathered} \text { Regulation } \\ \text { (Size) } \end{gathered}$ | $\begin{aligned} & \text { Regulation } \\ & \text { (Quota) } \end{aligned}$ | $\begin{gathered} \text { Regulation } \\ \text { (Other) } \end{gathered}$ | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 461,091 | 7.4 | 45.6 | 40.1 | 1.9 | 0.0 | 4.9 | 100.0 |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 613,835 | 1.0 | 64.4 | 30.7 | 0.0 | 0.0 | 3.9 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 120,949 | 15.3 | 20.0 | 55.4 | 4.5 | 0.4 | 4.4 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 574,365 | 2.8 | 5.2 | 81.9 | 1.3 | 0.7 | 8.2 | 100.0 |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 493,483 | 64.5 | 8.7 | 25.4 | 1.1 | 0.0 | 0.2 | 100.0 |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 824,905 | 73.9 | 0.0 | 25.0 | 0.9 | 0.1 | 0.0 | 100.0 |
| 26 Other fleets filtered out |  |  |  |  |  | 449,289 | 29.9 | 5.2 | 56.3 | 0.9 | 5.5 | 2.2 | 100.0 |

Species Group: SCUP

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | Regulation (Quota) | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 482,034 | 3.2 | 96.1 | 0.7 | 0.0 | 0.0 | 0.0 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 640,999 | 9.9 | 72.0 | 14.5 | 0.2 | 0.1 | 3.4 | 100.0 |
| 30 Other fleets filtered out |  |  |  |  |  | 299,477 | 8.6 | 49.4 | 39.7 | 1.2 | 0.0 | 1.1 | 100.0 |

Appendix Table 2B, continued. Estimated discards (live pounds) and percentage by discard reason category for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011.

Species Group: AMERICAN PLAICE

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | $\begin{gathered} \text { Regulation } \\ \text { (Size) } \end{gathered}$ | Regulation (Quota) | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 7 | Otter Trawl | OPEN | all | NE | sm | 75,890 | 1.2 | 4.9 | 93.9 | 0.0 | 0.0 | 0.0 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 357,353 | 0.1 | 98.7 | 0.0 | 0.0 | 1.1 | 0.0 | 100.0 |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 139,598 | 8.5 | 0.0 | 91.5 | 0.0 | 0.0 | 0.0 | 100.0 |
| 29 Other fleets filtered out |  |  |  |  |  | 18,543 | 15.2 | 77.3 | 5.5 | 0.2 | 1.5 | 0.4 | 100.0 |

Species Group: ATLANTIC COD

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | $\begin{gathered} \text { Trip } \\ \text { Category } \end{gathered}$ | Region | $\begin{array}{r} \text { Mesh } \\ \text { Group } \end{array}$ | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | $\begin{gathered} \text { Regulation } \\ \text { (Quota) } \end{gathered}$ | Regulation (Other) (Other) | $\begin{gathered} \text { Poor } \\ \text { Quality } \end{gathered}$ | Other | Total \% |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 322, 226 | 0.0 | 93.5 | 6.0 | 0.0 | 0.4 | 0.1 | 100.0 |
| 31 Other fleets filtered out |  |  |  |  |  | 432,368 | 2.3 | 79.0 | 5.8 | 0.1 | 9.7 | 3.2 | 100.0 |

## Species Group: ATLANTIC HALIBUT

| Row | Gear Type |  |  |  | Access Area | Trip Category | Region | MeshGroup | Discarded | Discard by Reason Category [\%] |  |  |  |  |  | Total \% |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | ```MRgulation``` | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other |  |
| 8 | Otter | Trawl |  |  | OPEN | all | NE | 19 | 30,511 | 0.4 | 90.7 | 7.2 | 0.5 | 0.0 | 1.2 | 100.0 |
| 17 | Otter | Trawl, | Haddock | Separator | OPEN | all | NE | 1 g | 1,736 | 0.0 | 97.9 | 2.1 | 0.0 | 0.0 | 0.0 | 100.0 |
| 26 | Sink, | Anchor, | Drift | Gillnet | OPEN | all | NE | 1 g | 4,281 | 0.9 | 92.2 | 3.7 | 1.1 | 1.4 | 0.8 | 100.0 |
| 27 | Sink, | Anchor, | Drift | Gillnet | OPEN | all | NE | $\times 19$ | 14,382 | 0.0 | 45.7 | 48.0 | 0.5 | 5.8 | 0.0 | 100.0 |
| 28 Other fleets filtered out |  |  |  |  |  |  |  |  | 1,687 | 16.0 | 78.7 | 5.3 | 0.0 | 0.0 | 0.0 | 100.0 |

Species Group: ATLANTIC WOLFFISH

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  | Total \% |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Discarded | No Market | $\begin{gathered} \text { Regulation } \\ \text { (Size) } \end{gathered}$ | $\begin{aligned} & \text { Regulation } \\ & \text { (Quota) } \end{aligned}$ | $\begin{aligned} & \text { Regulation } \\ & \text { (Other) } \end{aligned}$ | $\begin{gathered} \text { Poor } \\ \text { Quality } \end{gathered}$ | Other |  |
| 2 | Longline | OPEN | all | NE | all | 1,773 | 0.0 | 0.0 | 98.5 | 0.0 | 0.0 | 1.5 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 51,913 | 0.7 | 0.0 | 99.3 | 0.0 | 0.0 | 0.0 | 100.0 |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | 19 | 7,235 | 0.5 | 0.0 | 98.5 | 0.0 | 0.3 | 0.7 | 100.0 |
|  | 29 Other | eets fi | tered out |  |  | 3,107 | 2.2 | 0.0 | 97.8 | 0.0 | 0.0 | 0.0 | 100.0 |

Appendix Table 2B, continued. Estimated discards (live pounds) and percentage by discard reason category for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011.

Species Group: HADDOCK

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | $\begin{gathered} \text { Regulation } \\ \text { (Size) } \end{gathered}$ | Regulation (Quota) | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 32 Other fleets filtered out |  |  |  |  |  | 178,602 | 2.7 | 52.7 | 33.5 | 0.0 | 8.9 | 2.2 | 100.0 |

Species Group: OCEAN POUT

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | $\begin{aligned} & \text { Trip } \\ & \text { Category } \end{aligned}$ | Region | $\begin{array}{r} \text { Mesh } \\ \text { Group } \end{array}$ | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | Regulation (Quota) | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 30,880 | 97.1 | 0.0 | 2.9 | 0.0 | 0.0 | 0.0 | 100.0 |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 44,303 | 33.6 | 0.0 | 66.4 | 0.0 | 0.0 | 0.0 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 20,276 | 48.5 | 0.0 | 51.5 | 0.0 | 0.0 | 0.0 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 87,324 | 40.2 | 0.0 | 59.7 | 0.0 | 0.0 | 0.1 | 100.0 |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 8,671 | 41.9 | 0.0 | 58.1 | 0.0 | 0.0 | 0.0 | 100.0 |
| 17 | Otter Trawl, Haddock Separator | r OPEN | all | NE | 19 | 5,106 | 29.9 | 0.0 | 70.1 | 0.0 | 0.0 | 0.0 | 100.0 |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 7,771 | 58.7 | 0.0 | 41.3 | 0.0 | 0.0 | 0.0 | 100.0 |
|  | 25 Other fle | eets fi | tered out |  |  | 19,069 | 14.2 | 0.0 | 85.6 | 0.0 | 0.0 | 0.2 | 100.0 |

Species Group: POLLOCK

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row Gear Type |  | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | Regulation (Quota) | Regulation (Other) | $\begin{gathered} \text { Poor } \\ \text { Quality } \end{gathered}$ | Other | Total \% |
| 32 Other fleets filtered out |  |  |  |  |  | 205,832 | 0.6 | 66.8 | 0.8 | 0.0 | 30.8 | 1.0 | 100.0 |

Species Group: REDFISH

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  | Total \% |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | $\begin{gathered} \text { Trip } \\ \text { category } \end{gathered}$ | Region | $\begin{array}{r} \text { Mesh } \\ \text { Group } \end{array}$ | Discarded | No Market | Regulation (Size) (Size) | Regulation (Quota) | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other |  |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 256,498 | 3.7 | 95.4 | 0.0 | 0.0 | 0.5 | 0.4 | 100.0 |
|  |  | eets fil | ered out |  |  | 75,759 | 30.1 | 48.1 | 21.1 | 0.0 | 0.4 | 0.3 | 100.0 |

Appendix Table 2B, continued. Estimated discards (live pounds) and percentage by discard reason category for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011.

Species Group: WHITE HAKE


Species Group: WINDOWPANE FLOUNDER

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | $\begin{array}{r} \text { Mesh } \\ \text { Group } \end{array}$ | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | Regulation (Quota) | $\begin{aligned} & \text { Regulation } \\ & \text { (Other) } \end{aligned}$ | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 186, 292 | 67.2 | 1.1 | 27.2 | 4.3 | 0.0 | 0.2 | 100.0 |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 469, 307 | 33.1 | 0.0 | 49.8 | 17.1 | 0.0 | 0.0 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 413,193 | 13.3 | 0.2 | 86.2 | 0.0 | 0.0 | 0.3 | 100.0 |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 22,776 | 76.4 | 0.0 | 19.8 | 3.8 | 0.0 | 0.0 | 100.0 |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 35,073 | 65.7 | 0.0 | 33.8 | 0.5 | 0.0 | 0.0 | 100.0 |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 24,210 | 47.1 | 0.0 | 52.9 | 0.0 | 0.0 | 0.0 | 100.0 |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 124,924 | 63.9 | 0.0 | 33.1 | 3.0 | 0.0 | 0.0 | 100.0 |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 279,310 | 83.7 | 0.0 | 16.3 | 0.0 | 0.0 | 0.0 | 100.0 |
| 24 Other fleets filtered out |  |  |  |  |  | 72,620 | 44.0 | 0.0 | 55.8 | 0.1 | 0.0 | 0.0 | 100.0 |

Species Group: WINTER FLOUNDER

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | $\begin{gathered} \text { Trip } \\ \text { Category } \end{gathered}$ | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Discarded | No Market | $\begin{gathered} \text { Regulation } \\ \text { (Size) } \end{gathered}$ | Regulation (Quota) | $\begin{aligned} & \text { Regulation } \\ & \text { (Other) } \end{aligned}$ | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 295,090 | 3.8 | 0.0 | 96.2 | 0.0 | 0.0 | 0.0 | 100.0 |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 184,456 | 14.5 | 0.0 | 80.0 | 5.5 | 0.0 | 0.0 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 149,974 | 1.9 | 0.3 | 97.4 | 0.4 | 0.0 | 0.0 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 199,169 | 0.4 | 13.4 | 83.7 | 0.0 | 1.4 | 1.0 | 100.0 |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 322,797 | 71.8 | 0.2 | 28.0 | 0.0 | 0.0 | 0.0 | 100.0 |
| 27 Other fleets filtered out |  |  |  |  |  | 90,357 | 28.9 | 2.2 | 62.4 | 6.1 | 0.4 | 0.0 | 100.0 |

Appendix Table 2B, continued. Estimated discards (live pounds) and percentage by discard reason category for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011.

Species Group: WITCH FLOUNDER

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | Regulation (Quota) | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 212,145 | 35.3 | 0.2 | 64.4 | 0.0 | 0.0 | 0.0 | 100.0 |
| 6 | Otter Trawl | OPEN | all | MA | 1 g | 30,763 | 94.8 | 0.1 | 5.1 | 0.0 | 0.0 | 0.0 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 23,555 | 20.4 | 18.2 | 61.4 | 0.0 | 0.0 | 0.0 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | $1 g$ | 123,532 | 0.4 | 96.8 | 2.0 | 0.5 | 0.3 | 0.0 | 100.0 |
| 28 Other fleets filtered out |  |  |  |  |  | 837,266 | 2.8 | 0.5 | 96.7 | 0.0 | 0.0 | 0.0 | 100.0 |

Species Group: YELLOWTAIL FLOUNDER

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | Mesh Group | Discarded | No Market | Regulation (Size) | Regulation (Quota) | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 47,559 | 0.1 | 0.4 | 96.2 | 3.3 | 0.0 | 0.0 | 100.0 |
| 6 | Otter Trawl | OPEN | all | MA | 1 g | 36,283 | 0.0 | 16.8 | 83.2 | 0.0 | 0.0 | 0.0 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 55,057 | 12.0 | 5.1 | 82.9 | 0.0 | 0.0 | 0.0 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 227,850 | 0.7 | 93.1 | 4.1 | 0.0 | 1.0 | 1.1 | 100.0 |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 24,188 | 0.2 | 85.7 | 0.1 | 0.0 | 2.5 | 11.4 | 100.0 |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 34,745 | 10.3 | 0.5 | 40.0 | 49.2 | 0.0 | 0.0 | 100.0 |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 61,507 | 80.7 | 0.7 | 18.5 | 0.0 | 0.0 | 0.0 | 100.0 |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 207,760 | 74.6 | 1.5 | 23.7 | 0.2 | 0.0 | 0.0 | 100.0 |
| 24 Other fleets filtered out |  |  |  |  |  | 54,346 | 17.7 | 39.7 | 42.0 | 0.0 | 0.6 | 0.0 | 100.0 |

Species Group: OFFSHORE HAKE

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | $\begin{aligned} & \text { Mesh } \\ & \text { Group } \end{aligned}$ | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | Regulation (Quota) | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 1,062 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 |
| 6 | Otter Trawl | OPEN | all | MA | 19 | 10,013 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 5,979 | 97.7 | 0.0 | 2.3 | 0.0 | 0.0 | 0.0 | 100.0 |
| 8 | Otter Trawl | OPEN | all | NE | 1 g | 2,389 | 97.2 | 0.0 | 0.0 | 0.0 | 2.8 | 0.0 | 100.0 |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 3,925 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 |
| 27 Other fleets filtered out |  |  |  |  |  | 981 | 99.6 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 100.0 |

Appendix Table 2B, continued. Estimated discards (live pounds) and percentage by discard reason category for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011.

Species Group: RED HAKE


Species Group: SILVER HAKE


Species Group: ATLANTIC MACKEREL


Species Group: BUTTERFISH

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | $\begin{aligned} & \text { Trip } \\ & \text { Category } \end{aligned}$ | Region | Mesh Group | Discarded | No Market | $\begin{aligned} & \text { Regulation } \\ & \text { (Size) } \end{aligned}$ | $\begin{aligned} & \text { Regulation } \\ & \text { (Quota) } \end{aligned}$ | $\begin{gathered} \text { Regulation } \\ \text { (Other) } \end{gathered}$ | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 1,012,732 | 83.5 | 1.1 | 12.9 | 0.0 | 2.2 | 0.3 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 1,936,031 | 76.8 | 0.3 | 16.4 | 0.7 | 0.0 | 5.9 | 100.0 |
| 30 Other fleets filtered out |  |  |  |  |  | 55,511 | 98.2 | 1.5 | 0.0 | 0.0 | 0.2 | 0.1 | 100.0 |

Appendix Table 2B, continued. Estimated discards (live pounds) and percentage by discard reason category for the 23 individual species that comprise the 14 species groups for July 2010 through June 2011.

Species Group: ILLEX SQUID

|  |  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | $\begin{array}{r} \text { Mesh } \\ \text { Group } \end{array}$ | Discarded | No Market | $\begin{gathered} \text { Regulation } \\ \text { (Size) } \end{gathered}$ | Regulation (Quota) | Regulation (Other) | $\begin{aligned} & \text { Poor } \\ & \text { Quality } \end{aligned}$ | Other | Total \% |
| 5 | Otter Trawl | OPEN | all | MA | sm | 1,228,034 | 98.0 | 0.0 | 0.0 | 0.0 | 0.3 | 1.6 | 100.0 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 1,090,314 | 72.6 | 0.0 | 0.3 | 0.0 | 3.2 | 23.9 | 100.0 |
| 30 Other fleets filtered out |  |  |  |  |  | 183,477 | 99.5 | 0.0 | 0.5 | 0.0 | 0.0 | 0.0 | 100.0 |

Species Group: LOLIGO SQUID

|  |  |  |  |  |  | Discard by Reason Category [\%] |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row Gear Type | Access Area | $\begin{gathered} \text { Trip } \\ \text { Category } \end{gathered}$ | Region | Mesh Group | Discarded | No Market | $\begin{gathered} \text { Regulation } \\ \text { (Size) } \end{gathered}$ | Regulation (Quota) | Regulation (Other) | $\begin{gathered} \text { Poor } \\ \text { Quality } \end{gathered}$ | Other | Total \% |
| 32 Other fleets filtered out |  |  |  |  | 382, 295 | 84.1 | 0.1 | 0.2 | 0.0 | 3.5 | 12.1 | 100.0 |

Appendix Table 3. Fleet abbreviations used in Table 6 and Figures 1A, 1B, and 3. Fleets that were filtered out through the importance filter and fleets designated as in need of pilot coverage have been aggregated into "Other fleets."

| Row | Gear Type | Access Area | Trip <br> Category | Region | Mesh Group | Fleet Abbreviation |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | LL MA |
| 2 | Longline | OPEN | all | NE | all | LL NE |
| 3 | Hand Line | OPEN | all | MA | all | HND MA |
| 4 | Hand Line | OPEN | all | NE | all | HND NE |
| 5 | Otter Trawl | OPEN | all | MA | sm | OT sm MA |
| 6 | Otter Trawl | OPEN | all | MA | lg | OT $\lg$ MA |
| 7 | Otter Trawl | OPEN | all | NE | sm | OT sm NE |
| 8 | Otter Trawl | OPEN | all | NE | lg | OT lg NE |
| 9 | Scallop Trawl | AA | GEN | MA | all | SCT AA GEN MA |
| 10 | Scallop Trawl | AA | LIM | MA | all | SCT AA LIM MA |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | SCT OPEN GEN MA |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | SCT OPEN LIM MA |
| 13 | Otter Trawl, Ruhle | OPEN | all | MA | lg | OTR $\lg$ MA |
| 14 | Otter Trawl, Ruhle | OPEN | all | NE | sm | OTR sm NE |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | lg | OTR $\lg$ NE |
| 16 | Otter Trawl, Haddock Separator | OPEN | all | MA | lg | OTH $\lg$ MA |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | lg | OTH lg NE |
| 18 | Shrimp Trawl | OPEN | all | MA | all | SHT MA |
| 19 | Shrimp Trawl | OPEN | all | NE | all | SHT NE |
| 20 | Floating Trap | OPEN | all | MA | all | FT MA |
| 21 | Floating Trap | OPEN | all | NE | all | FT NE |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | GN sm MA |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | lg | GN lg MA |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | GN xlg MA |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | GN sm NE |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | lg | GN lg NE |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | GN xlg NE |
| 28 | Purse Seine | OPEN | all | MA | all | PS MA |
| 29 | Purse Seine | OPEN | all | NE | all | PS NE |
| 30 | Scallop Dredge | AA | GEN | MA | all | SCD AA GEN MA |
| 31 | Scallop Dredge | AA | GEN | NE | all | SCD AA GEN NE |
| 32 | Scallop Dredge | AA | LIM | MA | all | SCD AA LIM MA |
| 33 | Scallop Dredge | AA | LIM | NE | all | SCD AA LIM NE |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | SCD OPEN GEN MA |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | SCD OPEN GEN NE |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | SCD OPEN LIM MA |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | SCD OPEN LIM NE |
| 38 | Mid-water Paired \& Single Trawl | OPEN | all | MA | all | MWT MA |
| 39 | Mid-water Paired \& Single Trawl | OPEN | all | NE | all | MWT NE |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | FPT MA |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | FPT NE |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | CPT MA |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | CPT NE |
| 44 | Pots and Traps, Hagfish | OPEN | all | MA | all | HPT MA |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | HPT NE |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | SPT NE |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | LPT MA |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | LPT NE |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | CRPT MA |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | CRPT NE |
| 51 | Beam Trawl | OPEN | all | MA | all | BT MA |
| 52 | Beam Trawl | OPEN | all | NE | all | BT NE |
| 53 | Dredge, Other | OPEN | all | MA | all | DRO MA |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | CD MA |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | CD NE |
|  | Other fleets aggregated together |  |  |  |  | Other Fleets |

# Procedures for Issuing Manuscripts <br> in the <br> Northeast Fisheries Science Center Reference Document (CRD) Series 

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## Publications and Reports of the

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NOAA Technical Memorandum NMFS-NE -- This series is issued irregularly. The series typically includes: data reports of long-term field or lab studies of important species or habitats; synthesis reports for important species or habitats; annual reports of overall assessment or monitoring programs; manuals describing program-wide surveying or experimental techniques; literature surveys of important species or habitat topics; proceedings and collected papers of scientific meetings; and indexed and/or annotated bibliographies. All issues receive internal scientific review and most issues receive technical and copy editing.

Northeast Fisheries Science Center Reference Document -- This series is issued irregularly. The series typically includes: data reports on field and lab studies; progress reports on experiments, monitoring, and assessments; background papers for, collected abstracts of, and/or summary reports of scientific meetings; and simple bibliographies. Issues receive internal scientific review and most issues receive copy editing.

Resource Survey Report (formerly Fishermen's Report) -- This information report is a regularly-issued, quick-turnaround report on the distribution and relative abundance of selected living marine resources as derived from each of the NEFSC's periodic research vessel surveys of the Northeast's continental shelf. This report undergoes internal review, but receives no technical or copy editing.

[^88]Prioritization Process I Ilustrative Examples

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## 2012 Illustrative Examples for SBRM Omnibus Amendment (June 4, 2013 version)

## Background

Illustrative examples of the two prioritization approaches proposed by the Standardized Bycatch Reporting Methodology (SBRM) Fishery Management Action Team (FMAT) are presented. The illustrative examples apply the 2012 Northeast Fisheries Science Center’s (NEFSC) sea day budget to the proposed SBRM and non-SBRM funding classifications. The sea days within the SBRM funding classification are then assigned to fleets ${ }^{1}$ according to two proposed prioritizations approaches: proportional approach and penultimate approach. These illustrative examples were requested by the Councils and it is anticipated that the examples will be included in the SBRM Amendment appendices.

## Number of Sea Day Needed

Sample size analyses were conducted to estimate the numbers of sea days needed to monitor 14 federally managed fish and invertebrate species groups and one species of sea turtles (Table 1). For fish/invertebrate species groups, the numbers of sea days needed to achieve a $30 \%$ coefficient of variation (CV) of total discards of each species groups were estimated for 55 fleets using data collected during June 2010 through July 2011 utilizing estimation methods described by Wigley et al. (2012). A total of 18,641 sea days are needed for the 14 fish and invertebrate species groups (Table 2).

For loggerhead turtles, the numbers of sea days needed to achieve a $30 \%$ CV of turtle discards was estimated by fishery, defined as a managed fish or invertebrate species landed on vessels using bottom otter trawl, sink gillnet, or scallop dredge gear in the Mid-Atlantic region (see Murray 2012). The maximum amount of projected coverage across all the fisheries was considered the desired level of sampling to monitor turtle discards for that gear type. Roughly 4,800 days are needed across bottom trawl fisheries. Roughly 1,400 days are needed across sink gillnet fisheries. Lastly, approximately 1,300 days are needed in the scallop dredge fishery, based on loggerhead bycatch precision levels after chain mats were implemented in the fishery.

[^89]The numbers of sea days needed to achieve a $30 \%$ CV associated with the Mid-Atlantic ${ }^{2}$ turtle gear types and fish/invertebrate fleets are given in Table 3. The numbers of sea days needed for the combined fish/invertebrates and turtle species groups are derived as follows:

- If the sum of the sea days needed for fish/invertebrates species groups of the corresponding fish fleets exceeds the sea days needed for the turtle gear type, then the sea days needed for fish/invertebrate sea day are used.
- If the number of sea days needed for turtles for the gear type exceeds the sum of the sea days needed for fish/invertebrates of the corresponding fish fleets, then the sea days needed for turtles are distributed according to the proportion of sea days needed for fish/invertebrates of the corresponding fish fleets.

A total of 20,590 sea days are needed for fish/invertebrates and loggerhead turtles (COMBINED; Table 4) during the April 2012 through March 2013 period.

## Funding available for the April 2012 to March 2013 period

Based upon the March 13, 2012 NEFSC’s Northeast Fisheries Observer Program (NEFOP) budget, there was agency funding for 8,786 days. Based upon an initial observer set-aside compensation rate analysis, there was industry funding for 3,606 days. There was a total of 12,392 days available for observer coverage.

Below is a summary of the two funding source categories: agency-funded and industry-funded. Within the agency-funded category, there are six sub-categories.

## Agency Funding Source

Based upon the March 13, 2012 budget, the NEFSC has funds for 8,786 sea days. The funding sources for these sea days include: Atlantic Coast Observers (484 days), New England Groundfish (2,448 days), At-Sea Monitoring (ASM, partially funded by National Observer Program [NOP]; 5,255 days), Reducing Bycatch - Observers (49 days), NOP (276 days), and Marine Mammal Protection Act (MMPA; 274 days).
Based upon the proposed SBRM Amendment, four of the six agency-funded sub-categories would be used to fund observer coverage under SBRM and would be used to determine if a shortfall in funds exists. The four sub-categories are: (1) Northeast Groundfish (to be referred to as "NEFOP for SBRM" in the future); (2) Atlantic Coast Observers; (3) National Observer Program; and (4) Reducing Bycatch - Observers. The other two 2012 funding sub-categories (MMPA and ASM) would be allocated to fleets according to other priorities and would not necessarily be allocated according to the SBRM process.

[^90]Using the 2012 budget, there would have been 3,257 ( $484+2448+49+276$ ) days available to the SBRM process; the remaining $5,529(5,255+274)$ days would not be available to the SBRM process (non-SBRM). In 2012, 37\% of the agency-funded sea days would have been applicable to the SBRM process.

While the 5,529 days are not subject to the SBRM allocation process, it is important to note that the 5,255 days associated with ASM would support observed trips that employ a "complete" sampling protocol ${ }^{3}$ and hence these sea days would support the monitoring of all species, including the 15 SBRM species groups. Observed trips that were funded by the 274 MMPA days would have either "limited" or "complete" sampling protocols. All of the MMPA days would support marine mammal and turtle monitoring; however, any trip employing a "limited" sampling protocol would not support the monitoring of the 14 SBRM fish/invertebrate species groups.

## Industry Funding Source

The number of industry-funded sea days available depends upon the total expected budget from the Research Set Aside (RSA) program and the increase in landings allowed for vessels carrying observers (i.e., the compensation rate). Based upon projected landings and expected prices, the RSA program generates funds in support of discard monitoring of the scallop fleets. A compensation rate analysis was undertaken to support observer coverage of the nine industryfunded scallop fleets. The sea days for the nine industry-funded fleets are presented in Rows 9, $10,12,30,31,32,33,36$, and 37 (Table 4).

Based upon the initial compensation rate analysis, a total of 3,606 sea days were funded: 1,713 days for Open areas, 240 days for Delmarva Access Area (DMV), 720 days for Hudson Canyon Access Area (HC), 240 days for Closed Area I (CAI), 453 days for Closed Area II (CAII), and 240 days in the Nantucket Lightship Access Area (NLAA).

- The industry-funded schedule runs March 1 through February, a 12-month period that is shifted one month from the NEFOP sea day schedule of April to March.
- A description of the set-aside compensation rate calculations is available on-line at: http://www.nero.noaa.gov/nero/regs/infodocs/FY12ObsCompRateCalculationSum.pdf

Limited Access General Category (LAGC) open area fleets were not industry-funded fleets (Rows 11, 34, and 35; Table 4) in 2012.

[^91]While the 3,606 industry-funded days are not subject to the SBRM prioritization process, it is important to note that the observed trips funded by these sea days would employ the "complete" sampling protocol and hence these sea days would support the monitoring of the 15 SBRM species groups.

## SBRM Prioritization Trigger

Over all fleets, a funding shortfall of 8,198 days ( $20,590-12,392$ ) would have been expected. Within the agency-funded fleets, a funding shortfall of 9,515 days $(18,301-8,786)$ would have been expected. Within the agency-funded fleets and SBRM-applicable funding, a funding shortfall of 15,044 days ( $18,301-3,257$; Table 4 ) would have been expected. This shortfall would have triggered the SBRM prioritization process.

In 2012, SBRM-applicable funding (3,257 days) exceeded the number of sea days needed to obtain the minimum pilot coverage across all agency-funded fleets (1,225 days; Table 4), hence either one of the prioritization alternatives could have been employed.

The following describes the steps taken to determine whether or not the SBRM prioritization trigger would have been met (Table 4). Steps 1 - 10 are independent of the prioritization approach.

Step 1. Derive minimum pilot coverage (MPC) for each fleet. Minimum pilot coverage is the minimum number of sea days needed to monitor the fleet and is calculated as three trips multiplied by the Vessel Trip Report (VTR) mean trip length in a calendar quarter, summed over all quarters with VTR activity. Three trips per quarter is the minimum sample size identified in Evaluating Bycatch: A National Approach to Standardized Bycatch Monitoring Programs (NMFS 2004; Table 6, page 77)

A total of 2,008 days is needed of minimum pilot coverage across all fleets (Table 4).
Step 2. Derive the number of sea days needed for the 14 fish species groups (see Wigley et al. 2012).

Step 3. Derive the number of sea days needed for sea turtles (see Murray 2012).
Step 4. To support the proposed prioritization approaches, derive the number of sea days needed for loggerhead turtles for each of the fish fleets associated with the turtle gear type group.
a. Derive the percentage of days for each fish fleet within a turtle gear type group. For each fleet associated with a turtle gear type, divide the sea days needed for fish by the sum of the sea days needed for the gear type group.
b. Derive the number of sea days needed for loggerhead turtles by fish fleet. Multiply the number of turtle sea days needed for the gear type by the percentage of days needed for each fish fleet.

Step 5. Derive the number of sea days needed for fish and turtles COMBINED; select the largest of the two sea days (i.e., sea days needed for the 14 fish species groups and sea days needed for loggerhead turtles) within the fleet.

A total of 20,590 days were needed to achieve a $30 \%$ CV on the discards of the 15 species groups in 2012 (Table 4).

Step 6. Partition fleets into funding source categories and sum the number of sea days needed, by funding source for: (a) minimum pilot sea days needed, and (b) COMBINED sea days needed.

In 2012, there were nine industry-funded fleets (see NEFSC and NERO 2012).
There were 1,225 days and 783 days needed for minimum pilot coverage for agencyfunded and industry-funded fleets, respectively (Table 4).

There were 18,301 days and 2,289 days needed to achieve a $30 \%$ CV for the 15 species groups for agency-funded and industry-funded fleets, respectively (Table 4).

Step 7. Obtain funded sea days, by funding source category. For agency-funded sea days, calculate the number of sea days applicable to the SBRM process (SBRM versus nonSBRM).

There are 3,257 agency-funded days applicable to the SBRM process. There are 5,529 agency-funded days that are not applicable to the SBRM process (non-SBRM) and 3,606 industry-funded days.

Step 8. Evaluate needed sea days versus funded sea days for each funding category and calculate shortfall or surplus sea days associated with the SBRM process.

If the SBRM prioritization trigger was not reached (no shortfall for SBRM) - STOP ${ }^{4}$ Assign sea days to fleets according to Step 4.

If SBRM prioritization trigger was reached (shortfall exists), then determine if SBRMapplicable funded sea days exceed the sea days needed for minimum pilot coverage.

If YES, apply the prioritization approach when SBRM-applicable funded sea days are greater than minimum pilot coverage days.

If NO, apply the prioritization approach when SBRM-applicable funded sea days are less than minimum pilot coverage days.

[^92]Note: if the SBRM-applicable funded sea days equal minimum pilot coverage days then assign funded sea days according to the minimum pilot coverage days (Step 1).

For SBRM-applicable funds, there was a shortfall of 15,044 days. There were sufficient agency-funded days to support the use of prioritization approaches since funded sea days exceed the sea days needed for minimum pilot coverage ( $3,257>1,225$ ). The two proposed prioritization approaches are described in the following next two sections.

For complete accounting of all sea days in 2012, the illustrative examples include the sea days that would have been subjected to SBRM prioritizations, as well as the other funded sea days that would not have been subject to the SBRM prioritization but would have supported bycatch monitoring of the 15 SBRM species groups (sea days with "complete" sampling protocols). The allocation of the non-SBRM sea days and the industry-funded sea days are independent of the SBRM prioritization alternative and are tracked separately in the illustrative examples; these are described below.

Step 9. Allocation of agency-funded non-SBRM sea days: ASM and MMPA days.
The 5,255 ASM sea days would have been assigned to trips via the Pre-Trip Notification System (PTNS). This means that the observer coverage within each of these fleets would depend upon industry activity during the April 2012 through March 2013 period. The 5,255 ASM sea days have been proportionally allocated based on the previous year's industry activity, and thus the allocation would have been considered provisional (Tables 5 and 6).

The 274 MMPA sea days, all assumed to have limited sampling protocols, would have been allocated to a row designated as "MMPA coverage" (Tables 5 and 6).

There would have been a total of 5,529 non-SBRM sea days (5,255 + 274).
Step 10. The sea days for the nine industry-funded fleets would have been assigned via the callin system. Similar to the non-SBRM sea days, the sea day coverage for industry-funded fleets would depend on industry activity during the April 2012 through March 2013 period and would be capped as described above. These 3,606 industry-funded sea days have not been allocated to individual fish fleets, but rather to groups of fish fleets that correspond to the stratification used in compensation rate analysis: Mid-Atlantic access area fleets (Rows 9, 10, 30, and 32; Tables 5 and 6); Open areas fleets (Rows 12, 36, and 37; Tables 5 and 6); and New England access area fleets (Rows 31 and 33; Tables 5 and 6 ). The allocated sea days represent the maximum coverage (i.e., caps).

Step 11. The sea days allocated for the April 2012 - March 2013 (TOTAL) is the sum of the SBRM prioritized days, non-SBRM days, and industry-funded days, a total of 12,392 days (3,257 + 5,529 + 3,606).

## Prioritization Alternatives when SBRM-applicable funded sea days are greater than MPC days

If SBRM prioritization trigger was reached (shortfall exists) and SBRM-applicable funded sea days are greater than the sea days needed for minimum pilot coverage, then prioritization among fleets are needed.

## Proportional Approach

As described in the draft SBRM Amendment, the number of agency-funded sea days applicable to the SBRM prioritization was assigned to each fleet (fishing mode) based on the shortfall ratio (funded days/ needed days) after the number of sea days needed for minimum pilot coverage had been removed.

The following describes the steps taken to assign the agency-funded sea days applicable to the SBRM prioritization process using the proportional approach applied to the 2012 budget (Table 5). Steps P1 to P4 are associated with prioritization approaches and should not be confused with Steps 1 to 11.

Step P1. Derive the "COMBINED MPC Adjusted" days for each agency-funded fleet by subtracting the "Min. Pilot Coverage" days (Step 1) from the "COMBINED" days (Step 5).

Step P2. Derive the "Proportional Shortfall". Over all agency-funded fleets, subtract the sum of the "Min. Pilot Coverage" days (Step 1) from the sum of the SBRM prioritized "COMBINED" days (Step 5) and divide by the sum of the "COMBINED MPC Adjusted" (Step P1).

There were 3,257 agency-funded days available for SBRM prioritization. Of these, 1,225 days would have been assigned to all fleets to meet the minimum pilot days. The remaining 2,032 days ( $3,257-1,225$ ) would have been available to proportionally allocate among the agencyfunded fleets (Table 5). The sum of the COMBINED MPC Adjusted sea days would have been 17,076. The proportional shortfall would have been 0.12 (2,032 / 17,076).

Step P3. Derive the "COMBINED MPC Adjusted Rescaled" days for each agency-funded fleet by multiplying the "COMBINED MPC Adjusted" days (Step P1) by the "Proportional Shortfall" (Step P2).

Step P4. Derive the "SBRM PRIORITIZED" days for each agency-funded fleet by adding the "Min Pilot Coverage" days (Step 1) to the "COMBINED MPC Adjusted Rescaled" days (Step P3).

The SBRM prioritized sea days would have then been added to the non-SBRM days (Step 9) and the industry-funded days (Step 10) to obtain the sea days allocated for April 2102 - March 2013 (TOTAL; Step 11).

Using the proportional prioritization approach, the 3,257 SBRM prioritized sea days would have provided observer coverage to all 55 fleets (Table 5). There would have been 22 fleets with no reduction in the number of sea days needed - the fleets that would have needed only minimum
pilot coverage. There would have been 24 fleets with a reduction in the sea days needed. There would have been 28 species groups and fleets combinations for which the expected CV would be greater than $30 \%$. While the decrease in total sea days occurs proportionally across fleets, the resulting increase in CV at the cell (species groups/fleets) level would have varied within and across fleets.

## Penultimate Approach

As described in the draft SBRM Amendment, the number of agency-funded sea days applicable to the SBRM prioritization was assigned to each fleet (fishing mode) after sequentially removing the sea days needed for the species group/fleet with the highest sea day difference between adjacent species groups within a fleet until the sea day shortfall is removed.

The following describes the steps taken to assign the agency-funded sea days applicable to the SBRM prioritization process using the penultimate approach applied to the 2012 budget (Table 6). Steps P1 to P4 are associated with prioritization approaches and should not be confused with Steps 1 to 11 .

Step P1. For each agency-funded fleet, list the sea days needed for the SBRM species groups (fish/invertebrates Table 2; loggerhead turtle Table 4) in descending order within a fleet. Use the minimum pilot days as the minimum sea days needed for the fleet.

Step P2. Calculate the differences in sea days between adjacent species groups within each agency-funded fleet.

Step P3. Within the resulting matrix of differences (Step P2), identify the largest difference and remove the sea days associated with the species group accounting for this difference.

Repeat this process for the next largest difference, with the constraint that the differences are taken in penultimate order (from left to right in the matrix) within a fleet, until the cumulative reduction of sea days equals the sea day shortfall (Step 8). If the reduction in sea days using the next largest (penultimate) value is greater than the shortfall, reduce the number of sea days only enough to remove the shortfall.

The 2012 sea day shortfall would have been 15,044 days. The 3,879 sea days (RCRAB in Row 8) associated with the largest sea day difference $(3,091)$ between adjacent species groups would have been removed first (Table 6). Given the penultimate fleet constraint (i.e., cannot remove the sea days of a species group unless all species groups with greater numbers of sea days have been removed within the fleet), the 5,551 sea days (RCRAB in Row 6) associated with the next largest sea day difference $(2,599)$ between adjacent species groups would have been removed next. The 2,952 sea days (TURS in Row 6) associated with the next largest sea days difference $(2,619)$, given the penultimate fleet constraint, would have been removed next, etc. In 2012, the 97 sea days associated with the last species group that would have been removed (DOG in Row 26) would have removed more sea days than would have been needed to reach the shortfall amount of 15,044 day (Table 6). Thus, only 23 of the 83 sea day difference between adjacent species groups (or in this case between species group and minimum pilot coverage) would have
been used (Table 6). The prioritized sea days for this fleet (Row 26) would have been 74 (9723).

Step P4. After the removal of sea days within a fleet (Step P3), the remaining highest sea days (i.e., the penultimate or the left-hand-most value in Step P1) would have become the "SBRM PRIORITIZED" sea days required for that fleet.

The SBRM prioritized sea days would have then been added to the non-SBRM days (Step 9) and the industry-funded days (Step 10) to obtain the sea days allocated for April 2102 - March 2013 (TOTAL; Step 11).

Using the penultimate prioritization approach, the 3,257 SBRM prioritized sea days would have provided observer coverage to all 55 fleets. There would have been 44 fleets with no reduction in sea days required. There would have been 17 cells (species group and fleet combinations) where the number of sea days assigned would have been less than the sea days needed to achieve a $30 \%$ CV. These 17 cells occurred in 11 fleets (Rows 5, 6, 7, 8, 17, 22, 23, 24, 26, 39, and 48; Table 6).

## Changes in Precision Resulting from Prioritization Approaches (when SBRM-applicable funded sea days are greater than MPC days)

The relationships between the coefficient of variation and the sample size are given in Figures 1 and 2 for fish/invertebrates and loggerhead turtles, respectively. The sea days (sample size) corresponding to those prioritized to the fleet via the two prioritization approaches are given and the difference in expected CV can be determined for each species group.

For the penultimate approach, the expected precision of the discard estimates of the 17 cells would be greater than $30 \%$ CV and vary by species group and fleet. The penultimate approach adjusts the CV upward on the fewest number of cells (species groups/fleets). The proportional approach adjusts the CV upward for all species groups in the fleet for all agency-funded fleets that require more than minimum pilot coverage. Hence, for all fleets for which prioritized sea days are less than the number of sea days needed, the expected precision for some species group may exceed a $30 \%$ CV. However, it does not necessarily mean that the expected precision for all species will exceed $30 \%$. For example, in the MA extra large mesh gillnet fleet (Row 24), the prioritized days yield an expected CV that is less than $30 \%$ for skates and monkfish (Figure 1) but not for loggerhead turtles (Figure 2). The MA extra large gillnet fleet (Row 24) is associated with the loggerhead turtle MA gillnet gear type and the loggerhead turtle species group is the species group with the largest number of sea days needed. This situation may occur for any of the fish fleets associated with the turtle gear types when the sea days needed for the fish fleets are "driven" by sea turtles.

It is important to note that other funding sources (agency-funded non-SBRM prioritized days such as ASM or MMPA and industry-funded days) support the monitoring of the 15 SBRM species groups. When the days from other funding sources are added to the fleet, the precision will increase (the CV decrease) and more species groups will achieve a $30 \%$ CV or less. For example, NE large mesh otter trawl (Row 8) would have either 280 or 489 days allocated via the
penultimate or proportional approaches, respectively; however, with the additional 1,981 ASM days, all fish species groups would be expected to achieve a $30 \%$ CV. Another example would occur in the Mid-Atlantic scallop dredge turtle gear group; three of the four fish fleets that comprise the turtle gear group are industry-funded fleets (Figure 2 refers to, but does not include, industry-funded days).

## Prioritization Alternatives when SBRM-applicable funded sea days are less than MPC days

If the SBRM prioritization trigger was reached (shortfall exists) and SBRM-applicable funded sea days are less than the sea days needed for minimum pilot coverage, then prioritization among fleets are needed. These alternatives remove sea day coverage completely from some fleets.

While there was a shortfall in SBRM-applicable funded sea days in 2012 budget, there was not a shortfall with regard in minimum pilot coverage day ( $3,257>1,225$ ). Hence, the following two examples have used a hypothetical number of 1,000 agency-funded sea days applicable to the SBRM process.

## Option 1: Penultimate MPC Approach

As described in the draft SBRM Amendment, the number of agency-funded sea days applicable to the SBRM prioritization process was assigned to each fleet (fishing mode) by sequentially eliminating coverage in fleets that have the highest minimum pilot coverage days until the shortfall in MPC days is removed.

The following describes the steps taken to assign the agency-funded sea days applicable to the SBRM prioritization process using the penultimate MPC (option 1) approach applied to the 2012 budget (Table 7). Steps P1 to P4 are associated with the prioritization approach and should not be confused with Steps 1 to 11 .

Step P1. Derive the minimum pilot coverage shortfall. Subtract the SBRM-applicable funded sea days (Step 6b) from the sum of minimum pilot coverage sea days for agencyfunded fleets (Step 6a).

Using the hypothetical example of 1,000 SBRM-applicable days, there would have been a minimum pilot coverage shortfall of 225 days (1,000-1,225).

Step P2. Within the agency-funded fleets, rank the minimum pilot days (Step 1) in descending order.

Step P3. Using the ranking in Step P2, identify the fleet and the minimum pilot days with highest number of minimum pilot coverage days (rank = 1). Repeat this process for the next highest number of minimum pilot coverage days until the cumulative reduction in sea days is equal to, or than greater, the MPC shortfall.

Step P4. Derive the "SBRM PRIORITIZED Option 1" by using the MPC days (Step 1) and removing the sea days for the fleets identified in Step P3.

In this example, 294 days were removed from three fleets. The 294 days exceeds the number of days needed to reduce the MPC shortfall by 69 days (294-225). The 69 "remaining" days would be proportionally allocated among the fleets that have sea days assigned. In this example, there are 52 fleets with MPC days assigned. Note: the 69 days distributed proportionally among the fleets is not shown in Table 7).

## Option 2: Penultimate MPC Ratio Approach

As described in the draft SBRM Amendment, the number of agency-funded sea days applicable to the SBRM prioritization process was assigned to each fleet (fishing mode) by sequentially eliminating coverage in fleets that had the highest ratio of minimum pilot coverage days to actual days absent from port reported in the Vessel Trip Report in the previous year until the shortfall in MPC days is removed.

The following describes the steps taken to assign the agency-funded sea days applicable to the SBRM prioritization process using the penultimate MPC ratio (option 2) approach applied to the 2012 budget (Table 8). Steps P1 to P6 are associated with the prioritization approach and should not be confused with Steps 1 to 11 .

Step P1. Derive the minimum pilot coverage shortfall. Subtract the SBRM-applicable days (Step 6b) from the sum of minimum pilot coverage for agency-funded fleets (Step 6a).

Using the hypothetical example of 1,000 SBRM-applicable days, there would have been a minimum pilot coverage shortfall of 225 days (1,000-1,225).

Step P2. For each fleet, derived the number of days absent from port in the VTR using the previous year's data (see Wigley et al. 2012, Table 3).

Step P3. Derive the ratio of MPC days to VTR days. For each agency-funded fleet, divide the minimum pilot coverage days (Step 1) by the VTR days absent (Step P2).

Step P4. Rank the ratio (MPC/VTR) derived in Step P3 in descending order.
Step P5. Using the ranking in Step P4, identify the fleet and the minimum pilot days with highest ratio (rank $=1$ ). Repeat this process for the next highest ratio until the cumulative reduction in sea days is equal to, or than greater, the MPC shortfall.

Fleets with low ratios indicate fleets with high numbers of days absent from port. Note: the MPC/VTR ratio can be greater than 1 for fleets with very low numbers of trips. Because the sea day allocations are for coverage in the upcoming year, it is assumed that a minimum of three trips would occur in each quarter of the year for which there was industry activity in the previous year. Table 2 in Wigley et al. 2012 reveals that there are some fleet and quarter combinations where industry activity occurred but less than three trips.

Step P6. Derive the "SBRM PRIORITIZED Option 2" by using the MPC days (Step 1) and removing the sea days for the fleets identified in Step P5.

In this example, 238 days were removed from eight fleets. The 238 days exceeds the number of days needed to reduce the MPC shortfall by 13 days ( $238-225$ ). The 13 "remaining" days would be proportionally allocated among the fleets that have sea days assigned. In this example, there are 47 fleets with MPC days assigned. Note: the 13 days distributed proportionally among the fleets is not shown in Table 8).

## Changes in Coverage and Precision Resulting from Prioritization Approaches (when SBRM-applicable funded sea days are less than MPC days)

Both of these Options remove coverage from fleets. Option 1 would eliminate coverage in fleets with longest average trip length. For example a fleet that required 60 days for minimum pilot coverage would be eliminated before a fleet requiring 15 days of coverage. Option 1 would impact the fewest fleets. Option 2 would eliminate coverage from fleets with low numbers of days absent. The expected precision for species groups in fleets with the minimum pilot days would vary among fleets and species groups and would be exceed a $30 \%$ CV for all fleets that require more sea days than minimum pilot coverage days. Figures 1 and 2 may be used to determine the expected precision of species groups in fleets with prioritized sea days derived from these two prioritization approaches.

## References Cited

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Northeast Fisheries Science Center (NEFSC) and Northeast Regional Office (NERO). 2012. Proposed 2012 observer sea day allocation, March 23, 2012. Internal document presented to the Northeast Regional Coordinating Committee. 11 p. Available on-line at: http://www.nefsc.noaa.gov/femad/fsb/SBRM/2012/Proposed_2012_Observer_Sea_Day_ Allocation_3-23-2012_v3.pdf

Wigley SE, Blaylock J, Rago PJ, Shield G. 2012. 2012 discard estimation, precision, and sample size analyses for 14 federally managed species in the northeast region. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 12-17; 147 p. Available online:
http://www.nefsc.noaa.gov/publications/crd/crd1217

Table 1. List of the 14 fish and invertebrate species groups and one species of sea turtles (in bold), with species group abbreviations in parentheses, and the species comprising these groups, corresponding to the 13 federal fishery management plans in the Northeast region.

| ATLANTIC SALMON (SAL) |
| :--- |
| BLUEFISH (BLUE) |
| FLUKE - SCUP - BLACK SEA BASS (FSB) |
| Black Sea Bass |
| Fluke |
| Scup |
| HERRING, ATLANTIC (HERR) |
| LARGE MESH GROUNDFISH (GFL) |
| American Plaice |
| Atlantic Cod |
| Atlantic Halibut |
| Atlantic Wolffish |
| Haddock |
| Ocean Pout |
| Pollock |
| Redfish |
| White Hake |
| Windowpane Flounder |
| Winter Flounder |
| Witch Flounder |
| Yellowtail Flounder |
| MONKFISH (MONK) |
| RED CRAB (RCRAB) |
| SEA SCALLOP (SCAL) |
| SKATE COMPLEX (SKATE) |
| Barndoor Skate |
| Clearnose Skate |
| Little Skate |
| Rosette Skate |
| Smooth Skate |
| Thorny Skate |
| Winter Skate |
| SMALL MESH GROUNDFISH (GFS) |
| Offshore Hake |
| Red Hake |
| Silver Hake |
| SPINY DOGFISH (DOG) |
| SQUID - BUTTERFISH - MACKEREL (SBM) |
| Atlantic Mackerel |
| Butterfish |
| Illex Squid |
| Loligo Squid |
| SURFCLAM - OCEAN QUAHOG (SCOQ) |
| Surfclam |
| Ocean Quahog |
| TILEFISH (TILE) |
| LOGGERHEAD TURTLE (TURS) |

Table 2. The number of sea days needed to achieve a $30 \%$ CV based on the variance of the discard estimate for each the fish/invertebrate species groups, the number of pilot sea days, minimum pilot sea days, and 2012 sea days (the maximum number of sea days needed for each fleet) based on July 2010 through June 2011 data. Red font indicates basis for fleet sea days; species group and fleet abbreviations are given in Table 1 and Appendix Table 1 respectively. [This is modified version of Wigley et al 2012 Table 5 - this version includes minimum pilot sea days]

| Row | Gear Type | Access Area | Trip Category | Region | Mesh | BLUE | HERR | SAL | RCRAB | SCAL | SBM | MONK | GFL | GFS | SKATE | DOG | FSB | SCOQ | TLLE | $\begin{aligned} & \text { Pilot } \\ & \text { d } \end{aligned}$ | $\begin{aligned} & \text { Min } \\ & \text { Pilot } \\ & \text { days } \end{aligned}$ | 2012 <br> Sea Days Needed <br> for FISH |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Longline | OPEN | all | MA | all | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 |
| 2 | Longline | OPEN | all | NE | all | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 6 | 16 |
| 3 | Hand Line | OPEN | all | MA | all | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 13 | 81 |
| 4 | Hand Line | OPEN | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 | 16 | 16 |
| 5 | Otter Trawl | OPEN | all | MA | sm | 0 | 0 | 0 | 3,231 | 0 | 364 | 0 | 497 | 545 | 397 | 325 | 513 | 0 | 0 | 160 | 30 | 3,231 |
| 6 | Otter Trawl | OPEN | all | MA | 1 g | 0 | 0 | 0 | 5,551 | 0 | 0 | 164 | 141 | 0 | 107 | 333 | 173 | 0 | 0 | 266 | 27 | 5,551 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 0 | 0 | 0 | 0 | 0 | 411 | 0 | 461 | 451 | 531 | 1,151 | 489 | 0 | 0 | 168 | 29 | 1,151 |
| 8 | Otter Trawl | OPEN | all | NE | 19 | 0 | 0 | 0 | 3,879 | 0 | 0 | 568 | 76 | 280 | 261 | 229 | 788 | 0 | 0 | 415 | 35 | 3,879 |
| 9 | Scallop Trawl | AA | GEN | MA | all | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| 10 | Scallop Trawl | AA | LIM | MA | all | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 25 | 22 | 32 |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 | 163 |
| $13+$ | Otter Traw, Ruhle | OPEN | all | MA | 1 g | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| $14+$ | Otter Traw, Ruhle | OPEN | all | NE | sm | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | 1 g | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 59 | 59 | 59 |
| 16 + | Otter Trawl, Haddock Separator | OPEN | all | MA | 1 g | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 8 | 8 |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | 1 g | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 257 | 567 | 0 | 0 | 0 | 100 | 100 | 567 |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 131 | 120 | 131 |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 65 | 13 | 34 |
| 20 | Floating Trap | OPEN | all | MA | all | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 21 | Floating Trap | OPEN | all | NE | all | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 22 | Sink, Anchor, Dritt Gillnet | OPEN | all | MA | sm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 13 | 13 |
| 23 | Sink, Anchor, Dritt Gillnet | OPEN | all | MA | 1 g | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 13 | 13 |
| 24 | Sink, Anchor, Dritt Gillnet | OPEN | all | MA | xlg | 0 | 0 | 0 | 0 | 0 | 0 | 70 | 0 | 0 | 83 | 0 | 0 | 0 | 0 | 61 | 5 | 83 |
| 25 | Sink, Anchor, Dritt Gillnet | OPEN | all | NE | sm | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 |
| 26 | Sink, Anchor, Dritt Gillnet | OPEN | all | NE | Ig | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 97 | 0 | 0 | 0 | 134 |  | 97 |
| 27 | Sink, Anchor, Dritt Gillnet | OPEN | all | NE | xlg | 0 | 0 | 0 | 0 | 0 | 0 | 132 | 0 | 0 | 118 | 171 | 0 | 0 | 0 | 94 | 19 | 171 |
| 28 | Purse Seine | OPEN | all | MA | all | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 29 | Purse Seine | OPEN | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 23 | 23 |
| 30 | Scallop Dredge | AA | GEN | MA | all | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 |
| 31 | Scallop Dredge | AA | GEN | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 14 | 14 |
| 32 | Scallop Dredge | AA | LIM | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 282 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 102 | 102 | 282 |
| 33 | Scallop Dredge | AA | LIM | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 189 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 121 | 121 | 189 |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 95 | 17 | 50 |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 87 | 17 | 17 |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 312 | 0 | 0 | 164 | 0 | 0 | 0 | 0 | 238 | 109 | 312 |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 0 | 0 | 0 | 0 | 500 | 0 | 234 | 107 | 0 | 163 | 505 | 607 | 0 | 0 | 277 | 124 | 607 |
| 38 | Mid-water Paired \& Single Trawl | OPEN | all | MA | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 17 | 17 |
| 39 | Mid-water Paired \& Single Trawl | OPEN | all | NE | all | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 571 | 0 | 0 | 0 | 43 | 43 | 571 |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 13 | 25 |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 9 | 15 |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 12 | 27 |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 18 | 26 |
| 44 | Pots and Traps, Hagish | OPEN | all | MA | all | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 45 | Pots and Traps, Hagish | OPEN | all | NE | all | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 6 | 6 | 6 | - 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 47 | Pots and Traps, Lobster | OPEN | all | MA | all | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 16 | 65 |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 429 | 17 | 429 |
| 49 | Pots and Traps, Crab | OPEN | all | MA | all | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 |
| 51 | Beam Trawl | OPEN | all | MA | all | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 |
| 52 | Beam Trawl | OPEN | all | NE | all | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| 53 | Dredge, Other | OPEN | all | MA | all | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 24 | 67 |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 | 16 | 38 |
|  |  |  |  |  |  | 1,638 | 1,638 | 1,638 | 14,299 | 2,138 | 2,413 | 3,589 | 2,920 | 2,948 | 3,801 | 5,587 | 4,208 | 1,638 | 1,638 | 4,379 | 2,008 | 18,641 |

Table 3. The numbers of sea days needed to achieve a $30 \%$ CV associated with the Mid-Atlantic turtle gear types and fish/invertebrate fleets. [Loggerhead turtle days taken from Murray 2012]

| Turtle Gear Types and Fish Fleets | Sea Days Needed |  |
| :--- | :---: | :---: |
|  | Loggerhead Turtles | Fish/Invertebrates <br> Species Groups |
| MA Otter Trawl and Scallop Trawl <br> Rows 5, 6, 9, 10, 11, and 12 | 4,838 | 9,096 |
| MA Gillnet <br> Rows 22, 23, and 24 | 1,440 | 109 |
| MA Scallop Dredge <br> Rows 30, 32, 34, and 36 | 1,293 | 675 |

Table 4. The number of sea days used in the determination of the SBRM trigger (Steps 1 through 8) using the 2012 budget.


Table 5. Sea day allocation using the proportional prioritization approach for the SBRM-applicable sea days in the 2012 budget.

|  |  |  |  |  |  | Step 1 | Step 5 | Step P1 | Step P3 | Step P4 | Step 9 | Step 10 | Step 11 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Row | Gear Type | Access Area | Trip Category | Region | Mesh | 2012 <br> Sea Days <br> for Min Pilot <br> Coverage <br> (MPC) | 2012 <br> Sea Days Needed COMBINED | 2012 <br> Sea Days <br> Needed <br> COMBINED <br> MPC Adjusted | 2012 <br> Sea Days <br> Needed <br> COMBINED <br> MPC Adjusted <br> Rescaled | 2012 Sea Days SBRM PRIORITIZED (Proportional) | $2012$ <br> Sea Days non-SBRM (Catch share, MMPA, Discovery) | $\begin{array}{\|c\|} \hline 2012 \\ \text { Industry- } \\ \text { funded } \\ \text { Sea Days } \\ \hline \end{array}$ | Sea Days <br> Allocated for <br> April 2012 - <br> March 2013 <br> (TOTAL) |
| 1 | Longline | OPEN | all | MA | all | 67 | 67 | 0 | 0 | 67 |  |  | 67 |
| 2 | Longline | OPEN | all | NE | all | 16 | 16 | 0 | 0 | 16 | 106 |  | 122 |
| 3 | Hand Line | OPEN | all | MA | all | 13 | 81 | 68 | 8 | 21 |  |  | 21 |
| 4 | Hand Line | OPEN | all | NE | all | 16 | 16 | 0 | 0 | 16 | 280 |  | 296 |
| 5 | Otter Trawl | OPEN | all | MA | sm | 30 | 3,231 | 3,201 | 381 | 411 |  |  | 411 |
| 6 | Otter Trawl | OPEN | all | MA | lg | 27 | 5,551 | 5,524 | 657 | 684 | 1,271 |  | 1,955 |
| 7 | Otter Trawl | OPEN | all | NE | sm | 29 | 1,151 | 1,122 | 134 | 163 |  |  | 163 |
| 8 | Otter Trawl | OPEN | all | NE | lg | 35 | 3,879 | 3,844 | 457 | 492 | 1,981 |  | 2,473 |
| 9 | Scallop Trawl | AA | GEN | MA | all | 21 | 21 |  |  |  |  |  |  |
| 10 | Scallop Trawl | AA | LIM | MA | all | 98 | 98 |  |  |  |  |  |  |
| 11 | Scallop Trawl | OPEN | GEN | MA | all | 22 | 32 | 10 | 1 | 23 |  |  | 23 |
| 12 | Scallop Trawl | OPEN | LIM | MA | all | 163 | 163 |  |  |  |  |  |  |
| $13+$ | Otter Trawl, Ruhle | OPEN | all | MA | lg | 9 | 9 | 0 | 0 | 9 |  |  | 9 |
| 14 + | Otter Trawl, Ruhle | OPEN | all | NE | sm | 27 | 27 | 0 | 0 | 27 |  |  | 27 |
| 15 | Otter Trawl, Ruhle | OPEN | all | NE | lg | 59 | 59 | 0 | 0 | 59 | 37 |  | 96 |
| $16+$ | Otter Trawl, Haddock Separator | OPEN | all | MA | lg | 8 | 8 | 0 | 0 | 8 | 0 |  | 8 |
| 17 | Otter Trawl, Haddock Separator | OPEN | all | NE | lg | 100 | 567 | 467 | 56 | 156 | 203 |  | 359 |
| 18 | Shrimp Trawl | OPEN | all | MA | all | 120 | 131 | 11 | 1 | 121 |  |  | 121 |
| 19 | Shrimp Trawl | OPEN | all | NE | all | 13 | 34 | 21 | 2 | 15 |  |  | 15 |
| 20 | Floating Trap | OPEN | all | MA | all | 6 | 6 | 0 | 0 | 6 |  |  | 6 |
| 21 | Floating Trap | OPEN | all | NE | all | 6 | 6 | 0 | 0 | 6 |  |  | 6 |
| 22 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | sm | 13 | 172 | 159 | 19 | 32 |  |  | 32 |
| 23 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | Ig | 13 | 172 | 159 | 19 | 32 |  |  | 32 |
| 24 | Sink, Anchor, Drift Gillnet | OPEN | all | MA | xlg | 15 | 1,096 | 1,081 | 129 | 144 | 287 |  | 431 |
| 25 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | sm | 41 | 41 | 0 | 0 | 41 |  |  | 41 |
| 26 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | lg | 14 | 97 | 83 | 10 | 24 | 640 |  | 664 |
| 27 | Sink, Anchor, Drift Gillnet | OPEN | all | NE | xlg | 19 | 171 | 152 | 18 | 37 | 450 |  | 487 |
| 28 | Purse Seine | OPEN | all | MA | all | 15 | 15 | 0 | 0 | 15 |  |  | 15 |
| 29 | Purse Seine | OPEN | all | NE | all | 23 | 23 | 0 | 0 | 23 |  |  | 23 |
| 30 | Scallop Dredge | AA | GEN | MA | all | 31 | 59 |  |  |  |  |  |  |
| 31 | Scallop Dredge | AA | GEN | NE | all | 14 | 14 |  |  |  |  |  |  |
| 32 | Scallop Dredge | AA | LIM | MA | all | 102 | 540 |  |  |  |  | 1,200 | 1,200 |
| 33 | Scallop Dredge | AA | LIM | NE | all | 121 | 189 |  |  |  |  | 693 | 693 |
| 34 | Scallop Dredge | OPEN | GEN | MA | all | 17 | 96 | 79 | 9 | 26 |  |  | 26 |
| 35 | Scallop Dredge | OPEN | GEN | NE | all | 17 | 17 | 0 | 0 | 17 |  |  | 17 |
| 36 | Scallop Dredge | OPEN | LIM | MA | all | 109 | 598 |  |  |  |  | 1,713 | 1,713 |
| 37 | Scallop Dredge | OPEN | LIM | NE | all | 124 | 607 |  |  |  |  |  | 0 |
| 38 | Mid-water Paired \& Single Trawl | OPEN | all |  | all | 17 | 17 | 0 | 0 | 17 |  |  | 17 |
| 39 | Mid-water Paired \& Single Trawl | OPEN | all | NE | all | 43 | 571 | 528 | 63 | 106 |  |  | 106 |
| 40 | Pots and Traps, Fish | OPEN | all | MA | all | 13 | 25 | 12 | 1 | 14 |  |  | 14 |
| 41 | Pots and Traps, Fish | OPEN | all | NE | all | 9 | 15 | 6 | 1 | 10 |  |  | 10 |
| 42 | Pots and Traps, Conch | OPEN | all | MA | all | 12 | 27 | 15 | 2 | 14 |  |  | 14 |
| 43 | Pots and Traps, Conch | OPEN | all | NE | all | 18 | 26 | 8 | 1 | 19 |  |  | 19 |
| 44 | Pots and Traps, Hagish | OPEN | all | MA | all | 3 | 3 | 0 | 0 | 3 |  |  | 3 |
| 45 | Pots and Traps, Hagfish | OPEN | all | NE | all | 74 | 74 | 0 | 0 | 74 |  |  | 74 |
| 46 | Pots and Traps, Shrimp | OPEN | all | NE | all | 6 | 6 | 0 | 0 | 6 |  |  | 6 |
| 47 | Pots and Traps, Lobster | OPEN | all |  | all | 16 | 65 | 49 | 6 | 22 |  |  | 22 |
| 48 | Pots and Traps, Lobster | OPEN | all | NE | all | 17 | 429 | 412 | 49 | 66 |  |  | 66 |
| 49 | Pots and Traps, Crab | OPEN | all |  | all | 12 | 12 | 0 | 0 | 12 |  |  | 12 |
| 50 | Pots and Traps, Crab | OPEN | all | NE | all | 67 | 67 | 0 | 0 | 67 |  |  | 67 |
| 51 | Beam Trawl | OPEN | all | MA | all | 31 | 31 | 0 | 0 | 31 |  |  | 31 |
| 52 | Beam Trawl | OPEN | all | NE | all | 16 | 16 | 0 | 0 | 16 |  |  | 16 |
| 53 | Dredge, Other | OPEN | all | MA | all | 41 | 41 | 0 | 0 | 41 |  |  | 41 |
| 54 | Ocean Quahog/Surf Clam Dredge | OPEN | all | MA | all | 24 | 67 | 43 | 5 | 29 |  |  | 29 |
| 55 | Ocean Quahog/Surf Clam Dredge | OPEN | all | NE | all | 16 | 38 | 22 | 3 | 19 |  |  | 19 |
|  | MMPA coverage |  |  |  |  |  |  |  |  |  | 274 |  | 274 |
|  |  |  |  |  | Total | 2,008 | 20,590 | 17,076 | 2,032 | 3,257 | 5,529 | 3,606 | 12,392 |
|  | Step 6a | Agency Industry | $\begin{aligned} & \text { Fleets (M } \\ & \text { Fleets (M } \end{aligned}$ | $\begin{aligned} & \text { Bilot Seal } \\ & \text { Bilot Sea } \end{aligned}$ | Days Needed) Days Needed) | $\begin{gathered} 1,225 \\ 783 \\ \hline \end{gathered}$ |  |  |  |  |  |  |  |
|  | Step 6b |  | Agency Industry | $\begin{aligned} & \text { ets (Sea } \\ & \text { ets (Sea } \end{aligned}$ | Days Needed) Days Needed) |  | $\begin{gathered} \hline 18,301 \\ 2,289 \\ \hline \end{gathered}$ |  |  |  |  |  |  |
|  | Step 7 |  | Agency Agency | ets (Sea ets (Sea | Days Funded) Days Funded) |  | $\begin{aligned} & \hline 3,257 \\ & 5,529 \end{aligned}$ | 2,032 |  |  |  |  |  |
|  |  |  | Industry | ets (Sea | Days Funded) |  | 3,606 |  |  | Step P2 |  |  |  |
|  |  |  |  | Agency F | eet Difference |  | -15,044 |  | Agency pro | portion shortfall | 0.12 |  |  |
|  | Step 8 |  |  | ndustry F | eet Difference |  | 1,317 |  |  |  |  |  |  |
|  |  | Is SBRM prioriciz | ritization ne | ed? Are | here sufficient | funds to apply | YES |  |  |  |  |  |  |
|  |  |  | Turtle | ear Types | MA OT |  | 9,096 |  |  | 1,118 |  |  |  |
|  |  |  |  |  | MA GN |  | 1,440 |  |  | 208 |  |  |  |
|  |  |  |  |  | MA SD |  | 1,293 |  |  | 26 |  |  |  |
|  | KEY: AF = Agency funded fleets | IF = Industry fu | funded fleet |  |  |  |  |  |  |  |  |  |  |
|  | Steps independent of SBRM prioritiz | zation approach |  |  |  |  |  |  |  |  |  |  |  |
|  | Prioritization Steps | Fleets with red | duction in | days |  |  |  |  |  |  |  |  |  |

Table 6. Sea day allocation using the penultimate prioritization approach for the SBRM-applicable sea days in the 2012 budget.


Table 7. Sea day allocation using the penultimate MPC prioritization (Option 1) approach for 1,000 SBRMapplicable sea days in the 2012 budget.


| Total |  |  | 2,008 | 18,641 |  | 20,590 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Step 6a | Agency Fleets (Min Pilot Sea Days Needed) Industry Fleets (Min Pilot Sea Days Needed) |  | 1,225 <br> 88 |  |  |  |
| Step 6b | Agency Fleets (Sea Days Needed) Industry Fleets (Sea Days Needed) |  |  |  |  | 18,301 |
|  |  |  |  |  |  | 2,289 |
| Step 7 | Agency Fleets (Sea D | Funded) |  | SBRM prioritized non-SBRM prioritized |  | 1,000 |
|  | Agency Fleets (Sea Days Funded) Industry Fleets (Sea Days Funded) |  |  |  |  | 5,529 |
|  |  |  |  |  |  | 3,606 |
| Step 8 | Agency Fleet Difference |  |  | SHORTFALLSURPLUS |  | -17,301 |
|  | Industry Fleet Difference |  |  |  |  | 1,317 |
|  | Is SBRM prioritization needed? Are there sufficient funds to apply the priori YES |  |  |  |  | NO |
|  | Turtle Gear Types | MA OT |  | 9,096 | 4,838 | 9,096 |
|  |  | MA GN |  | 109 | 1,440 | 1,440 |
|  |  | MA SD |  | 675 | 1,293 | 1,293 |


| KEY: AF $=$ Agency funded fleets | IF $=$ Industry funded fleets |
| :--- | :--- |
| Steps independent of SBRM prioritization approach |  |


| Prioritization Steps | Fleets with reduction in sea days |
| :--- | :--- | :--- |

SBRM-applicable days < MPC Days OPTION 1


| Step P4 | Step 9 | Step 10 | Step 11 |
| :---: | :---: | :---: | :---: |
| 2012 Sea Days SBRM PRIORITIZED (SBRM < MPC Option 1) | 2012 <br> Sea Days non-SBRM (Catch share, MMPA, Discovery) |  | Sea Days <br> Allocated for <br> April 2012 - <br> March 2013 <br> (TOTAL) |
| 67 |  |  | 67 |
| 16 | 106 |  | 122 |
| 13 |  |  | 13 |
| 16 | 280 |  | 296 |
| 30 |  |  | 30 |
| 27 | 1,271 |  | 1,298 |
| 29 |  |  | 29 |
| 35 | 1,981 |  | 2,016 |
|  |  |  |  |
|  |  |  |  |
| 22 |  |  | 22 |
|  |  |  |  |
| 9 |  |  | 9 |
| 27 |  |  | 27 |
| 59 | 37 |  | 96 |
| 8 |  |  | 8 |
| 0 | 203 |  | 203 |
| 0 |  |  | 0 |
| 13 |  |  | 13 |
| 6 |  |  | 6 |
| 6 |  |  | 6 |
| 13 |  |  | 13 |
| 13 |  |  | 13 |
| 15 | 287 |  | 302 |
| 41 |  |  | 41 |
| 14 | 640 |  | 654 |
| 19 | 450 |  | 469 |
| 15 |  |  | 15 |
| 23 |  |  | 23 |
|  |  |  |  |
|  |  |  |  |
|  |  | 1,200 | 1,200 |
|  |  | 693 | 693 |
| 17 |  |  | 17 |
| 17 |  |  | 17 |
|  |  | 1,713 | 1,713 |
|  |  |  |  |
| 17 |  |  | 17 |
| 43 |  |  | 43 |
| 13 |  |  | 13 |
| 9 |  |  | 9 |
| 12 |  |  | 12 |
| 18 |  |  | 18 |
| 3 |  |  | 3 |
| 0 |  |  | 0 |
| 6 |  |  | 6 |
| 16 |  |  | 16 |
| 17 |  |  | 17 |
| 12 |  |  | 12 |
| 67 |  |  | 67 |
| 31 |  |  | 31 |
| 16 |  |  | 16 |
| 41 |  |  | 41 |
| 24 |  |  | 24 |
| 16 |  |  | 16 |
|  | 274 |  | 274 |
| 69 |  |  | 69 |
| 1,000 | 5,529 | 3,606 | 10,135 |


| Step P1 |
| :---: |
| 225 |

MPC Shortfall

Table 8. Sea day allocation using the penultimate MPC Ratio prioritization (Option 2) approach for 1,000 SBRM-applicable sea days in the 2012 budget.



$\frac{\text { Steps independent of SBRM priontization approach }}{\text { Priotitization Steps }}$

$\frac{\text { Step P1 }}{225}$ MPC Shortaal


Figure 1. Results from the 2012 sample size analysis conducted by Wigley et al. (2012). The curves represent the relationship between the coefficient of variation (CV) and the sample size (in terms of sea days, trips, and percentage of trips) for each of the fish/invertebrate species groups that were not filtered out by the importance filter, for agency-funded fleets where discards could be estimated. To illustrate the difference in expected CV, two sample sizes are indicated by the colored lines: the green solid line indicates the number of sea days allocated via the proportional approach, and the blue dashed line indicates the number of sea days allocated via the penultimate approach. See Figure 2 for loggerhead turtle graphs. [This figure is a modified version of Figure 3 in Wigley et al. 2012.]


Figure 1, continued. Results from the 2012 sample size analysis conducted by Wigley et al. (2012). The curves represent the relationship between the coefficient of variation (CV) and the sample size (in terms of sea days, trips, and percentage of trips) for each of the fish/invertebrate species groups that were not filtered out by the importance filter, for agency-funded fleets where discards could be estimated. To illustrate the difference in expected CV, two sample sizes are indicated by the colored lines: the green solid line indicates the number of sea days allocated via the proportional approach, and the blue dashed line indicates the number of sea days allocated via the penultimate approach. See Figure 2 for loggerhead turtle graphs. [This figure is a modified version of Figure 3 in Wigley et al. 2012.]

OTH Ig NE (Row 17)


SHT NE (Row 19)


Figure 1, continued. Results from the 2012 sample size analysis conducted by Wigley et al. (2012). The curves represent the relationship between the coefficient of variation (CV) and the sample size (in terms of sea days, trips, and percentage of trips) for each of the fish/invertebrate species groups that were not filtered out by the importance filter, for agency-funded fleets where discards could be estimated. To illustrate the difference in expected CV, two sample sizes are indicated by the colored lines: the green solid line indicates the number of sea days allocated via the proportional approach, and the blue dashed line indicates the number of sea days allocated via the penultimate approach. See Figure 2 for loggerhead turtle graphs. [This figure is a modified version of Figure 3 in Wigley et al. 2012.]

GN xlg MA (Row 24)


GN Ig NE (Row 26)


Figure 1, continued. Results from the 2012 sample size analysis conducted by Wigley et al. (2012). The curves represent the relationship between the coefficient of variation (CV) and the sample size (in terms of sea days, trips, and percentage of trips) for each of the fish/invertebrate species groups that were not filtered out by the importance filter, for agency-funded fleets where discards could be estimated. To illustrate the difference in expected CV, two sample sizes are indicated by the colored lines: the green solid line indicates the number of sea days allocated via the proportional approach, and the blue dashed line indicates the number of sea days allocated via the penultimate approach. See Figure 2 for loggerhead turtle graphs. [This figure is a modified version of Figure 3 in Wigley et al. 2012.]


Figure 1, continued. Results from the 2012 sample size analysis conducted by Wigley et al. (2012). The curves represent the relationship between the coefficient of variation (CV) and the sample size (in terms of sea days, trips, and percentage of trips) for each of the fish/invertebrate species groups that were not filtered out by the importance filter, for agency-funded fleets where discards could be estimated. To illustrate the difference in expected CV, two sample sizes are indicated by the colored lines: the green solid line indicates the number of sea days allocated via the proportional approach, and the blue dashed line indicates the number of sea days allocated via the penultimate approach. See Figure 2 for loggerhead turtle graphs. [This figure is a modified version of Figure 3 in Wigley et al. 2012.]


Figure 2. Estimated sea days needed to monitor loggerhead turtle interactions in the Mid-Atlantic in a) otter trawl gear catching NE multispecies; b) sink gillnet gear catching spot; and c) dredge gear catching scallops. These fisheries are the "drivers" for all monitoring in each respective gear type. Reference lines are indicated at the 30\% precision goal. To illustrate the difference in expected CV, two sample sizes are indicated by the colored lines: the green solid line indicates the number of sea days allocated via the proportional approach, and the blue dashed line indicates the number of sea days allocated via the penultimate approach. [This figure is a modified version of Figure 1 in Murray. 2012.]

Appendix Table 1. Fleet abbreviations used in the tables of this report.

| Abbreviation | Definition |
| :--- | :--- |
| MA | Mid-Atlantic ports (CT and southward) |
| NE | New England ports (RI and northward) |
| sm | Small mesh (less than 5.5 inches) |
| lg | Large mesh (5.5 to 7.99 inches) |
| xlg | Extra large mesh (8 inches and greater) |
| LIM | Limited access category |
| GEN | General category |
| OPEN | Non-access area |
| AA | Access area |

## Appendix I <br> Draft Proposed Regulations

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## PART 648--FISHERIES OF THE NORTHEASTERN UNITED STATES

1. The authority citation for part 648 continues to read as follows:

Authority: 16 U.S.C. 1801 et seq.
2. In § 648.11, add paragraph (g)(5)(iii), and revise paragraphs (h) and (i) to read as follows:
§ 648.11 At-sea sea sampler/observer coverage.
*****
(g) ***
(5) $* * *$
(iii) Owners of scallop vessels shall pay observer service providers for observer services within 45 days of the end of a fishing trip on which an observer deployed.
*****
(h) Observer service provider approval and responsibilities - (1) General. An entity seeking to provide observer services must apply for and obtain approval from NMFS following submission of a complete application. A list of approved observer service providers shall be distributed to vessel owners and shall be posted on the NMFS/NEFOP website at: www.nefsc.noaa.gov/femad/fsb/.
(2) [Reserved]
(3) Contents of application. An application to become an approved observer service provider shall contain the following:
(i) Identification of the management, organizational structure, and ownership structure of the applicant's business, including identification by name and general function of all controlling management interests in the company, including but not limited to owners, board members, officers, authorized agents, and staff. If the applicant is a corporation, the articles of incorporation must be provided. If the applicant is a partnership, the partnership agreement must be provided.
(ii) The permanent mailing address, phone and fax numbers where the owner(s) can be contacted for official correspondence, and the current physical location, business mailing address, business telephone and fax numbers, and business email address for each office.
(iii) A statement, signed under penalty of perjury, from each owner or owners, board members, and officers, if a corporation, that they are free from a conflict of interest as described under paragraph (h)(6) of this section.
(iv) A statement, signed under penalty of perjury, from each owner or owners, board members, and officers, if a corporation, describing any criminal conviction(s), Federal contract(s) they have had and the performance rating they received on the contracts, and previous decertification action(s) while working as an observer or observer service provider.
(v) A description of any prior experience the applicant may have in placing individuals in remote field and/or marine work environments. This includes, but is not limited to, recruiting, hiring, deployment, and personnel administration.
(vi) A description of the applicant's ability to carry out the responsibilities and duties of a fishery observer services provider as set out under paragraph (h)(5) of this section, and the arrangements to be used.
(vii) Evidence of holding adequate insurance to cover injury, liability, and accidental death for observers during their period of employment (including during training). Workers' Compensation and Maritime Employer's Liability insurance must be provided to cover the
observer, vessel owner, and observer provider. The minimum coverage required is $\$ 5$ million. Observer service providers shall provide copies of the insurance policies to observers to display to the vessel owner, operator, or vessel manager, when requested.
(viii) Proof that its observers, whether contracted or employed by the service provider, are compensated with salaries that meet or exceed the U.S. Department of Labor (DOL) guidelines for observers. Observers shall be compensated as Fair Labor Standards Act (FLSA) non-exempt employees. Observer providers shall provide any other benefits and personnel services in accordance with the terms of each observer's contract or employment status.
(ix) The names of its fully equipped, NMFS/NEFOP certified, observers on staff or a list of its training candidates (with resumes) and a request for an appropriate NMFS/NEFOP Observer Training class. The NEFOP training has a minimum class size of eight individuals, which may be split among multiple vendors requesting training. Requests for training classes with fewer than eight individuals will be delayed until further requests make up the full training class size.
(x) An Emergency Action Plan (EAP) describing its response to an "at sea" emergency with an observer, including, but not limited to, personal injury, death, harassment, or intimidation.
(4) Application evaluation. (i) NMFS shall review and evaluate each application submitted under paragraph (h)(3) of this section. Issuance of approval as an observer provider shall be based on completeness of the application, and a determination by NMFS of the applicant's ability to perform the duties and responsibilities of a fishery observer service provider, as demonstrated in the application information. A decision to approve or deny an application shall be made by NMFS within 15 business days of receipt of the application by NMFS.
(ii) If NMFS approves the application, the observer service provider's name will be added to the list of approved observer service providers found on the NMFS/NEFOP website specified in paragraph (h)(1) of this section, and in any outreach information to the industry. Approved observer service providers shall be notified in writing and provided with any information pertinent to its participation in the fishery observer program.
(iii) An application shall be denied if NMFS determines that the information provided in the application is not complete or the evaluation criteria are not met. NMFS shall notify the applicant in writing of any deficiencies in the application or information submitted in support of the application. An applicant who receives a denial of his or her application may present additional information to rectify the deficiencies specified in the written denial, provided such information is submitted to NMFS within 30 days of the applicant's receipt of the denial notification from NMFS. In the absence of additional information, and after 30 days from an applicant's receipt of a denial, an observer provider is required to resubmit an application containing all of the information required under the application process specified in paragraph (h)(3) of this section to be re-considered for being added to the list of approved observer service providers.
(5) Responsibilities of observer service providers. (i) An observer service provider must provide observers certified by NMFS/NEFOP pursuant to paragraph (i) of this section for deployment in a fishery when contacted and contracted by the owner, operator, or vessel manager of a fishing vessel, unless the observer service provider refuses to deploy an observer on a requesting vessel for any of the reasons specified at paragraph (h)(5)(viii) of this section.
(ii) An observer service provider must provide to each of its observers:
(A) All necessary transportation, including arrangements and logistics, of observers to the initial location of deployment, to all subsequent vessel assignments, and to any debriefing locations, if necessary;
(B) Lodging, per diem, and any other services necessary for observers assigned to a fishing vessel or to attend an appropriate NMFS/NEFOP observer training class;
(C) The required observer equipment, in accordance with equipment requirements listed on the NMFS/NEFOP website specified in paragraph (h)(1) of this section, prior to any deployment and/or prior to NMFS observer certification training; and
(D) Individually assigned communication equipment, in working order, such as a mobile phone, for all necessary communication. An observer service provider may alternatively compensate observers for the use of the observer's personal mobile phone, or other device, for communications made in support of, or necessary for, the observer's duties.
(iii) Observer deployment logistics. Each approved observer service provider must assign an available certified observer to a vessel upon request. Each approved observer service provider must be accessible 24 hours per day, 7 days per week, to enable an owner, operator, or manager of a vessel to secure observer coverage when requested. The telephone system must be monitored a minimum of four times daily to ensure rapid response to industry requests. Observer service providers approved under paragraph (h) of this section are required to report observer deployments to NMFS daily for the purpose of determining whether the predetermined coverage levels are being achieved in the appropriate fishery.
(iv) Observer deployment limitations. (A) A candidate observer's first four deployments and the resulting data shall be immediately edited and approved after each trip by NMFS/NEFOP prior to any further deployments by that observer. If data quality is considered acceptable, the observer would be certified.
(B) Unless alternative arrangements are approved by NMFS, an observer provider must not deploy any observer on the same vessel for more than two consecutive multi-day trips, and not more than twice in any given month for multi-day deployments.
(v) Communications with observers. An observer service provider must have an employee responsible for observer activities on call 24 hours a day to handle emergencies involving observers or problems concerning observer logistics, whenever observers are at sea, stationed shoreside, in transit, or in port awaiting vessel assignment.
(vi) Observer training requirements. The following information must be submitted to NMFS/NEFOP at least 7 days prior to the beginning of the proposed training class: A list of observer candidates; observer candidate resumes; and a statement signed by the candidate, under penalty of perjury, that discloses the candidate's criminal convictions, if any. All observer trainees must complete a basic cardiopulmonary resuscitation/first aid course prior to the end of a NMFS/NEFOP Observer Training class. NMFS may reject a candidate for training if the candidate does not meet the minimum qualification requirements as outlined by NMFS/NEFOP minimum eligibility standards for observers as described on the NMFS/NEFOP website.
(vii) Reports. (A) Observer deployment reports. The observer service provider must report to NMFS/NEFOP when, where, to whom, and to what fishery (including Open Area or Access Area for sea scallop trips) an observer has been deployed, within 24 hours of the observer's departure. The observer service provider must ensure that the observer reports back to NMFS its Observer Contract (OBSCON) data, as described in the certified observer training, within 24 hours of landing. OBSCON data are to be submitted electronically or by other means
specified by NMFS. The observer service provider shall provide the raw (unedited) data collected by the observer to NMFS within 4 business days of the trip landing.
(B) Safety refusals. The observer service provider must report to NMFS any trip that has been refused due to safety issues, e.g., failure to hold a valid USCG Commercial Fishing Vessel Safety Examination Decal or to meet the safety requirements of the observer's pre-trip vessel safety checklist, within 24 hours of the refusal.
(C) Biological samples. The observer service provider must ensure that biological samples, including whole marine mammals, sea turtles, and sea birds, are stored/handled properly and transported to NMFS within 7 days of landing.
(D) Observer debriefing. The observer service provider must ensure that the observer remains available to NMFS, either in-person or via phone, at NMFS' discretion, including NMFS Office for Law Enforcement, for debriefing for at least 2 weeks following any observed trip. If requested by NMFS, an observer that is at sea during the 2-week period must contact NMFS upon his or her return.
(E) Observer availability report. The observer service provider must report to NMFS any occurrence of inability to respond to an industry request for observer coverage due to the lack of available observers by 5 p.m., Eastern Time, of any day on which the provider is unable to respond to an industry request for observer coverage.
(F) Other reports. The observer service provider must report possible observer harassment, discrimination, concerns about vessel safety or marine casualty, or observer illness or injury; and any information, allegations, or reports regarding observer conflict of interest or breach of the standards of behavior, to NMFS/NEFOP within 24 hours of the event or within 24 hours of learning of the event.
(G) Observer status report. The observer service provider must provide NMFS/NEFOP with an updated list of contact information for all observers that includes the observer identification number, observer's name, mailing address, email address, phone numbers, homeports or fisheries/trip types assigned, and must include whether or not the observer is "in service," indicating when the observer has requested leave and/or is not currently working for an industry funded program.
(H) Vessel contract. The observer service provider must submit to NMFS/NEFOP, if requested, a copy of each type of signed and valid contract (including all attachments, appendices, addendums, and exhibits incorporated into the contract) between the observer provider and those entities requiring observer services.
(I) Observer contract. The observer service provider must submit to NMFS/NEFOP, if requested, a copy of each type of signed and valid contract (including all attachments, appendices, addendums, and exhibits incorporated into the contract) between the observer provider and specific observers.
(J) Additional information. The observer service provider must submit to NMFS/NEFOP, if requested, copies of any information developed and/or used by the observer provider and distributed to vessels, such as informational pamphlets, payment notification, description of observer duties, etc.
(viii) Refusal to deploy an observer. (A) An observer service provider may refuse to deploy an observer on a requesting fishing vessel if the observer service provider does not have an available observer within 48 hours of receiving a request for an observer from a vessel.
(B) An observer service provider may refuse to deploy an observer on a requesting fishing vessel if the observer service provider has determined that the requesting vessel is inadequate or unsafe pursuant to the reasons described at §600.746.
(C) The observer service provider may refuse to deploy an observer on a fishing vessel that is otherwise eligible to carry an observer for any other reason, including failure to pay for previous observer deployments, provided the observer service provider has received prior written confirmation from NMFS authorizing such refusal.
(6) Limitations on conflict of interest. An observer service provider:
(i) Must not have a direct or indirect interest in a fishery managed under Federal regulations, including, but not limited to, a fishing vessel, fish dealer, fishery advocacy group, and/or fishery research;
(ii) Must assign observers without regard to any preference by representatives of vessels other than when an observer will be deployed; and
(iii) Must not solicit or accept, directly or indirectly, any gratuity, gift, favor, entertainment, loan, or anything of monetary value from anyone who conducts fishing or fishing related activities that are regulated by NMFS, or who has interests that may be substantially affected by the performance or nonperformance of the official duties of observer providers.
(7) Removal of observer service provider from the list of approved observer service providers. An observer service provider that fails to meet the requirements, conditions, and responsibilities specified in paragraphs (h)(5) and (h)(6) of this section shall be notified by NMFS, in writing, that it is subject to removal from the list of approved observer service providers. Such notification shall specify the reasons for the pending removal. An observer service provider that has received notification that it is subject to removal from the list of approved observer service providers may submit written information to rebut the reasons for removal from the list. Such rebuttal must be submitted within 30 days of notification received by the observer service provider that the observer service provider is subject to removal and must be accompanied by written evidence rebutting the basis for removal. NMFS shall review information rebutting the pending removal and shall notify the observer service provider within 15 days of receipt of the rebuttal whether or not the removal is warranted. If no response to a pending removal is received by NMFS, the observer service provider shall be automatically removed from the list of approved observer service providers. The decision to remove the observer service provider from the list, either after reviewing a rebuttal, or if no rebuttal is submitted, shall be the final decision of NMFS and the Department of Commerce. Removal from the list of approved observer service providers does not necessarily prevent such observer service provider from obtaining an approval in the future if a new application is submitted that demonstrates that the reasons for removal are remedied. Certified observers under contract with an observer service provider that has been removed from the list of approved service providers must complete their assigned duties for any fishing trips on which the observers are deployed at the time the observer service provider is removed from the list of approved observer service providers. An observer service provider removed from the list of approved observer service providers is responsible for providing NMFS with the information required in paragraph (h)(5)(vii) of this section following completion of the trip. NMFS may consider, but is not limited to, the following in determining if an observer service provider may remain on the list of approved observer service providers:
(i) Failure to meet the requirements, conditions, and responsibilities of observer service providers specified in paragraphs $(\mathrm{h})(5)$ and $(\mathrm{h})(6)$ of this section;
(ii) Evidence of conflict of interest as defined under paragraph (h)(6) of this section;
(iii) Evidence of criminal convictions related to:
(A) Embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property; or
(B) The commission of any other crimes of dishonesty, as defined by state law or Federal law, that would seriously and directly affect the fitness of an applicant in providing observer services under this section;
(iv) Unsatisfactory performance ratings on any Federal contracts held by the applicant; and
(v) Evidence of any history of decertification as either an observer or observer provider.

## (i) Observer certification.

(1) To be certified, employees or sub-contractors operating as observers for observer service providers approved under paragraph (h) of this section must meet NMFS National Minimum Eligibility Standards for observers. NMFS National Minimum Eligibility Standards are available at the National Observer Program website: www.nmfs.noaa.gov/op/pds/categories/science_and_technology.html.
(2) Observer training. In order to be deployed on any fishing vessel, a candidate observer must have passed an appropriate NMFS/NEFOP Observer Training course. If a candidate fails training, the candidate shall be notified in writing on or before the last day of training. The notification will indicate the reasons the candidate failed the training. Observer training shall include an observer training trip, as part of the observer's training, aboard a fishing vessel with a trainer. A candidate observer's first four deployments and the resulting data shall be immediately edited and approved after each trip by NMFS/NEFOP, prior to any further deployments by that observer. If data quality is considered acceptable, the observer would be certified.
(3) Observer requirements. All observers must:
(i) Have a valid NMFS/NEFOP fisheries observer certification pursuant to paragraph (i)(1) of this section;
(ii) Be physically and mentally capable of carrying out the responsibilities of an observer on board fishing vessels, pursuant to standards established by NMFS. Such standards are available from NMFS/NEFOP website specified in paragraph (h)(1) of this section and shall be provided to each approved observer service provider;
(iii) Have successfully completed all NMFS-required training and briefings for observers before deployment, pursuant to paragraph (i)(2) of this section; and
(iv) Hold a current Red Cross (or equivalence) CPR/First Aid certification.
(v) Accurately record their sampling data, write complete reports, and report accurately any observations relevant to conservation of marine resources or their environment.
(4) Probation and decertification. NMFS may review observer certifications and issue observer certification probation and/or decertification as described in NMFS policy found on the NMFS/NEFOP website specified in paragraph (h)(1) of this section.
(5) Issuance of decertification. Upon determination that decertification is warranted under paragraph (i)(4) of this section, NMFS shall issue a written decision to decertify the observer to the observer and approved observer service providers via certified mail at the observer's most current address provided to NMFS. The decision shall identify whether a certification is revoked and shall identify the specific reasons for the action taken.

Decertification is effective immediately as of the date of issuance, unless the decertification official notes a compelling reason for maintaining certification for a specified period and under specified conditions. Decertification is the final decision of NMFS and the Department of Commerce and may not be appealed.

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3. Add § 648.18 to Subpart A to read as follows:
§ 648.18 Standardized bycatch reporting methodology.
NMFS shall comply with the Standardized Bycatch Reporting Methodology (SBRM) provisions established in the following fishery management plans: Atlantic Bluefish; Atlantic Sea Scallop; Atlantic Surfclam and Ocean Quahog; Atlantic Herring; Atlantic Salmon; Deep-Sea Red Crab; Mackerel, Squid, and Butterfish; Monkfish; Northeast Multispecies; Northeast Skate Complex; Spiny Dogfish; Summer Flounder, Scup, and Black Sea Bass; and Tilefish. *****
4. In § 648.22, paragraph (c)(13) is added to read as follows:
§ 648.22 Atlantic mackerel, squid, and butterfish specifications.
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(c) $* * *$
(13) Changes, as appropriate, to the SBRM, including the coefficient of variation (CV) based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industryfunded observers or observer set aside programs.
$* * * * *$
5. In § 648.25, paragraph (a)(1) is revised to read as follows:
§ 648.25 Atlantic mackerel, squid, and butterfish framework adjustments to management measures.
(a) $* * *$
(1) Adjustment process. The MAFMC shall develop and analyze appropriate management actions over the span of at least two MAFMC meetings. The MAFMC must provide the public with advance notice of the availability of the recommendation(s), appropriate justification(s) and economic and biological analyses, and the opportunity to comment on the proposed adjustment(s) at the first meeting and prior to and at the second MAFMC meeting. The MAFMC's recommendations on adjustments or additions to management measures must come from one or more of the following categories: Adjustments within existing ABC control rule levels; adjustments to the existing MAFMC risk policy; introduction of new AMs, including subACTs; minimum fish size; maximum fish size; gear restrictions; gear requirements or prohibitions; permitting restrictions; recreational possession limit; recreational seasons; closed areas; commercial seasons; commercial trip limits; commercial quota system, including commercial quota allocation procedure and possible quota set-asides to mitigate bycatch; recreational harvest limit; annual specification quota setting process; FMP Monitoring Committee composition and process; description and identification of EFH (and fishing gear management measures that impact EFH); description and identification of habitat areas of particular concern; overfishing definition and related thresholds and targets; regional gear restrictions; regional season restrictions (including option to split seasons); restrictions on vessel
size (LOA and GRT) or shaft horsepower; changes to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industryfunded observers or observer set aside programs; any other management measures currently included in the FMP; set aside quota for scientific research; regional management; process for inseason adjustment to the annual specification; mortality caps for river herring and shad species; time/area management for river herring and shad species; and provisions for river herring and shad incidental catch avoidance program, including adjustments to the mechanism and process for tracking fleet activity, reporting incidental catch events, compiling data, and notifying the fleet of changes to the area(s); the definition/duration of 'test tows,' if test tows would be utilized to determine the extent of river herring incidental catch in a particular area(s); the threshold for river herring incidental catch that would trigger the need for vessels to be alerted and move out of the area(s); the distance that vessels would be required to move from the area(s); and the time that vessels would be required to remain out of the area(s). Measures contained within this list that require significant departures from previously contemplated measures or that are otherwise introducing new concepts may require amendment of the FMP instead of a framework adjustment.
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6. In $\S 648.41$, paragraph (a) is revised to read as follows:
§ 648.41 Framework specifications.
(a) Within season management action. The New England Fishery Management Council (NEFMC) may, at any time, initiate action to implement, add to or adjust Atlantic salmon management measures to:
(i) Allow for Atlantic salmon aquaculture projects in the EEZ, provided such an action is consistent with the goals and objectives of the Atlantic Salmon FMP; and
(ii) Make changes to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs.
7. In § 648.55, paragraphs (f)(39) and (40) are revised and paragraph (f)(41) is added to read as follows:
§ 648.55 Framework adjustments to management measures.
*****
(f) $* * *$
(39) Adjusting EFH closed area management boundaries or other associated measures;
(40) Changes to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set-aside programs; and
(41) Any other management measures currently included in the FMP.
8. In § 648.79, paragraph (a)(1) is revised to read as follows:
§ 648.79 Surfclam and ocean quahog framework adjustments to management measures.
(a) $* * *$
(1) Adjustment process. The MAFMC shall develop and analyze appropriate management actions over the span of at least two MAFMC meetings. The MAFMC must provide the public with advance notice of the availability of the recommendation(s), appropriate justification(s) and economic and biological analyses, and the opportunity to comment on the proposed adjustment(s) at the first meeting, and prior to and at the second MAFMC meeting. The MAFMC's recommendations on adjustments or additions to management measures must come from one or more of the following categories: Adjustments within existing ABC control rule levels; adjustments to the existing MAFMC risk policy; introduction of new AMs, including subACTs; the overfishing definition (both the threshold and target levels); description and identification of EFH (and fishing gear management measures that impact EFH); habitat areas of particular concern; set-aside quota for scientific research; VMS; OY range; suspension or adjustment of the surfclam minimum size limit; and changes to the SBRM, including the CVbased performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industryfunded observers or observer set aside programs. Issues that require significant departures from previously contemplated measures or that are otherwise introducing new concepts may require an amendment of the FMP instead of a framework adjustment.

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9. In § 648.90, paragraphs (a)(2)(i), (a)(2)(iii), (b)(1)(ii), (c)(1)(i), (c)(1)(ii) and are revised to read as follows:
§ 648.90 NE multispecies assessment, framework procedures and specifications, and flexible area action system.
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(a) $* * *$
(2) Biennial review.
(i) The NE multispecies PDT shall meet on or before September 30 every other year, unless otherwise specified in paragraph (a)(3) of this section, under the conditions specified in that paragraph, to perform a review of the fishery, using the most current scientific information available provided primarily from the NEFSC. Data provided by states, ASMFC, the USCG, and other sources may also be considered by the PDT. Based on this review, the PDT will develop ACLs for the upcoming fishing year(s) as described in paragraph (a)(4) of this section and develop options for consideration by the Council if necessary, on any changes, adjustments, or additions to DAS allocations, closed areas, or other measures necessary to rebuild overfished stocks and achieve the FMP goals and objectives, including changes to the SBRM.
(ii) ***
(iii) Based on this review, the PDT shall recommend ACLs and develop options necessary to achieve the FMP goals and objectives, which may include a preferred option. The PDT must demonstrate through analyses and documentation that the options they develop are expected to meet the FMP goals and objectives. The PDT may review the performance of different user groups or fleet sectors in developing options. The range of options developed by the PDT may include any of the management measures in the FMP, including, but not limited to: ACLs, which must be based on the projected fishing mortality levels required to meet the goals and objectives outlined in the FMP for the 12 regulated species and ocean pout if able to be
determined; identifying and distributing ACLs and other sub-components of the ACLs among various segments of the fishery; AMs; DAS changes; possession limits; gear restrictions; closed areas; permitting restrictions; minimum fish sizes; recreational fishing measures; describing and identifying EFH; fishing gear management measures to protect EFH; designating habitat areas of particular concern within EFH; and changes to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs. In addition, the following conditions and measures may be adjusted through future framework adjustments: Revisions to DAS measures, including DAS allocations (such as the distribution of DAS among the four categories of DAS), future uses for Category C DAS, and DAS baselines, adjustments for steaming time, etc.; modifications to capacity measures, such as changes to the DAS transfer or DAS leasing measures; calculation of areaspecific ACLs, area management boundaries, and adoption of area-specific management measures; sector allocation requirements and specifications, including the establishment of a new sector, the disapproval of an existing sector, the allowable percent of ACL available to a sector through a sector allocation, and the calculation of PSCs; sector administration provisions, including at-sea and dockside monitoring measures; sector reporting requirements; state-operated permit bank administrative provisions; measures to implement the U.S./Canada Resource Sharing Understanding, including any specified TACs (hard or target); changes to administrative measures; additional uses for Regular B DAS; reporting requirements; the GOM Inshore Conservation and Management Stewardship Plan; adjustments to the Handgear A or B permits; gear requirements to improve selectivity, reduce bycatch, and/or reduce impacts of the fishery on EFH; SAP modifications; revisions to the ABC control rule and status determination criteria, including, but not limited to, changes in the target fishing mortality rates, minimum biomass thresholds, numerical estimates of parameter values, and the use of a proxy for biomass may be made either through a biennial adjustment or framework adjustment; changes to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs; and any other measures currently included in the FMP.
(b) $* * *$
(1) $* * *$
(ii) The Whiting PDT, after reviewing the available information on the status of the stock and the fishery, may recommend to the Council any measures necessary to assure that the specifications will not be exceeded; changes to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs; as well as changes to the appropriate specifications.
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(c) $* * *$
(1) $* * *$
(i) After a management action has been initiated, the Council shall develop and analyze appropriate management actions over the span of at least two Council meetings. The Council shall provide the public with advance notice of the availability of both the proposals and the analyses and opportunity to comment on them prior to and at the second Council meeting. The

Council's recommendation on adjustments or additions to management measures, other than to address gear conflicts, must come from one or more of the following categories: DAS changes; effort monitoring; data reporting; possession limits; gear restrictions; closed areas; permitting restrictions; crew limits; minimum fish sizes; onboard observers; minimum hook size and hook style; the use of crucifer in the hook-gear fishery; sector requirements; recreational fishing measures; area closures and other appropriate measures to mitigate marine mammal entanglements and interactions; description and identification of EFH; fishing gear management measures to protect EFH; designation of habitat areas of particular concern within EFH; changes to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs; and any other management measures currently included in the FMP.
(ii) The Council's recommendation on adjustments or additions to management measures pertaining to small-mesh NE multispecies, other than to address gear conflicts, must come from one or more of the following categories: Quotas and appropriate seasonal adjustments for vessels fishing in experimental or exempted fisheries that use small mesh in combination with a separator trawl/grate (if applicable); modifications to separator grate (if applicable) and mesh configurations for fishing for small-mesh NE multispecies; adjustments to whiting stock boundaries for management purposes; adjustments for fisheries exempted from minimum mesh requirements to fish for small-mesh NE multispecies (if applicable); season adjustments; declarations; participation requirements for any of the Gulf of Maine/Georges Bank small-mesh multispecies exemption areas; OFL and ABC values; ACL, TAL, or TAL allocations, including the proportions used to allocate by season or area; small-mesh multispecies possession limits, including in-season AM possession limits; changes to reporting requirements and methods to monitor the fishery; and biological reference points, including selected reference time series, survey strata used to calculate biomass, and the selected survey for status determination; and changes to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs. $* * * * *$
10. In § 648.96, paragraph (a)(3)(ii) is revised to read as follows: § 648.96 FMP review, specification, and framework adjustment process.
(a) $* * *$
(3) ***
(ii) The range of options developed by the Councils may include any of the management measures in the Monkfish FMP, including, but not limited to: ACTs; closed seasons or closed areas; minimum size limits; mesh size limits; net limits; liver-to-monkfish landings ratios; annual monkfish DAS allocations and monitoring; trip or possession limits; blocks of time out of the fishery; gear restrictions; transferability of permits and permit rights or administration of vessel upgrades, vessel replacement, or permit assignment; measures to minimize the impact of the monkfish fishery on protected species; gear requirements or restrictions that minimize bycatch or bycatch mortality; transferable DAS programs; changes to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-
funded observers or observer set aside programs; changes to the Monkfish Research Set-Aside Program; and other frameworkable measures included in §§648.55 and 648.90.

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11. In § 648.102, paragraph (a)(10) is added to read as follows: § 648.102 Summer flounder specifications.
(a) ***
(10) Changes, as appropriate, to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs.
$* * * * *$
12. In $\S 648.110$, paragraph (a)(1) is revised to read as follows: § 648.110 Summer flounder framework adjustments to management measures.
(a) $* * *$
(1) Adjustment process. The MAFMC shall develop and analyze appropriate management actions over the span of at least two MAFMC meetings. The MAFMC must provide the public with advance notice of the availability of the recommendation(s), appropriate justification(s) and economic and biological analyses, and the opportunity to comment on the proposed adjustment(s) at the first meeting and prior to and at the second MAFMC meeting. The MAFMC's recommendations on adjustments or additions to management measures must come from one or more of the following categories: Adjustments within existing ABC control rule levels; adjustments to the existing MAFMC risk policy; introduction of new AMs, including subACTs; minimum fish size; maximum fish size; gear restrictions; gear requirements or prohibitions; permitting restrictions; recreational possession limit; recreational seasons; closed areas; commercial seasons; commercial trip limits; commercial quota system including commercial quota allocation procedure and possible quota set asides to mitigate bycatch; recreational harvest limit; specification quota setting process; FMP Monitoring Committee composition and process; description and identification of essential fish habitat (and fishing gear management measures that impact EFH); description and identification of habitat areas of particular concern; regional gear restrictions; regional season restrictions (including option to split seasons); restrictions on vessel size (LOA and GRT) or shaft horsepower; operator permits; changes to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs; any other commercial or recreational management measures; any other management measures currently included in the FMP; and set aside quota for scientific research. Issues that require significant departures from previously contemplated measures or that are otherwise introducing new concepts may require an amendment of the FMP instead of a framework adjustment.
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13. In § 648.122, paragraph (a)(13) is added to read as follows:
§ 648.122 Scup specifications.
(a) $* * *$
(13) Changes, as appropriate, to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs.
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14. In § 648.130, paragraph (a)(1) is revised to read as follows:
§ 648.130 Scup framework adjustments to management measures.
(a) $* * *$
(1) Adjustment process. The MAFMC shall develop and analyze appropriate management actions over the span of at least two MAFMC meetings. The MAFMC must provide the public with advance notice of the availability of the recommendation(s), appropriate justification(s) and economic and biological analyses, and the opportunity to comment on the proposed adjustment(s) at the first meeting and prior to and at the second MAFMC meeting. The MAFMC's recommendations on adjustments or additions to management measures must come from one or more of the following categories: Adjustments within existing ABC control rules; adjustments to the existing MAFMC risk policy; introduction of new AMs, including sub-ACTs; minimum fish size; maximum fish size; gear restrictions; gear restricted areas; gear requirements or prohibitions; permitting restrictions; recreational possession limits; recreational seasons; closed areas; commercial seasons; commercial trip limits; commercial quota system including commercial quota allocation procedure and possible quota set asides to mitigate bycatch; recreational harvest limits; annual specification quota setting process; FMP Monitoring Committee composition and process; description and identification of EFH (and fishing gear management measures that impact EFH); description and identification of habitat areas of particular concern; regional gear restrictions; regional season restrictions (including option to split seasons); restrictions on vessel size (LOA and GRT) or shaft horsepower; operator permits; changes to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs; any other commercial or recreational management measures; any other management measures currently included in the FMP; and set aside quota for scientific research.
15. In $\S 648.142$, paragraph (a)(12) is added to read as follows: § 648.142 Black sea bass specifications.
(a) ***
(12) Changes, as appropriate, to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs.
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16. In § 648.162, paragraph (a)(9) is added to read as follows: § 648.162 Bluefish specifications.
(a) $* * *$
(9) Changes, as appropriate, to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs; and
$* * * * *$
17. In § 648.167, paragraph (a)(1) is revised to read as follows:
§ 648.167 Bluefish framework adjustment to management measures.
(a) $* * *$
(1) Adjustment process. After a management action has been initiated, the MAFMC shall develop and analyze appropriate management actions over the span of at least two MAFMC meetings. The MAFMC shall provide the public with advance notice of the availability of both the proposals and the analysis and the opportunity to comment on them prior to and at the second MAFMC meeting. The MAFMC's recommendation on adjustments or additions to management measures must come from one or more of the following categories: Adjustments within existing ABC control rule levels; adjustments to the existing MAFMC risk policy; introduction of new AMs, including sub-ACTs; minimum fish size; maximum fish size; gear restrictions; gear requirements or prohibitions; permitting restrictions; recreational possession limit; recreational season; closed areas; commercial season; description and identification of EFH; fishing gear management measures to protect EFH; designation of habitat areas of particular concern within EFH; changes to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs; and any other management measures currently included in the FMP. Measures that require significant departures from previously contemplated measures or that are otherwise introducing new concepts may require an amendment of the FMP instead of a framework adjustment.
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18. In $\S 648.200$, paragraph (b) is revised to read as follows:
§ 648.200 Specifications.
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(b) Guidelines. As the basis for its recommendations under paragraph (a) of this section, the PDT shall review available data pertaining to: Commercial and recreational catch data; current estimates of fishing mortality; discards; stock status; recent estimates of recruitment; virtual population analysis results and other estimates of stock size; sea sampling and trawl survey data or, if sea sampling data are unavailable, length frequency information from trawl surveys; impact of other fisheries on herring mortality; and any other relevant information. The specifications recommended pursuant to paragraph (a) of this section must be consistent with the following: *****
19. In § 648.206, paragraph (b)(29) is added to read as follows: § 648.206 Framework provisions. *****
(b) $* * *$
(29) Changes, as appropriate, to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs;
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20. In § 648.232, paragraph (a)(6) is added to read as follows:
§648.232 Spiny dogfish specifications.
(a) ***
(6) Changes, as appropriate, to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs;
$* * * * *$
21. In § 648.239, paragraph (a)(1) is revised to read as follows:
§ 648.239 Spiny dogfish framework adjustments to management measures.
(a) $* * *$
(1) Adjustment process. After the Councils initiate a management action, they shall develop and analyze appropriate management actions over the span of at least two Council meetings. The Councils shall provide the public with advance notice of the availability of both the proposals and the analysis for comment prior to, and at, the second Council meeting. The Councils' recommendation on adjustments or additions to management measures must come from one or more of the following categories: Adjustments within existing ABC control rule levels; adjustments to the existing MAFMC risk policy; introduction of new AMs, including subACTs; minimum fish size; maximum fish size; gear requirements, restrictions, or prohibitions (including, but not limited to, mesh size restrictions and net limits); regional gear restrictions; permitting restrictions, and reporting requirements; recreational fishery measures (including possession and size limits and season and area restrictions); commercial season and area restrictions; commercial trip or possession limits; fin weight to spiny dogfish landing weight restrictions; onboard observer requirements; commercial quota system (including commercial quota allocation procedures and possible quota set-asides to mitigate bycatch, conduct scientific research, or for other purposes); recreational harvest limit; annual quota specification process; FMP Monitoring Committee composition and process; description and identification of essential fish habitat; description and identification of habitat areas of particular concern; overfishing definition and related thresholds and targets; regional season restrictions (including option to split seasons); restrictions on vessel size (length and GRT) or shaft horsepower; target quotas; measures to mitigate marine mammal entanglements and interactions; regional management; changes to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs; any other management measures currently included in the Spiny Dogfish FMP; and measures to regulate aquaculture projects. Measures that require significant departures from previously contemplated measures or that are otherwise introducing new concepts may require an amendment of the FMP instead of a framework adjustment.

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22. In § 648.260, paragraph (a)(1) is revised to read as follows:
§648.260 Specifications.
(a) $* * *$
(1) The Red Crab PDT shall meet at least once annually during the intervening years between Stock Assessment and Fishery Evaluation (SAFE) Reports, described in paragraph (b) of this section, to review the status of the stock and the fishery. Based on such review, the PDT shall provide a report to the Council on any changes or new information about the red crab stock and/or fishery, and it shall recommend whether the specifications for the upcoming year(s) need to be modified. At a minimum, this review shall include a review of at least the following data, if available: Commercial catch data; current estimates of fishing mortality and catch-per-uniteffort (CPUE); discards; stock status; recent estimates of recruitment; virtual population analysis results and other estimates of stock size; sea sampling, port sampling, and survey data or, if sea sampling data are unavailable, length frequency information from port sampling and/or surveys; impact of other fisheries on the mortality of red crabs; and any other relevant information.
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23. In § 648.261, paragraph (a)(1) is revised to read as follows:
§ 648.261 Framework adjustment process.
(a) $* * *$
(1) In response to an annual review of the status of the fishery or the resource by the Red Crab PDT, or at any other time, the Council may recommend adjustments to any of the measures proposed by the Red Crab FMP, including the SBRM. The Red Crab Oversight Committee may request that the Council initiate a framework adjustment. Framework adjustments shall require one initial meeting (the agenda must include notification of the impending proposal for a framework adjustment) and one final Council meeting. After a management action has been initiated, the Council shall develop and analyze appropriate management actions within the scope identified below. The Council may refer the proposed adjustments to the Red Crab Committee for further deliberation and review. Upon receiving the recommendations of the Oversight Committee, the Council shall publish notice of its intent to take action and provide the public with any relevant analyses and opportunity to comment on any possible actions. After receiving public comment, the Council must take action (to approve, modify, disapprove, or table) on the recommendation at the Council meeting following the meeting at which it first received the recommendations. Documentation and analyses for the framework adjustment shall be available at least 2 weeks before the final meeting.
24. In 648.292, paragraph (a) is revised to read as follows:

## § 648.292 Tilefish specifications.

*****
(a) Annual specification process. The Tilefish Monitoring Committee shall review the ABC recommendation of the SSC, tilefish landings and discards information, and any other relevant available data to determine if the ACL, ACT, or total allowable landings (TAL) requires modification to respond to any changes to the stock's biological reference points or to ensure that the rebuilding schedule is maintained. The Monitoring Committee will consider whether any additional management measures or revisions to existing measures are necessary to ensure that
the TAL will not be exceeded, including changes, as appropriate, to the SBRM. Based on that review, the Monitoring Committee will recommend ACL, ACT, and TAL to the Tilefish Committee of the MAFMC. Based on these recommendations and any public comment received, the Tilefish Committee shall recommend to the MAFMC the appropriate ACL, ACT, TAL, and other management measures for a single fishing year or up to 3 years. The MAFMC shall review these recommendations and any public comments received, and recommend to the Regional Administrator, at least 120 days prior to the beginning of the next fishing year, the appropriate ACL, ACT, TAL, the percentage of TAL allocated to research quota, and any management measures to ensure that the TAL will not be exceeded, for the next fishing year, or up to 3 fishing years. The MAFMC's recommendations must include supporting documentation, as appropriate, concerning the environmental and economic impacts of the recommendations. The Regional Administrator shall review these recommendations, and after such review, NMFS will publish a proposed rule in the FEDERAL REGISTER specifying the annual ACL, ACT, TAL and any management measures to ensure that the TAL will not be exceeded for the upcoming fishing year or years. After considering public comments, NMFS will publish a final rule in the FEDERAL REGISTER to implement the ACL, ACT, TAL and any management measures. The previous year's specifications will remain effective unless revised through the specification process and/or the research quota process described in paragraph (e) of this section. NMFS will issue notification in the FEDERAL REGISTER if the previous year's specifications will not be changed.
$* * * * *$
25. In § 648.299, paragraph (a)(1)(xviii) is added to read as follows:
§ 648.299 Tilefish framework specifications.
(a) $* * *$
(1) ***
(xviii) Changes, as appropriate, to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs;

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26. In 648.320, paragraphs (a)(5)(ii) and (iii) are revised and paragraph (a)(5)(iv) is added to read as follows: § 648.320 Skate FMP review and monitoring.
(a) $* * *$
(5) $* * *$
(ii) In-season possession limit triggers for the wing and/or bait fisheries;
(iii) Required adjustments to in-season possession limit trigger percentages or the ACLACT buffer, based on the accountability measures specified at §648.323; and
(iv) Changes, as appropriate, to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs.
$* * * * *$
27. In § 648.321, paragraphs (b)(22) and (b)(23) are revised and paragraph (b)(24) is added to read as follows:
§ 648.321 Framework adjustment process.
*****
(b) $* * *$
(22) Reduction of the baseline 25-percent ACL-ACT buffer to less than 25 percent;
(23) Changes to catch monitoring procedures; and
(24) Changes, as appropriate, to the SBRM, including the CV-based performance standard, the means by which discard data are collected/obtained, fishery stratification, the process for prioritizing observer sea-day allocations, reports, and/or industry-funded observers or observer set aside programs.

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[^0]:    ${ }^{1}$ For a more detailed discussion of sampling design, bias (accuracy), and precision, please see Chapter 5 of this document.

[^1]:    ${ }^{4}$ ICNAF formerly coordinated management of many fisheries off the east coast of North America. ICNAF lasted until 1979, when it was partly replaced by Northwest Atlantic Fisheries Organization (NAFO).

[^2]:    ${ }^{5}$ Atlantic mackerel ranges from the Gulf of St. Lawrence to Cape Lookout, NC; Loligo squid ranges from Newfoundland to the Gulf of Venezuela; Illex squid ranges from the Labrador Sea to the Florida Straits; and butterfish range from the Gulf of St. Lawrence to the coast of Florida.

[^3]:    ${ }^{6}$ There are three SAPs currently in place: The Closed Area I Hook Gear Haddock SAP is open to NE multispecies DAS vessels fishing with hook gear in a portion of Closed Area I; the Eastern U.S./Canada Haddock SAP Pilot Program is open to NE multispecies DAS vessels using a haddock "separator" trawl in portions of the Eastern U.S./Canada Area and Closed Area II; and the Closed Area II Yellowtail Flounder SAP is open to NE multispecies DAS vessels fishing for yellowtail flounder in the southern portion of Closed Area II.
    ${ }^{7}$ The U.S./Canada Resource Sharing Understanding (Understanding) was reached between the United States and Canada regarding the management of Georges Bank cod, Georges Bank haddock, and Georges Bank yellowtail flounder resources found within the waters of both countries in an area known as the U.S./Canada Management Area. Amendment 13 implements certain measures consistent with the Understanding, including a requirement to use VMS, an area declaration requirement, and specific gear requirements (flatfish net or haddock separator trawl).

[^4]:    ${ }^{8}$ There are no data currently available on the recreational landings of witch flounder.

[^5]:    ${ }^{9}$ Directed fishing for spiny dogfish continued in state waters until 2004, by which time the states had

[^6]:    ${ }^{10}$ Summer flounder range from Nova Scotia to Florida; scup range from the Bay of Fundy to Florida; and black sea bass range from southern Nova Scotia to southern Florida and into the Gulf of Mexico.

[^7]:    ${ }^{11}$ The summer flounder TAL is allocated 60 percent to the commercial fishery and 40 percent to the recreational. The scup TAL is allocated 78 percent to the commercial fishery, while 22 percent is allocated to the recreational fishery. The black sea bass TAL is allocated 49 percent to the commercial fishery, with 51 percent allocated to the recreational fishery.
    ${ }^{12}$ Similar to the percentage allocation of the TAL to the commercial and recreational fisheries, the FMP allocates the commercial summer flounder quota among the states from North Carolina to Maine according to specific percentage shares.
    ${ }^{13}$ An Omnibus Amendment (Amendment 19 to the Summer Flounder, Scup, and Black Sea Bass FMP) is under development that may revise the AMs for the Mid-Atlantic Council's recreational fisheries.

[^8]:    ${ }^{14}$ The Maine mahogany clam is the same species as the ocean quahog, but is found in the inshore waters of the State of Maine and supports a small artisanal fishery. This fishery had been operating on an experimental basis since 1990, but was beginning to move offshore into Federal waters.

[^9]:    ${ }^{15}$ The tilefish fishery south of the Virginia/North Carolina border is currently managed as part of the Snapper-Grouper Complex FMP developed by the South Atlantic Fishery Management Council.

[^10]:    ${ }^{16}$ For the purposes of the SBRM, the area associated with a fishing mode is based on the port of departure of a fishing vessel, regardless of where the fishing activity occurred. A more detailed explanation of this characteristic is provided in Chapter 5.

[^11]:    ${ }^{17}$ Note that landings of surfclams and ocean quahogs are reported in bushels (bu) rather than in pounds (lb). Landings of all other species are reported in pounds.

[^12]:    ${ }^{18}$ May 1, 2004, was the effective date of a rule requiring all federally permitted seafood dealers in the Northeast except those handling lobster only to report fish purchases electronically via computer. Prior to this rule, all dealers were required to report all fish purchases on paper forms, submitted monthly, and dealers that purchase certain species were required to provide additional summary information on a weekly basis through an automated telephone call-in system. The May 1, 2004, rule consolidated the two reporting requirements, eliminated both the telephone call-in system and the paper reports, and implemented an online reporting program known as the Standard Atlantic Fisheries Information System (SAFIS).
    19 "Market category" is a term used to describe the various forms or sizes of fish products sold to dealers and for which different prices may be paid (for example, dealers will pay fishing vessels different prices per lb for "whale" cod, "market" cod, and "scrod" (small) cod).

[^13]:    ${ }^{20}$ The terms "head boat" and "party boat" refer to same thing: boats that take large groups of anglers on a fishing trip. Generally, the anglers purchase individual tickets to fish, and the vessels may carry up to 100

[^14]:    anglers. The duration of head boat trips is usually 4 to 12 hours. "Charter boat" refers to vessels that are hired-often for a full day-by a pre-formed group of 4 to 8 anglers (NRC 2006). Charter boats are often associated with large pelagic fisheries, but will often seek other species if the principal target is unavailable or if bag limits are met before the charter expires.
    ${ }^{21}$ For website, see www.st.nmfs.noaa.gov.
    ${ }^{22}$ Unless otherwise noted, all of the information in this subsection is drawn from NRC 2006.

[^15]:    ${ }^{23}$ In some NMFS documents, the FHS is considered a component of the MRFSS. In others, it is presented as a supplement to the MRFSS. Such distinctions are merely semantic and have no relevance to the quality of the data and the degree to which the programs are integrated.

[^16]:    ${ }^{24}$ Sections 4.7.2.14.7.2.1, MRFSS Intercept Survey, and 4.7.2.2, MRFSS Telephone Survey, are taken largely from Witzig et al. (2006).

[^17]:    ${ }^{25}$ The "hot deck" imputation method "replaces missing values in the data for a given household or angler with values randomly selected from complete, current observations obtained for households or anglers with similar characteristics. Hot-deck imputation leads to a complete data set that preserves the original variability of the sampled data better than 'mean' imputation. It is also usually preferred over 'cold-deck' imputation which replaces missing values in current data with values randomly selected from historical observations." (Ditton et al. 2001)

[^18]:    ${ }^{26}$ The discard-to-kept ratio is abbreviated as $\mathrm{d} / \mathrm{k}$, and the discard-to-days-absent ratio is abbreviated as d/da.
    ${ }^{27}$ A "CV" is a coefficient of variation and is a standard measure of precision, calculated as the ratio of the square root of the variance of the bycatch estimate (i.e., the standard error) to the bycatch estimate itself. The higher the CV, the larger the standard error is relative to the estimate. A lower CV reflects a smaller standard error relative to the estimate. A 0-percent CV means there is no variance in the sampling distribution. Alternatively, CVs of 100 percent or higher indicate that there is considerable variance in the estimate. Chapter 5 describes several ways in which the variances of the data and the estimates can be minimized, including stratifying the sampling frame and optimizing sampling effort.

[^19]:    ${ }^{28}$ Reports prepared since 2000 may be found at http://www.nefsc.noaa.gove/nefsc.saw. Earlier reports are available by email (contact: saw_reports@noaa.gov).

[^20]:    ${ }^{29}$ On-vessel sampling of large-volume fisheries can be difficult. Subsampling protocols were developed for the purse seine and mid-water pair trawl fisheries during 2004; thus the results for species groups from these fleets should be considered preliminary. Sampling protocols have since been established for these large volume fisheries; the standardized sampling protocols for all fisheries with observer coverage are provided in the Northeast Fisheries Observer Program Manual.

[^21]:    ${ }^{30}$ Hail weight is the amount of landings estimated by the fishing vessel on the FVTR; round weight is the weight of the whole, live fish; dressed weight is the weight of the fish carcass after the head, viscera, and fins are removed.

[^22]:    ${ }^{34}$ The fourth root transformation approximates a natural logarithm transformation without the difficulty of adding a constant (Green 1979).

[^23]:    ${ }^{35}$ From mid-November 2004 through October 2005, regulations for the Northeast multispecies fishery included a pilot program that prohibited discards of legal-sized groundfish and required fishermen to take specific actions when the catch of these species exceeded very low limits. There is evidence that compliance with these regulations was influenced by the presence of an observer (NEFMC 2006). Investigation of whether this effect also influenced discards was not attempted in this analysis because the program was in effect for just over one month in 2004, a small number of vessels participated during this period, and the trips cannot be (directly) identified in the FVTR data for comparison.

[^24]:    ${ }^{36}$ The ESA (1973) defines takes as: "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct"

[^25]:    ${ }^{37}$ In the sea turtle sample size analysis, Mid-Atlantic refers to areas fished west of $70^{\circ} \mathrm{W}$. In the fish/invertebrate sample size analysis, Mid-Atlantic refers to region based on port of departure from Connecticut and southward. Although it is recognized that port of departure may differ from the area fished, an odds ratio analysis conducted to evaluate broad-scale spatial coherence indicated a strong relationship between area fished (statistical area) and port of departure (region). Based upon this analysis, the 'Mid-Atlantic' stratifications used in two analyses were considered similar.

[^26]:    ${ }^{38}$ The analytical techniques, procedures, and models employed in stock assessments vary by stock assessment and are reviewed as part of each stock assessment (the NEFSC SAW/SARC process). These techniques, procedures, and models are updated with each stock assessment as new data are incorporated into the stock assessment process and as new techniques, procedures, and models are developed and refined. It would be neither practicable nor appropriate to attempt to identify or prescribe the analytical tools to be used in future stock assessments.

[^27]:    ${ }^{39}$ For example, some frameworks or annual adjustments set an annual quota or allocate DAS to a fleet. Absent the action, zero DAS may be allocated (no fishing), or no quota may be established (unlimited fishing). Thus, the implications of the no action alternative may be very different depending on the type of management system in place. In these cases, the status quo would continue a set of regulations that would provide for some level of controlled fishing activity.

[^28]:    ${ }^{40}$ Note that nothing in this alternative, or in this amendment, requires the establishment of a fisheries observer program. The NEFOP is a long-standing, well-established at-sea fisheries observer program that has been in place for over 20 years. The NEFOP observer program manual (NMFS 2005a), biological sampling manual (NMFS 2006a), training manuals, data handling procedures (see Appendix D), and formal training facility and training program serve as a model for other observer programs around the country and around the world. The focus of the amendment is on how the NEFOP is utilized to provide adequate data on discards occurring in fisheries.

[^29]:    ${ }^{41}$ At a meeting on August 22, 2006, members of the Science and Statistical Committees of the New England and Mid-Atlantic Councils met to conduct a peer-review of the analytical components of this amendment. During the review and discussion, the SSC members agreed and recommended that the SBRM Amendment include an "importance filter" as a means to most effectively determine the appropriate target observer coverage levels for the various fishing modes.

[^30]:    ${ }^{42}$ This last filter, described here as a placeholder for possible future action, is intended to address species, such as Atlantic herring or mackerel, for which the total landings of that species could be markedly less than the total allowable catch and, therefore, may be an incomplete measure of the implications of the bycatch amount in the subject fishing mode.

[^31]:    ${ }^{43}$ In the draft 2007 SBRM Omnibus Amendment, three options were presented: Annually; every 5 years; and according to the SAFE reporting schedule. Based upon further consideration and review, a fourth option was added to the final draft of the 2007 SBRM Omnibus Amendment to provide a comprehensive SBRM Review Report every 3 years.

[^32]:    ${ }^{44}$ Available at www.nmfs.noaa.gov/op/pds/documents/04/109/04-109-01.pdf/.

[^33]:    ${ }^{45}$ In this case, "unique" is meant to reflect the species codes reported by observers. There is some degree of overlap among the reported species. For example, while all relevant flounder species are recorded separately, there is also a "flounder, NK" category for flounders that cannot be clearly identified to the species. There are also several types of marine fauna that are not identified to the species level, such as starfish, sponges, and sea cucumbers, but are instead identified at this level.

[^34]:    ${ }^{46}$ Southern New England is generally considered to be the area of the continental shelf off the coasts of Massachusetts, Rhode Island, and Long Island, New York, from the Great South Channel to Hudson Canyon.

[^35]:    ${ }^{47}$ Some fishery resources, such as hagfish and cusk, are landed for sale commercially but are not the subject of an FMP. For some of these, such as hagfish, an FMP is expected within the next several years, but there are some fishery resources for which no FMP is planned.

[^36]:    ${ }^{49}$ Blue whales are considered only an occasional "visitor" to this region.

[^37]:    ${ }^{50}$ The permit structure under the Skate FMP remains open access, as there is no limited access skate permit. However, effectively only the skate bait exemption fishery is completely open access. With the exception of the skate bait exemption fishery, possession of more than a low incidental catch level of skates requires the vessel to be operating on either a monkfish, sea scallop, or Northeast multispecies day-at-sea (DAS), which in turn requires the vessel to hold a limited access permit in at least one of these fisheries.

[^38]:    ${ }^{51}$ Archipelago Marine Research, Ltd. (2006), identifies the costs to purchase, install, and maintain a complete electronic monitoring system. While this fee schedule is focused on the British Columbia groundfish longline fisheries, the costs identified are presumed to be transferable to other fisheries. Published costs in Canadian dollars were converted to U.S. dollars based on the published exchange rate for September 7, 2006.
    ${ }^{52}$ Kinsolving (2006) also provides estimates of the cost to purchase a complete electronic monitoring system, ranging from $\$ 4,250$, if off-the-shelf components are used, to $\$ 8,000$ if a package system is purchased from an approved contractor. For the purposes of this analysis, the costs published by Archipelago Marine Research, Ltd. (2006), were used to simplify the analysis and to clearly identify the source of the costs used.

[^39]:    OBTAINING A COPY: To obtain a copy of a NOAA Technical Memorandum NMFS-NE or a Northeast Fisheries Science Center Reference Document, or to subscribe to the Resource Survey Report, either contact the NEFSC Editorial Office (166 Water St., Woods Hole, MA 02543-1026; 508-495-2228) or consult the NEFSC webpage on "Reports and Publications" (http:// www.nefsc.noaa.gov/nefsc/publications/).

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[^40]:    N/A = No observations in 2004.

[^41]:    N/A = No observations in 2004.

[^42]:    N/A = No observations in 2004.

[^43]:    N/A = No observations in 2004.

[^44]:    N/A = No observations in 2004.

[^45]:    N/A = No observations in 2004.

[^46]:    N/A = No observations in 2004.

[^47]:    N/A = No observations in 2004.

[^48]:    N/A = No observations in 2004.

[^49]:    N/A = No observations in 2004.

[^50]:    N/A = No observations in 2004.

[^51]:    N/A = No observations in 2004.

[^52]:    N/A = No observations in 2004.

[^53]:    N/A = No observations in 2004.

[^54]:    N/A = No observations in 2004.

[^55]:    ${ }^{1}$ www.nefsc.noaa.gov/publications/crd/crd1109/
    ${ }^{2}$ www.nefsc.noaa.gov/publications/crd/crd1227/

[^56]:    14 Maine Street, Suite 200, Brunswick, Maine 04011-2026 • 207-729-7733 • Fax: 207-729-7373 • www.clf.org

[^57]:    ${ }^{1}$ Conservation Law Foundation v. Evans, 209 F. Supp. 2d (D.D.C. 2001); Conservation Law Foundation v. Evans, D.D.C. No. 04-811 ESH (March 9, 2005)(consolidated as Oceana v. Evans). In the 2001ruling, the Court explicitly criticized NMFS for relying upon bycatch reporting methods that were demonstrably inaccurate and inadequate. In the March 9, 2005 ruling, the Court referenced these earlier findings. Oceana v. Evans, at 85.
    ${ }^{2}$ Oceana v. Evans, D.D.C. No. 04-811 at 85.
    ${ }^{3} \mathrm{Id}$. at 79-82.
    ${ }^{4} \mathrm{Id}$. at 83-84.
    ${ }^{5}$ Id. at 84-85.
    ${ }^{6} I d$. at 85 .

[^58]:    ${ }^{7}$ Id. at 85-86.
    ${ }^{8}$ Id. at 79-82.
    ${ }^{9}$ The Court noted specifically that the FMP evaluates various kinds of reporting for different types of fishing gear and vessels. (See CLF Mot. Ex. 2 (HMS FMP, August 2003) at Ch. 5, pp. 34-36 (previously provided as part of this record).

[^59]:    ${ }^{10}$ Oceana v. Evans, D.D.C. No. 04-811 at 84-85.

[^60]:    ${ }^{1}$ Standardized Bycatch Reporting Methodology Draft Document downloaded from http://www.nero.noaa.gov/mediacenter/2013/09/2013nersbrmdraftamendment.pdf , September 27, 2013. Oceana submits these comment based on the documents available on 9/27/2013 and notes that the document was incomplete at that time with the notable omission of appendices and supporting materials.
    ${ }^{2}$ Id at 3 (Section 1.3)

[^61]:    ${ }^{3}$ See Oceana letter to Doug Potts, FMAT Chair May 17, 2013.
    ${ }^{4}$ See Testimony and Answers to questions by Doug Potts, NEFMC meeting April, 2013 and June, 2013.

[^62]:    ${ }^{5}$ Oceana, Inc. v. Locke, 670 F.3d 1238 (D.C. Cir. 2011)
    ${ }^{6}$ Standardized Bycatch Reporting Methodology Draft Document page 238.
    ${ }^{7}$ ld.

[^63]:    ${ }^{8}$ National Marine Fisheries Service. 2004. Evaluating bycatch: a national approach to standardized bycatch monitoring programs. at 59
    ${ }^{9}$ Id at 85

[^64]:    ${ }^{10}$ Northeast Multispecies Framework Adjustment 48, page 413-420: http://www.nefmc.org/nemulti/frame/fw\%2048/130307 FW48 Figures Repaired.pdf
    ${ }^{11}$ National Marine Fisheries Service National Standard One Final Rule (74 Fed. Reg 3178, January 16, 2009)

[^65]:    ${ }^{12}$ Magnuson-Stevens Act Section 303 (a) (11)
    ${ }^{13}$ Magnuson Stevens Act, Section 104
    ${ }^{14}$ Standardized Bycatch Reporting Methodology Draft Document, at 9
    ${ }^{15}$ Id at 47
    ${ }^{16}$ Magnuson Stevens Act, Section 303 (a)(15)
    ${ }^{17}$ Standardized Bycatch Reporting Methodology Draft Document, at 47

[^66]:    ${ }^{18} \mathrm{ld}$.
    ${ }^{19}$ Id at 3)
    ${ }^{20}$ Standardized Bycatch Reporting Methodology Draft Document, at 146
    ${ }^{21} 2012$ Discard Estimation, Precision, and Sample Size Analyses for14 Federally Managed Species Groups in the Northeast Region. NEFSC CRD 12-17.

[^67]:    ${ }^{22}$ See Agency response to Oceana comments in 2008 Standardized Bycatch Reporting Methodology Final Rule (73 Fed. Reg. 4741, January 28, 2008)
    ${ }^{23}$ Standardized Bycatch Reporting Methodology Draft Document, section 1.3 at 3
    ${ }^{24}$ Id at 39

[^68]:    ${ }^{25}$ Id at 2-3
    ${ }^{26}$ Management uncertainty occurs because of the lack of sufficient information about catch (e.g., late reporting, underreporting and misreporting of landings or bycatch). National Marine Fisheries Service National Standard One Final Rule (74 Fed. Reg, 3178, January 16, 2009)
    ${ }^{27}$ Stock assessment models have various sources of scientific uncertainty associated with them and many assessments have shown a repeating pattern that the previous assessment overestimated near-future biomass, and underestimated near future fishing mortality rates (i.e., called retrospective patterns).
    National Marine Fisheries Service National Standard One Final Rule (74 Fed. Reg. 3181, January 16, 2009)
    ${ }^{28}$ Standardized Bycatch Reporting Methodology Draft Document Footnote 36, at 207
    ${ }^{29}$ McAllister, M. K., 2007. Review of the Northeast Regional Standardized Bycatch Reporting Methodology. Lenfest Ocean Program.
    ${ }^{30}$ National Marine Fisheries Service. 2004. Evaluating bycatch: a national approach to standardized bycatch monitoring programs. at 58

[^69]:    ${ }^{31}$ Id at vi
    ${ }^{32}$ Standardized Bycatch Reporting Methodology Draft Document, at iii
    ${ }^{33}$ Comments of David Goethel on FW48. New England Fishery Management Council Meeting November, 2012.
    ${ }^{34}$ Standardized Bycatch Reporting Methodology Draft Document Page 177
    ${ }^{35}$ Id at176
    ${ }^{36}$ Id at 176
    ${ }^{37}$ Id at 177

[^70]:    ${ }^{38}$ Summary of Analyses Conducted to Determine At-Sea Monitoring Requirements for Multispecies SectorsFY2013 Page 8-9
    (http://www.nero.noaa.gov/ro/fso/reports/Sectors/ASM/FY2013_Multispecies_Sector_ASM_Requirements_Sum mary.pdf).
    ${ }^{39}$ total landed pounds; total roundfish pounds; total groundfish pounds; total non-groundfish pounds; total cod pounds; total groundfish value; total non-groundfish value; trip duration
    ${ }^{40}$ Benoit and Allard (2009)
    ${ }^{41}$ Summary of Analyses Conducted to Determine At-Sea Monitoring Requirements for Multispecies Sectors FY2013 at 8-9
    (http://www.nero.noaa.gov/ro/fso/reports/Sectors/ASM/FY2013_Multispecies_Sector_ASM_Requirements_Sum mary.pdf).
    ${ }^{42}$ See Oceana letter to Doug Potts, FMAT Chair May 17, 2013.
    ${ }^{43}$ See Magnuson Stevens Act Section 303 a(11)
    ${ }^{44}$ See Magnuson Stevens Act National Standard Two, Section 301 a(2)
    ${ }^{45}$ See Magnuson Stevens Acts Section 303 a(15)

[^71]:    ${ }^{46}$ See Oceana comments related to 2007 Standardized Bycatch Reporting Methodology Amendment and Implementing Regulations, submitted September 24, 2007.

[^72]:    ${ }^{47}$ Standardized Bycatch Reporting Methodology Draft Document at 119

[^73]:    ${ }^{1}$ The Northeast Multispecies fishing year runs annually from May 1 to April 30.

[^74]:    TO OBTAIN A COPY of a NOAA Technical Memorandum NMFS-NE or a Northeast Fisheries Science Center Reference Document, either contact the NEFSC Editorial Office ( 166 Water St., Woods Hole, MA 02543-1026; 508-495-2350) or consult the NEFSC webpage on "Reports and Publications" (http://www.nefsc.noaa.gov/nefsc/publications/). To access Resource Survey Report, consult the Ecosystem Surveys Branch webpage (http://www.nefsc.noaa.gov/femad/ecosurvey/mainpage/).

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[^75]:    ${ }^{1}$ For more information about the MWG, visit: www.gmri.org/monitoringworkinggroup
    ${ }^{2}$ Ultimately NMFS announced funding $100 \%$ of the ASM program in FY 2013, and as such, the ASM program continued to be operated by NMFS, and sectors did not propose alternate ASM programs.

[^76]:    ${ }^{3}$ No deletion was made, but could count only the gear type that landed the most fish if needed.
    ${ }^{4}$ We understand that smaller vessels, many of which are handgear A or category C vessels, are subject to the default NEFOP rate of $8 \%$, but are not required to call into PTNS and therefore may not be subject to additional ASM coverage.

[^77]:    ${ }^{5}$ Starting in FY12, NMFS' contracts with ASM providers are transitioning to a new billing structure of quarter-day (i.e., 6-hr) seadays; however this does not affect our historical analysis of FY 2010 and FY 2011 (http://www.nefsc.noaa.gov/fsb/asm/ASM\%202012\%20Contract\%20Information/AIS.Signed.Redacted.Contract-TOs-2.2012.pdf).

[^78]:    ${ }^{6}$ An average seaday in FY2010 cost $\$ 630.44+\$ 32.28$ in travel $+\$ 37.46$ in training for a subtotal of $\$ 700.19$. In addition, there were $\$ 217.76$ in NEFOP infrastructure and overhead costs for administration of the program, for a combined total of $\$ 917.95$ (Van Atten, 2001a as cited in Northern Economics, Inc. A Review of Observer and Monitoring Programs in the Northeast, the West Coast, and Alaska, prepared for Environmental Defense Fund, September 2011).

[^79]:    ${ }^{7}$ While the NEFMC clarified how the $30 \%$ CV standard is applied in FW48, we understand that this does not represent a change to current practices, and only clarifies the intent in the regulations.

[^80]:    Note: Abbreviation of Groundfish stock are defined as follows and those stocks with an "*" indicated are zero possession prohibited species under landing/possession limits. CODGBE: GB Cod East; FLWGB*: GB Winter Flounder; HADGM: GOM Haddock; POKGMASS: Pollock; $\quad$ YELCCGM: CC/GOM Yellowtail F CODGBW: GB Cod West; FLWGMSS: GOM Winter Flounder; CODGMSS: GOM Cod; FLWGMSS: GOM Winter Flounder;
    FLWSNEMA*: SNE Winter Flounder;

    HALGMMA: Halibut; HKWGMMA: White Hake; OPTGMMA*: Ocean Pout; PLAGMMA: American Plaice;

[^81]:    Note: Abbreviation of Groundfish stock are defined as follows and those stocks with an "*" indicated are zero possession prohibited species under landing/possession limits. CODGBE: GB Cod East; FLWGB*: GB Winter Flounder; HADGM: GOM Haddock; POKGMASS: Pollock; $\quad$ YELCCGM: CC/GOM Yellowtail Flour

    CODGBW: GB Cod West; FLWGMSS: GOM Winter Flounder; CODGMSS: GOM Cod;

    FLWGMSS: GOM Winter Flounder;
    FLWSNEMA*: SNE Winter Flounder;
    HADGBE: GB Haddock East;
    FLGMGBSS*: Northern Windowpane; HADGBW: GB Haddock West;

[^82]:    Note: Abbreviation of Groundfish stock are defined as follows and those stocks with an "*" indicated are zero possession prohibited species under landing/possession limits. $\begin{array}{ll}\text { CODGBE: GB Cod East; } & \text { FLWGB*: GB Winter Flounder; } \\ \text { CODGBW: GB Cod West; } & \text { FLWGMSS: GOM Winter Flounder; } \\ \text { CODGMSS: GOM Cod; } & \text { FLWSNEMA*: SNE Winter Flounder; }\end{array}$ HADGM: GOM Haddock; HALGMMA: Halibut; HKWGMMA: White Hake; OPTGMMA*: Ocean Pout; POKGMASS: Pollock;

    YELCCGM: CC/GOM Yellowtail Flounder; REDGMGBSS: Redfish; YELGB: GB Yellowtail Flounder; WITGMMA: Witch Flounder; YELSNE: SNE Yellowtail Flounder. FLDSNEMA*: Southern Windowpane; HADGBE: GB Haddock East; PLAGMMA: American Plaice;

[^83]:    ${ }^{1}$ www.nefsc.noaa.gov/publications/crd/crd1109/
    ${ }^{2}$ www.nefsc.noaa.gov/publications/crd/crd1227/

[^84]:    1 "fleet" is synonymous with "fishing mode."
    ${ }^{2}$ The Proposed 2012 Observer Sea Day Allocation (March 23, 2012) document is available on-line at: http://www.nefsc.noaa.gov/fsb/SBRM/2012/Proposed_2012_Observer_Sea_Day_Allocation_3-23-2012_v3.pdf
    ${ }^{3}$ A comparison of discard rates derived from observer and at-sea monitor data revealed there were generally no statistical differences in discard rates between the two data collection programs for the 14 fish species groups for four gear types (longline, large mesh otter trawl, large mesh gillnet and extra large mesh gillnet) where at-sea monitor data exist. See Northeast Fisheries Observer Program (2011) for more information on at-sea monitoring. ${ }^{4}$ Marine Recreational Fisheries Statistics Survey (MRFSS) was replaced with Marine Recreational Information Program (MRIP) in 2012.

[^85]:    ${ }^{5}$ Wigley et al. (2007) found that the majority (over 93\%) of 2004 observed trips both originated and fished in the same region and exhibited the same general pattern as in the VTR data. An updated analysis using data collected during July 2007 through June 2011 found similar results.
    ${ }^{6}$ See Wigley et al. 2007 for more details on self-reported VTR data.
    ${ }^{7}$ The trip-based allocation of Dealer (CFDETT/SyyyyAA) data are conducted annually and were not available when the annual discard estimation and sample size analyses were conducted.

[^86]:    ${ }^{8}$ Pilot coverage is defined as a minimum level of observer coverage necessary to acquire bycatch information with which to calculate variance estimates that in turn can be used to further define the level of sampling needed (NMFS 2004).

[^87]:    ${ }^{9}$ Fish disposition code "039" = POOR QUALITY, PREVIOUSLY DISCARDED has been excluded from this report.

[^88]:    TO OBTAIN A COPY of a NOAA Technical Memorandum NMFS-NE or a Northeast Fisheries Science Center Reference Document, either contact the NEFSC Editorial Office ( 166 Water St., Woods Hole, MA 02543-1026; 508-495-2350) or consult the NEFSC webpage on "Reports and Publications" (http://www.nefsc.noaa.gov/nefsc/publications/). To access Resource Survey Report, consult the Ecosystem Surveys Branch webpage (http://www.nefsc.noaa.gov/femad/ecosurvey/mainpage/).

    ANY USE OF TRADE OR BRAND NAMES IN ANY NEFSC PUBLICATION OR REPORT DOES NOT IMPLY ENDORSEMENT.

[^89]:    ${ }^{1}$ "fleet" is synonymous with "fishing mode." See Appendix Table 1 for fleet abbreviations.

[^90]:    ${ }^{2}$ In the sea turtle sample size analysis, Mid-Atlantic refers to areas fished west of $70^{\circ} \mathrm{W}$. In the fish/invertebrate sample size analysis, Mid-Atlantic refers to region based on port of departure from Connecticut and southward. Although it is recognized that port of departure may differ from the area fished, an odds ratio analysis conducted to evaluate broad-scale spatial coherence indicated a strong relationship between area fished (statistical area) and port of departure (region). Based upon this analysis, the 'Mid-Atlantic' stratifications used in two analyses were considered similar.

[^91]:    ${ }^{3}$ For most gear types, observers use a "complete" sampling protocol that includes obtaining species weights for both kept and discarded portions of all species in the catch on every haul. In addition to the "complete" sampling protocol, there is a "limited" sampling protocol that is used on some gillnet trips where specific information for marine mammals is collected. In a "limited" sampling scenario, only kept species weights are obtained (no discard weights) since the observer must watch the gillnet gear during haul-back to observe if marine mammals roll out of the gear before the gear returns to the deck.

[^92]:    ${ }^{4}$ When there are surplus sea days within a funding category, the surplus sea days may be allocated at the discretion of the agency as SBRM sea days are a minimum requirement, not a ceiling.

