PUBLIC HEARING DRAFT

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

November 2006

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Amendment 2 to the Atlantic Bluefish Fishery Management Plan (FMP); Amendment 2 to the Atlantic Herring FMP; Amendment 2 to the Atlantic Salmon FMP; Amendment 12 to the Atlantic Sea Scallop FMP; Amendment 1 to the Deep-Sea Red Crab FMP; Amendment 12 to the Mackerel, Squid, and Butterfish FMP; Amendment 3 to the Monkfish FMP; Amendment 15 to the Northeast Multispecies FMP; Amendment 1 to the Northeast Skate Complex FMP; Amendment 1 to the Spiny Dogfish FMP; Amendment 16 to the Summer Flounder, Scup, and Black Sea Bass FMP; Amendment 14 to the Surfclam and Ocean Quahog FMP; and Amendment 2 to the Tilefish FMP

Including an
Environmental Assessment,
an Initial Regulatory Flexibility Act Analysis,
and a Regulatory Impact Review

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Executive Summary

This is a public hearing draft of the omnibus amendment to the fishery management plans (FMPs) of the Mid-Atlantic and New England Fishery Management Councils. This omnibus amendment is being 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). The intent of the public hearing draft is to provide the public an opportunity to review the progress made thus far by the Councils and the National Marine Fisheries Service (NOAA Fisheries Service) on this issue and to comment on the document and/or the actions being proposed by the Councils and NOAA Fisheries Service.

The purpose of the amendment is to: Explain the methods and processes by which bycatch is currently monitored and assessed for Northeast Region fisheries; determine whether these methods and processes need to be modified and/or supplemented; establish standards of precision for bycatch estimation for all Northeast Region fisheries; and, thereby, document the SBRM established for all fisheries managed through the FMPs of the Northeast Region. The scope of the amendment is limited to those fisheries that are prosecuted in the Federal waters of the Northeast 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 39 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, there is overlap among the FMPs and the fisheries that occur in New England and the Mid-Atlantic. For example, New England vessels using extra-large mesh gillnets catch monkfish, skates, and Northeast multispecies, 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 Northeast Region SBRM is designed around “fishing modes” defined by the type of fishing gear used and the area from which the vessels depart. There are 39 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 in 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. Information gained from primary sources on fishery discards is used in conjunction with information from fishery independent surveys, seafood dealer purchase reports, and fishing vessel trip reports 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.

Northeast Region fisheries were stratified into 45 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 fishing vessel trip report (FVTR) data. Two ratio estimators were used: Discard-to-days–absent (d/da) and discard-to–kept (d/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 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 target 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 fleet and species/species group combination. The total estimated number of sea days necessary to achieve a 30 percent CV exceeded 33,000 days. Analyses were performed to evaluate potential sources of bias in the 2004 NEFOP 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.

To meet the purpose and need for this amendment, the Councils are considering alternatives for four principal components of the Northeast Region SBRM: (1) Bycatch reporting and monitoring mechanisms; (2) analytical techniques and allocation of fisheries observer effort; (3) a performance standard for the SBRM; and (4) an SBRM reporting and review process. In addition to the status quo bycatch reporting and monitoring mechanisms, the Councils are considering whether to implement electronic video monitoring to supplement or replace at-sea fisheries observers. The Councils are considering three alternatives relative to the process used to determine the appropriate allocation of fisheries observer effort: The status quo; a modification to the status quo that would incorporate an "importance filter" process; 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 are considering adoption of a coefficient of variance (CV) of 30 percent as the performance standard for the Northeast Region SBRM. Although there is currently no required process to provide periodic evaluations of the effectiveness of the SBRM, the Councils are considering requiring specific information to be provided at regular intervals for all of the subject FMPs.

The Councils' preferred alternatives are identified below.

<table>
<tr><th>SBRM Component</th><th colspan="6">Alternatives Under Consideration</th></tr>
<tr><td>1. Bycatch Reporting and Monitoring Mechanisms</td><td colspan="3">Status quo (preferred)</td><td colspan="3">Implement electronic video monitoring</td></tr>
<tr><td>2. Analytical Techniques and Allocation of Observers</td><td colspan="2">Status quo</td><td colspan="2">Status quo with importance filter (preferred)</td><td colspan="2">Minimum percent observer coverage</td></tr>
<tr><td>3. SBRM Standard</td><td colspan="3">Status quo</td><td colspan="3">Establish a CV standard (preferred)</td></tr>
<tr><td>4. SBRM Review/Reporting Process</td><td colspan="3">Status quo</td><td colspan="3">Specify an SBRM review process (preferred)</td></tr>
</table>

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 for the Northeast Region, 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.

Following public hearings and an opportunity for the public to review this amendment and submit comments to the Councils and NOAA Fisheries Service, the Councils will reconsider their preferred alternatives, and may modify the proposed SBRM accordingly. Once complete, the Councils will submit this amendment to NOAA Fisheries Service for review and implementation.

List of Acronyms and Abbreviations

ACCSP	Atlantic Coastal Cooperative Statistics Program
ACFCMA	Atlantic Coastal Fishery Cooperative Management Act
APA	Administrative Procedure Act
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
FMP	Fishery Management Plan
FOIA	Freedom of Information Act
FONSI	Finding Of No Significant Impact
FVTR	Fishing Vessel Trip Report
GPS	Global Positioning System
ICNAF	International Commission for the Northwest Atlantic Fisheries
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
MRFSS	Marine Recreational Fisheries Statistics Survey
NAFO	Northwest Atlantic Fisheries Organization
NASCO	North Atlantic Salmon Conservation Organization
NE	New England
NEFMC	New England Fishery Management Council
NEFOP	Northeast Fisheries Observer Program
NEFSC	Northeast Fisheries Science Center
NEMAP	Northeast Area Monitoring and Assessment Program
NEPA	National Environmental Policy Act
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 Fisheries Service Office of Law Enforcement
PRA	Paperwork Reduction Act
PREE	Preliminary Regulatory Economic Evaluation
PSP	Paralytic Shellfish Poisoning
QA/QC	Quality Assurance/Quality Control
RFA	Regulatory Flexibility Act
RIR	Regulatory Impact Review
SAFE	Stock Assessment and Fishery Evaluation
SAFIS	Standard Atlantic Fisheries Information System
SAP	Special Access Program
SAW/SARC	Stock Assessment Workshop/Stock Assessment Review Committee
SBRM	Standardized Bycatch Reporting Methodology
SFCPO	State-Federal Constituent Programs Office
SSC	Scientific and Statistical Committee
TAC	Total Allowable Catch
TAL	Total Allowable Level
U.S.	United States
USFWS	United States Fish and Wildlife Service
VMS	Vessel Monitoring System

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APPENDICES

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Chapter 1
Introduction and Background

1.1. Introduction

This document amends the fishery management plans (FMPs) of the Northeast 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 established 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 Northeast 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 NOAA Fisheries Service to address bycatch in all FMPs. This amendment will examine, for each of these Northeast 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 NOAA Fisheries Service 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 an Initial Regulatory Flexibility Analysis (IRFA).

This amendment was prepared by NOAA Fisheries Service, in cooperation with the Councils.

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 NOAA Fisheries Service (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.

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 fisheries management decisions.

1.4. Purpose and Need

This amendment is needed to ensure that all FMPs of the Northeast 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 Northeast 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 Northeast Region fisheries; and, thereby, (4) document the SBRMs established for all fisheries managed through the FMPs of the Northeast Region.

The scope of this amendment is limited to those fisheries that are prosecuted in the Federal waters of the Northeast 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 NOAA Fisheries Service, 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).

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 (*Loligo pealeii*) shortfin squid (*Illex illecebrosus*) butterfish (*Peprilus triacanthus*)
Monkfish	monkfish (*Lophius americanus*)
Northeast Multispecies	LARGE-MESH American plaice (*Hippoglossoides platessoides*) Atlantic cod (*Gadus morhua*) Atlantic halibut (*Hippoglossus hippoglossus*) haddock (*Melanogrammus aeglefinus*) ocean pout (*Zoarces americanus*) pollock (*Pollachius virens*) redfish (*Sebastes faciatus*) white hake (*Urophycis tenuis*) windowpane (*Scopthalmus aquosus*) winter flounder (*Pseudopleuronectes americanus*) witch flounder (*Glyptocephalus cynoglossus*) yellowtail flounder (*Limanda ferruginea*) SMALL-MESH offshore hake (*Merluccius albidus*) red hake (*Urophycis chuss*) 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 NOAA Fisheries Service (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 of these 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.

Therefore, in order to comply with the two Court Orders, NOAA Fisheries Service and the New England Council must amend the Northeast Multispecies and Atlantic Sea Scallop FMPs to ensure they comply with the SBRM provisions of the Magnuson-Stevens Act. Because many bycatch reporting and monitoring methods apply to and are interrelated with all Northeast Region fisheries, and because some of the weaknesses in the SBRM aspects of Amendment 13 and Amendment 10 may exist in other Northeast Region FMPs, NOAA Fisheries Service and both Councils have agreed to amend all Northeast Region FMPs in one “omnibus” amendment.

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 because of the regulations are called regulatory discards. 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 NOAA Fisheries Service.

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 SBRMs discussed herein will not specifically address reporting methodologies for marine mammals or seabirds. However, NOAA Fisheries Service 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 Magnuson-Stevens 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 Northeast 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 SBRMs that apply to all relevant fisheries in the Northeast 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 Northeast Region FMP. This overview briefly 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 Magnuson-Stevens Act compliance and the primary fishing modes as the operational unit for an SBRM.

Chapter 2 is the only one organized by FMP. The remaining chapters are organized by 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 preferred alternatives, under consideration in this amendment. 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 under consideration in this amendment. 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 IRFA, 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.

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Chapter 2
Description of the Fisheries

All of the FMP summaries below incorporate data from the seafood dealer purchase report database, from 2000-2005, 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. There has only been one amendment to the FMP, developed in response to the Sustainable Fisheries Act amendments to the Magnuson-Stevens Act and implemented in 2000.

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 Northeast 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. In recent years, commercial catch has ranged from 8.0 million lb in 2001 down to 6.0 million lb in 2005, and recreational catch has ranged from 11.4 million lb in 2002 up to 16.5 million lb in 2005 (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
2001	8,040,000 lb	13,230,000 lb
2002	6,427,000 lb	11,371,000 lb
2003	6,745,000 lb	13,136,000 lb
2004	7,512,000 lb	15,146,000 lb
2005	6,025,000 lb	16,473,000 lb

Table 2. Recent commercial and recreational landings of bluefish.

Primary Ports	Commercial Landings	Ex-vessel Value of Landings
Wanchese, NC	2,485,000 lb	$653,000
Long Beach/Barnegat Light, NJ	908,000 lb	$467,000
Hampton Bays, NY	884,000 lb	$385,000
Greenport, NY	390,000 lb	$114,000
Point Judith, RI	366,000 lb	$103,000
Point Pleasant, NJ	350,000 lb	$100,000
Amagansett, NY	293,000 lb	$77,000

Table 3. Primary ports associated with the bluefish fishery (values are averaged for 2000-2005).

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),[1] which regulated the high-seas 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 proposes a limited access qualification program, changes to management areas, and improved monitoring of catch.

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 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.

[1] 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).

	Commercial Landings	Recreational Landings
2001	215,410,000 lb	52,000 lb
2002	150,773,000 lb	11,000 lb
2003	214,171,000 lb	56,000 lb
2004	187,387,000 lb	27,000 lb
2005	191,413,000 lb	65,000 lb

Table 4. Recent commercial and recreational landings of herring.

Primary Ports	Commercial Landings	Ex-vessel Value of Landings
Gloucester, MA	43,607,000 lb	$2,948,000
Portland, ME	36,382,000 lb	$2,533,000
Rockland, ME	26,843,000 lb	$2,047,000
New Bedford, MA	12,331,000 lb	$860,000
North Kingston/Wickford, RI	11,230,000 lb	$1,136,000
Newington, NH	11,045,000 lb	$748,000
Stonington, ME	9,709,000 lb	$713,000
Bath, ME	9,643,000 lb	$624,000

Table 5. Primary ports associated with the herring fishery (values are averaged for 2000-2005).

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. Atlantic salmon in the Gulf of Maine are either 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 select few rivers in Maine.

The New England Council developed an FMP for Atlantic salmon that was implemented by the NOAA Fisheries Service 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 only 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.

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 salmon fishing continues in the Gulf of Maine under strict regulation. 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 revenues for farmed Atlantic salmon reached $58.2 million in 2001.

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 closed areas. 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 general category vessels that are not subject to DAS controls, but are subject to a 400 lb possession limit per fishing trip.

The Sea Scallop FMP has been further refined through multiple framework adjustments and amendments. The most recent amendment, Amendment 10, established a long-term, comprehensive program to manage the sea scallop fishery through an area rotation management program to maximize scallop yield. 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. Amendment 10 also included updated DAS allocations, measures to minimize bycatch to the extent practicable, measures to minimize the effects of scallop fishing on essential fish habitat to the extent practicable, and other measures to make the management program more effective, efficient, and flexible. Due to concerns about the rapid expansion of participation in the open access general category scallop fleet, the Council will consider ways to control capacity in this sector in an upcoming amendment.

Scallops are harvested primarily through the use of scallop dredges and trawls. In recent years (2000-2004), over 90 percent of all scallop landings are by dredge vessels. During the 2000-2004 fishing years, trawl vessels landed another 7-8 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. Since 1998, when new area closures were established, total commercial landings and revenue have nearly tripled without increasing the mortality rate (see Table 6). The value of commercial scallop landings for New England and Mid-Atlantic states in the year 2000 was estimated at $161 million. Increased landings were made possible by an increase in scallop biomass and favorable recruitment. 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, and Newport News, VA (see Table 7).

	Commercial Landings	Ex-vessel Value
2001	46,694,000 lb	$173,784,000
2002	52,686,000 lb	$202,383,000
2003	56,039,000 lb	$229,347,000
2004	64,506,000 lb	$320,696,000
2005	56,170,000 lb	$429,782,000

Table 6. Recent commercial landings of Atlantic sea scallops.

Primary Ports	Commercial Landings	Ex-vessel Value of Landings
New Bedford, MA	23,456,000 lb	$119,794,000
Newport News, VA	7,603,000 lb	$33,920,000
Cape May, NJ	6,184,000 lb	$29,467,000
Seaford, VA	5,040,000 lb	$25,263,000
Long Beach/Barnegat Light, NJ	3,925,000 lb	$22,784,000
Hampton, VA	3,255,000 lb	$14,075,000

Table 7. Primary ports associated with the sea scallop fishery (values are averaged for 2000-2005).

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 “under-exploited” 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, NOAA Fisheries Service 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. The only change to the FMP, implemented as Framework Adjustment 1, provided for a 3-year, rather than annual, specification-setting process.

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	Ex-vessel Value
2001	8,826,000 lb	$8,090,000
2002	4,724,000 lb	$3,997,000
2003	3,712,000 lb	$3,624,000
2004	3,952,000 lb	$4,214,000
2005	3,676,000 lb	$3,981,000

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

2.6. Mackerel, Squid, and Butterfish FMP

Atlantic mackerel, *Illex* and *Loligo* squid, and butterfish are all schooling pelagic species that range from at least the Gulf of St. Lawrence south to at least Cape Lookout, NC.[2] 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.

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. Amendment 8, implemented in 1999, was developed to bring the FMP into compliance with the Sustainable Fisheries Act. Future amendments to the FMP are intended to address limited access for the *Illex* squid fishery and bycatch (Amendment 9), develop a rebuilding plan for butterfish and address bycatch (Amendment 10), and address limited access for Atlantic mackerel (Amendment 11).

[2] 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.

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 80 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 *Loligo* fishery is managed via quarterly or trimester quota allocations and the directed fishery is closed when 80 percent of the quota allocations or 95 percent of the total domestic harvest is projected to be landed. The directed *Illex* or butterfish fisheries close when 95 percent of the total domestic harvest is projected to be landed. During closures of the directed *Loligo*, *Illex*, or butterfish fisheries, incidental catch fisheries for these species are permitted.

Although 1 percent of butterfish landed from 2000-2004 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 or 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 *Loligo* 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 2001-2005. Table 10 and Table 11 identify the recent landings, ex-vessel value, and primary ports for these fisheries.

	Recreational Landings
2001	3,386,000 lb
2002	2,852,000 lb
2003	1,698,000 lb
2004	1,134,000 lb
2005	2,289,000 lb

Table 9. Recreational landings of Atlantic mackerel.

	Atlantic mackerel		Butterfish		Illex squid		Loligo squid	
	Commercial Landings (1,000 lb)	Ex-vessel Value ($1,000)	Commercial Landings (1,000 lb)	Ex-vessel Value ($1,000)	Commercial Landings (1,000 lb)	Ex-vessel Value ($1,000)	Commercial Landings (1,000 lb)	Ex-vessel Value ($1,000)
2001	27,206	$2,223	9,709	$3,237	8,838	$1,937	31,388	$20,772
2002	58,489	$6,178	1,922	$1,007	6,062	$1,414	36,832	$23,542
2003	75,614	$7,922	1,181	$661	14,091	$3,980	26,313	$19,909
2004	121,239	$13,084	1,187	$724	56,045	$16,763	34,057	$25,745
2005	93,039	$10,025	866	$691	25,836	$8,077	36,942	$27,632

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

Atlantic mackerel		Butterfish		Illex squid		Loligo squid	
Primary Ports	Ex-vessel Value	Primary Ports	Ex-vessel Value	Primary Ports	Ex-vessel Value	Primary Ports	Ex-vessel Value
Cape May, NJ	$2,430,000	N. Kingstown, RI	$339,000	N. Kingstown, RI	$9,881,000	Point Judith, RI	$8,667,000
N. Kingstown/ Wickford, RI	$1,998,000	Point Judith, RI	$324,000	Cape May, NJ	$1,764,000	N. Kingstown/ Wickford, RI	$4,303,000
Portsmouth, RI	$1,244,000	Montauk, NY	$162,000	Point Judith, RI	$341,000	Hampton Bays, NY	$3,058,000
Gloucester, MA	$1,043,000	Hampton Bays, NY	$76,000	Newport, RI	$158,000	Montauk, NY	$2,922,000
New Bedford, MA	$1,000,000	Greenport, NY	$65,000			Cape May, NJ	$1,688,000

Table 11. Primary ports associated with the Atlantic mackerel, butterfish, and squid fisheries (values are averaged for 2000-2005).

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 ½-5 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	Ex-vessel Value
2001	27,700,000 lb	$44,194,000
2002	28,506,000 lb	$37,393,000
2003	30,046,000 lb	$38,758,000
2004	23,036,000 lb	$33,332,000
2005	21,991,000 lb	$42,041,000

Table 12. Recent commercial landings of monkfish.

Primary Ports	Commercial Landings	Ex-vessel Value of Landings
New Bedford, MA	5,287,000 lb	$9,203,000
Long Beach/Barnegat Light, NJ	4,016,000 lb	$5,560,000
Portland, ME	3,210,000 lb	$5,994,000
Gloucester, MA	2,609,000 lb	$4,335,000
Point Judith, RI	1,585,000 lb	$2,496,000
Chatham, MA	1,444,000 lb	$1,904,000
Boston, MA	1,241,000 lb	$1,974,000
Portsmouth, NH	1,014,000 lb	$1,481,000
Point Pleasant, NJ	972,000 lb	$1,309,000

Table 13. Primary ports associated with the monkfish fishery (values are averaged for 2000-2005).

Although the proportion of commercial landings by gear type varies by management area, overall, landings of monkfish are fairly evenly split between gillnets and otter trawls, which together account for 95 percent of landings (according to the fishing vessel trip report database, 2000-2004). Scallop dredges also catch monkfish, but in much smaller amounts (5 percent of reported landings, 2000-2004). No other gear types account for more than trace landings of monkfish. There is no recreational component to this fishery.

There are only two amendments to the Monkfish FMP: Amendment 1, which implemented the EFH provisions of the Magnuson-Stevens Act; and Amendment 2, which was implemented in 2005 and 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. A framework adjustment implemented in 2003 established a process to determine an annual TAC and appropriate fishing measures for each management area. Due to concern about the ability of the stocks to rebuild to target levels by the end of the rebuilding period under this process, there is a new framework adjustment under development.

2.8. Northeast Multispecies FMP

Fifteen species of groundfish are managed under this FMP (see Table 1). Twelve 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 fifteen 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 NOAA Fisheries Service and its individual species quotas were a continuation of the ICNAF quota-based 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 NOAA Fisheries Service 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 small-mesh 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 NOAA Fisheries Service 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)[3] 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.[4] 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.

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 fishing vessel trip report data for 2000-2004, gillnets contribute substantial amounts of Atlantic cod, pollock, redfish, and white hake. Other gears identified in the fishing vessel trip report 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 ex-vessel values for each of the primary ports.

[3] 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.

[4] 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).

	Commercial Landings	Recreational Landings[5]
2001	102,232,000 lb	10,252,000 lb
2002	91,757,000 lb	6,294,000 lb
2003	88,331,000 lb	6,588,000 lb
2004	83,523,000 lb	5,383,000 lb
2005	70,968,000 lb	4,154,000 lb

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

Primary Ports	Commercial Landings	Ex-vessel Value of Landings
New Bedford, MA	32,884,000 lb	$35,003,000
Gloucester, MA	15,472,000 lb	$18,019,000
Portland, ME	11,632,000 lb	$14,873,000
Chatham, MA	3,681,000 lb	$4,865,000
Boston, MA	2,921,000 lb	$3,387,000

Table 15. Primary ports associated with the large-mesh multispecies fishery (values are aggregated and averaged for 2000-2005).

	Commercial Landings	Recreational Landings[6]
2001	32,149,000 lb	19,000 lb
2002	19,514,000 lb	17,000 lb
2003	20,858,000 lb	4,000 lb
2004	19,387,000 lb	35,000 lb
2005	14,338,000 lb	68,000 lb

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

[5] There are no data currently available on the recreational landings of Atlantic halibut, American plaice, witch flounder, or redfish.
[6] 2005 recreational landings data on silver hake are not currently available.

Primary Ports	Commercial Landings	Ex-vessel Value of Landings
Point Judith, RI	4,773,000 lb	$1,692,000
New Bedford, MA	3,110,000 lb	$1,305,000
Montauk, NY	2,834,000 lb	$1,924,000
New London, CT	1,498,000 lb	$901,000
Gloucester, MA	1,137,000 lb	$556,000

Table 17. Primary ports associated with the small-mesh multispecies fishery (values are aggregated and averaged for 2000-2005).

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 Skate 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 regulations include 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 FMP also incorporates 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 are required to first undergo a “skate baseline review” to determine whether, and to what degree, the change may have an impact on skate conservation. Mitigation is required for any proposed action that would likely increase fishing mortality on one of the skate species under a formal rebuilding program. 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. Prior to the FMP, all skate catch was categorized generally as "skate spp." Stock assessments and efforts to manage fishing mortality have been hampered by a lack of species-specific catch information.

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 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 2000-2004, almost 80 percent of landings were from an otter trawl), although gillnets are also used (the remaining 20 percent of 2000-2004 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 (0.015 percent of all Atlantic coast recreational landings) and in the context of the overall skate fisheries (0.085 percent of all skate landings). 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	Ex-vessel Value
2001	18,171,000 lb	$3,354,000
2002	18,052,000 lb	$3,546,000
2003	19,912,000 lb	$4,087,000
2004	20,388,000 lb	$5,073,000
2005	18,080,000 lb	$5,020,000

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

Primary Ports	Commercial Landings	Ex-vessel Value of Landings
Point Judith, RI	2,021,000 lb	$157,000
Tiverton, RI	1,675,000 lb	$110,000
New Bedford, MA	1,582,000 lb	$690,000
Chatham, MA	1,361,000 lb	$471,000
Newport, RI	269,000 lb	$29,000

Table 19. Primary ports associated with the skate fishery (2000-2005 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 packs, and they move northward in the spring and summer and southward in the fall and winter. Spiny dogfish are known to attack and consume whatever is at hand, be it cod, haddock, mackerel, herring, flatfish, and sculpins, as well as jellyfish, crabs, octopods, and sea cucumbers, among other prey items. Although dogfish do 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 10 percent of their diet was composed of gadoids (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 most significant effect of the measures is the elimination of the directed dogfish fishery in Federal waters.[7]

[7] Directed fishing for spiny dogfish continued in state waters until 2004, by which time the states had followed suit to implement restrictive trip limits and eliminate the directed dogfish fishery.

Framework Adjustment 1 to the FMP provided for a multi-year, rather than annual, specification-setting process.

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. Because of the restrictive commercial trip limits designed to eliminate the directed dogfish fishery, all dogfish landings are the byproduct of other commercial fisheries. 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 2000-2004. Over the last several years, commercial landings ranged from 4.8 million lb in 2001 to as low as 1.9 million lb in 2004 (see Table 20). For fishing years 2000-2004 combined, the majority of commercial landings were made in Massachusetts ports (72 percent), with another percent made in New Jersey and North Carolina. Table 21 identifies the primary ports of spiny dogfish landings from 2000 to 2005.

	Commercial Landings	Ex-vessel Value
2001	4,849,000 lb	$1,099,000
2002	4,645,000 lb	$935,000
2003	2,313,000 lb	$299,000
2004	1,965,000 lb	$299,000
2005	2,236,000 lb	$460,000

Table 20. Recent commercial landings of spiny dogfish.

Primary Ports	Commercial Landings	Ex-vessel Value of Landings
Chatham, MA	2,186,000 lb	$428,500
Gloucester, MA	458,000 lb	$79,000
Provincetown, MA	258,000 lb	$52,000
Plymouth, MA	256,000 lb	$50,500
Hatteras, NC	149,000 lb	$18,000
Salisbury, MA	143,000 lb	$28,700
Point Judith, MA	126,000 lb	$20,500
Harwichport, MA	123,000 lb	$23,000

Table 21. Primary ports associated with the spiny dogfish fishery (values averaged for 2001-2005).

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.[8] 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.

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 NOAA Fisheries Service. In particular, the EFH provisions for all three species and the rebuilding program for scup were not approved.

[8] 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.

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.

For each of these three species, an annual TAL is established by the Council and the ASMFC and allocated between the recreational and commercial fishing sectors according to percentages identified in the FMP.[9] The commercial fisheries for all three species are now 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.[10] 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. 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.

There are two upcoming amendments to the FMP: The first will address the requirement to establish a rebuilding program for scup; and the second will address a wide range of issues associated with the management of all three species' fisheries (including the commercial/recreational splits, the state-by-state allocations of summer flounder commercial quota, the allocation of commercial scup quota among the three quota periods, among other issues).

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 of the total landings of these species (see Table 22). The primary

[9] 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.

[10] 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.

gears used in the commercial fisheries for these species vary. Based on fishing vessel trip report data from 2000-2004, summer flounder are caught almost exclusively (95 percent) with bottom otter trawls; scup are caught primarily (75 percent) with bottom otter trawls, but handlines/rod and reel accounted for 16 percent and pots, traps, and weirs accounted for another 6 percent; and black sea bass are caught in roughly equal amounts by handlines/rod and reel (34 percent), bottom otter trawls (35 percent), and pots and traps (30 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
2001	10,939,000 lb	11,660,000 lb	4,067,000 lb	4,262,000 lb	2,934,000 lb	3,986,000 lb
2002	14,491,000 lb	8,029,000 lb	7,282,000 lb	3,624,000 lb	3,557,000 lb	4,655,000 lb
2003	14,295,000 lb	11,663,000 lb	9,893,000 lb	8,484,000 lb	3,029,000 lb	3,691,000 lb
2004	18,160,000 lb	10,986,000 lb	9,361,000 lb	4,406,000 lb	3,095,000 lb	2,590,000 lb
2005	16,986,000 lb	10,115,000 lb	9,300,000 lb	2,380,000 lb	2,822,000 lb	2,269,000 lb

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	$3,420,000	Point Pleasant, NJ	$915,000	Ocean City, MD	$934,000
Point Pleasant, NJ	$3,312,000	Point Judith, RI	$874,000	Virginia Beach, VA	$779,000
Hampton, VA	$1,537,000	Montauk, NY	$565,000	Cape May, NJ	$643,000
Wanchese, NC	$1,526,000	Little Compton, RI	$500,000	Point Pleasant, NJ	$409,000
Hampton Bays, NY	$1,363,000	Cape May, NJ	$369,000	Point Judith, RI	$406,000
Belford, NJ	$1,173,000	Hampton Bays, NY	$352,000	Wanchese, NC	$286,000

Table 23. Primary ports associated with the summer flounder, scup, and black sea bass commercial fisheries (values are averaged for 2000-2005).

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 share holders are allowed to purchase, sell, or lease quota to and from other share holders. 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."[11] 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.

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,

[11] 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.

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.

Because of the presence of a toxin known to cause paralytic shellfish poisoning (PSP) in people consuming contaminated clams, eastern Georges Bank has been closed to the harvest of clams since 1990. Other areas in the Gulf of Maine and western Georges Bank were closed recently due to an outbreak of the PSP toxin in these areas.

	Atlantic Surfclam		Ocean Quahog	
	Commercial Landings	Ex-vessel Value	Commercial Landings	Ex-vessel Value
2001	68,864,000 lb	$38,025,000	37,993,000 lb	$23,866,000
2002	71,968,000 lb	$39,988,000	40,001,000 lb	$25,491,000
2003	69,502,000 lb	$39,427,000	41,881,000 lb	$26,030,000
2004	62,449,000 lb	$35,209,000	39,268,000 lb	$23,646,000
2005	49,651,000 lb	$27,534,000	30,408,000 lb	$18,556,000

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

Atlantic Surfclam			Ocean Quahog		
Primary Ports	Landings	Ex-vessel Value	Primary Ports	Landings	Ex-vessel Value
Atlantic City, NJ	36,768,000 lb	$19,709,000	Pt Pleasant, NJ	24,316,000 lb	$12,267,000
Pt Pleasant, NJ	16,382,000 lb	$7,531,000	New Bedford, MA	13,000,000 lb	$6,459,000
Ocean City, MD	4,881,000 lb	$3,180,000	Ocean City, MD	3,391,000 lb	$1,927,000
Oceanside, NY	3,496,000 lb	$2,029,000	Atlantic City, NJ	3,177,000 lb	$1,652,000
Wildwood, NJ	3,432,000 lb	$2,096,000	Wildwood, NJ	2,762,000 lb	$1,517,000

Table 25. Primary ports associated with the surfclam and ocean quahog commercial fisheries (values are averaged for 2000-2005).

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° 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.[12] 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 Counsel* 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. The current management of the commercial tilefish fishery relies upon annual quotas allocated to three categories of limited access permit vessels, and an incidental catch possession limit for vessels permitted to retain incidental levels of tilefish.

The commercial tilefish fishery is relatively small, with six vessels accounting for 85 percent of the total commercial tilefish landings between 1995 and 2002. Tilefish are primarily caught with bottom longlines (90 percent of landings reported in the fishing vessel trip report database from 2000-2004), although approximately 10 percent of landings are associated with bottom otter trawls.[13] There is effectively no recreational fishery for this species, with less than 2,200 lb landed annually for the last 25 years and only two fishing trips in Marine Recreational Fisheries Statistics Survey (MRFSS) database since 2000 reporting 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.

[12] 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.
[13] This number may not be reflective of the fishery under the FMP. Due to the ruling in Hajada v. Evans, there was a period during 2003 and 2004 during which there were no limited access permit requirements. During this time, landings by otter trawls may have been higher than would be expected under the FMP, given that the incidental catch permit category (where otter trawls would be used) is allocated 5 percent of the overall tilefish quota.

	Commercial Landings	Ex-vessel Value
2001	1,751,000 lb	$3,286,000
2002	1,714,000 lb	$3,505,000
2003	2,261,000 lb	$3,576,000
2004	2,316,000 lb	$3,328,000
2005	1,222,000 lb	$3,073,000

Table 26. Recent commercial landings of golden tilefish.

Primary Ports	Commercial Landings	Ex-vessel Value of Landings
Montauk, NY	931,000 lb	$1,835,000
Long Beach/Barnegat Light, NJ	805,000 lb	$1,181,000
Hampton Bays, NY	339,000 lb	$701,000
Point Judith, RI	130,000 lb	$125,000
Pine Beach, NJ	31,000 lb	$55,000

Table 27. Primary ports for the golden tilefish fishery (values are averaged for 2000-2005).

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Chapter 3
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.

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[14] 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 fishery, the information summarized in the following sections was derived from fishing vessels trip report (FVTR) data from 2000-2004, 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 Amendment. For a summary reference of the information presented, see Table 28 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 2002-2004, inclusive, are summarized below to provide a 3-year snapshot of the fishing activities of vessels using clam dredges. Due to complications associated with the database, this information is not organized based on the port of departure (New England vs. Mid-Atlantic), but is instead presented for the whole Northeast Region. This information focuses on landings of surfclam and ocean quahogs only. Supplemental information derived from the FVTR database provides information on the relative landings of other species by participating vessels.

[14] 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.

Over the 3-year period of 2002-2004, the number of participants in this fishing mode was consistent, with an average of 87 vessels each year. On average, these vessels made between 79 and 84 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 3-year period. Clam dredge vessels landed over 3.8 million bushels of ocean quahogs and almost 3.0 million bushels of surfclams per year, on average.[15]

The majority of clam dredge landings come into three New Jersey ports (Atlantic City, Point Pleasant, and Wildwood, together accounting for 63 percent of average annual landings). Atlantic City (2.2 million bushels per year, on average) and Point Pleasant (1.6 million bushels per year, on average) are the two primary ports for this fishing mode, but New Bedford, MA, also receives over 1 million bushels per year, on average (for 20 percent of total landings). Ocean City, MD, receives a smaller share (660,000 bushels), but still accounts for almost 10 percent of total annual landings. Although there have been up to 23 separate ports of landing in this fishing mode in any 1 year, these five ports account for almost 93 percent of total landings.

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 2002-2004, there were 22-25 vessels that submitted FVTRs (roughly 27 percent of those reporting via the clam log reports). These vessels reported taking between 16 and 35 trips per vessel each year, on average. These trips account for 7.6 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, monkfish, and blue crabs, although small amounts of whelks, cusk, and summer flounder were also reported during this timeframe. Most of the reported landings were sea scallops, with an average of 93,000 lb per year. Blue crab landings were much less, only 2,300 lb per year, and monkfish landings totaled less than 1,000 lb per year.

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 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.

[15] 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.

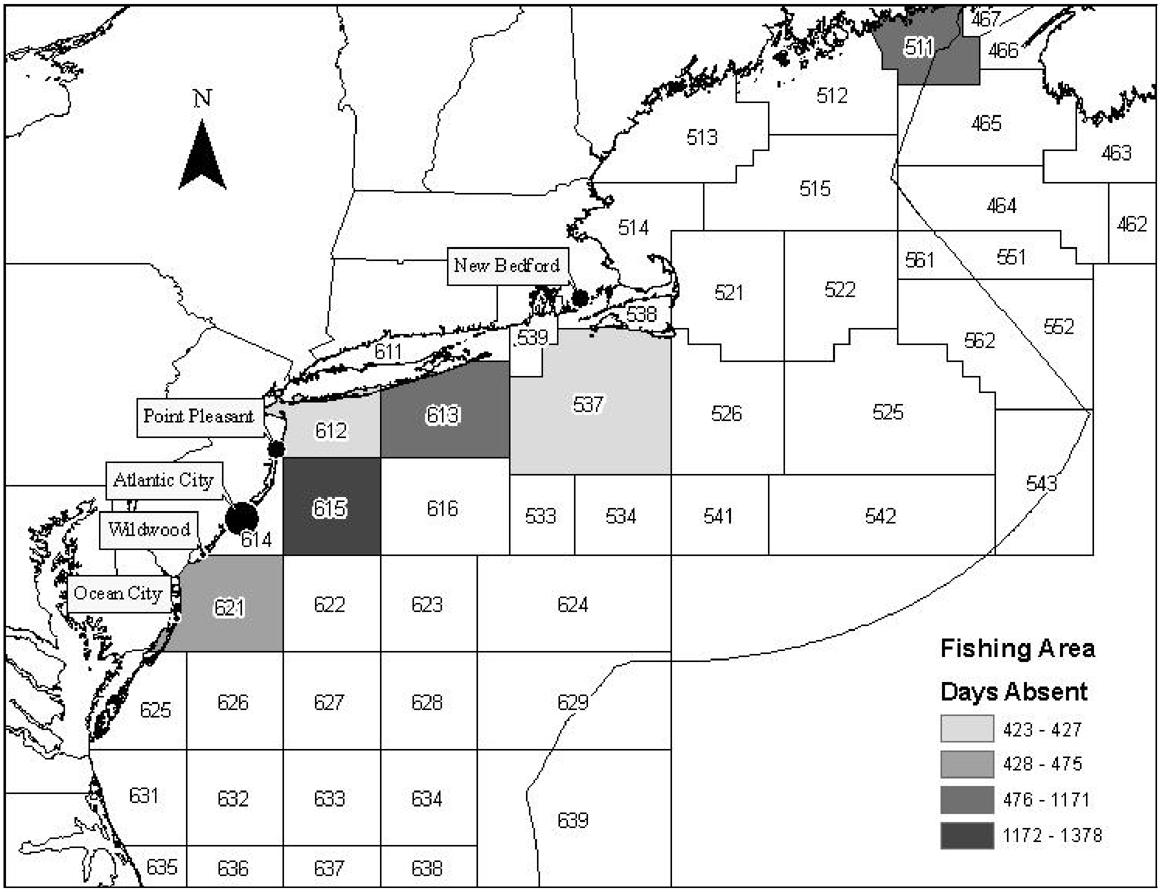

Figure 1. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the clam dredge fishing modes (New England and Mid-Atlantic combined).

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 10-11 trips annually. Most fishing trips in this mode are between 6 and 10 days in duration.

As noted, red crab is the primary target species for this fishing mode, with just under 3 million lb of landings per year. This represents 95 percent of the total landings by this fishery, although small amounts of Jonah crab (44,600 lb per year), green crab (26,500 lb per year), rock crab (17,800 lb per year), and other assorted crabs (56,400 lb per year) are also landed. Most landings currently come in to Fall River, MA, (99 percent of total mode landings in 2004), but this is a recent development (in 2004, the active red crab fishing vessels consolidated their landings in Fall River after moving out of Gloucester, New Bedford, and Fairhaven, MA). Figure 2 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

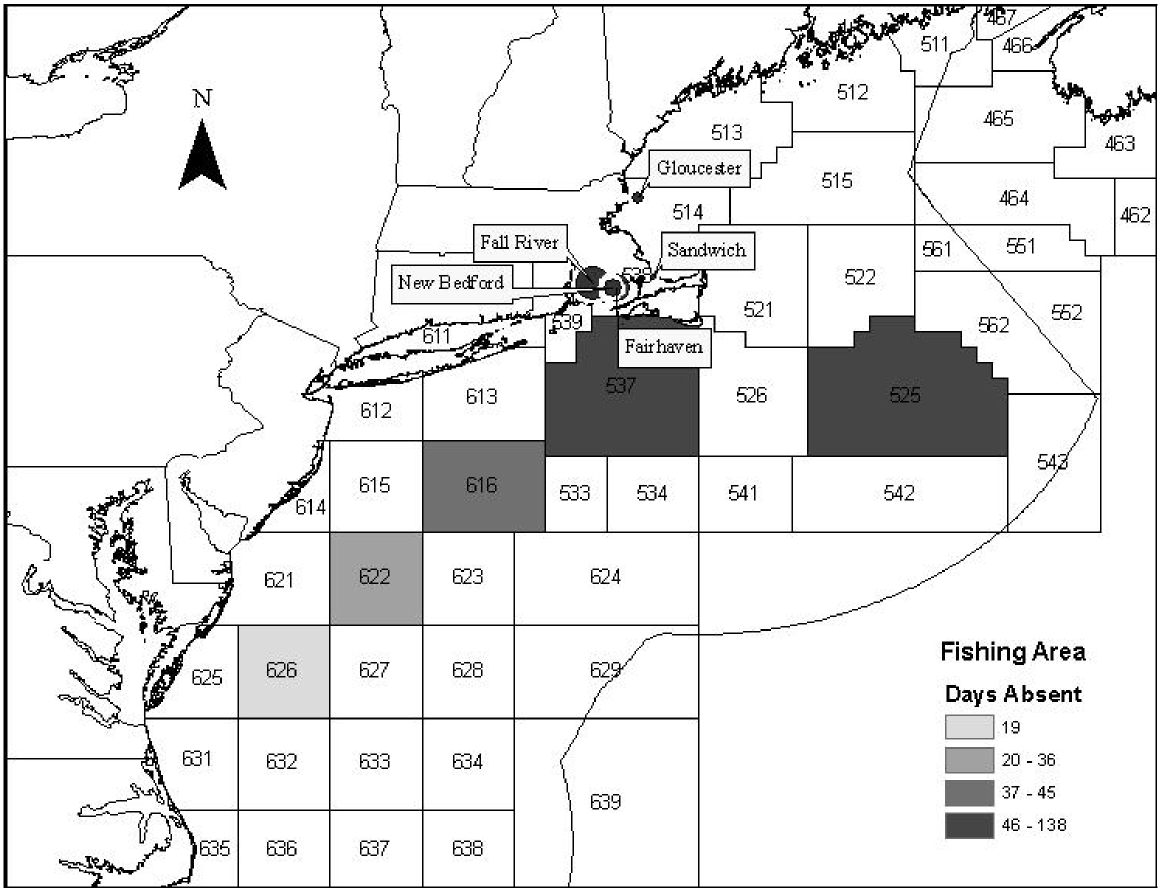

Figure 2. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England crab pot fishing mode.

3.2.2. Mid-Atlantic

Although most of the crab pot fishing effort in this region cannot be quantified using the FVTR database, there are a few federally permitted participants. Federally permitted vessels participating in the Mid-Atlantic crab pot fishery collectively land much smaller amounts of crab than those in New England. From 2000-2004, total landing by federally permitted vessels averaged less than 88,000 lb per year, although landings have increased recently and blue crab landings alone were 180,000 lb in 2004.

Blue crabs comprise most of the landings by federally permitted vessels (almost 84 percent), although red crab, lobster, green crab, and menhaden landings were also reported. The federally permitted vessels land mostly in New York ports (Brookhaven, Freeport, and other locations in Suffolk County), but relatively substantial landings also are made in Cape May, NJ. Figure 3 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

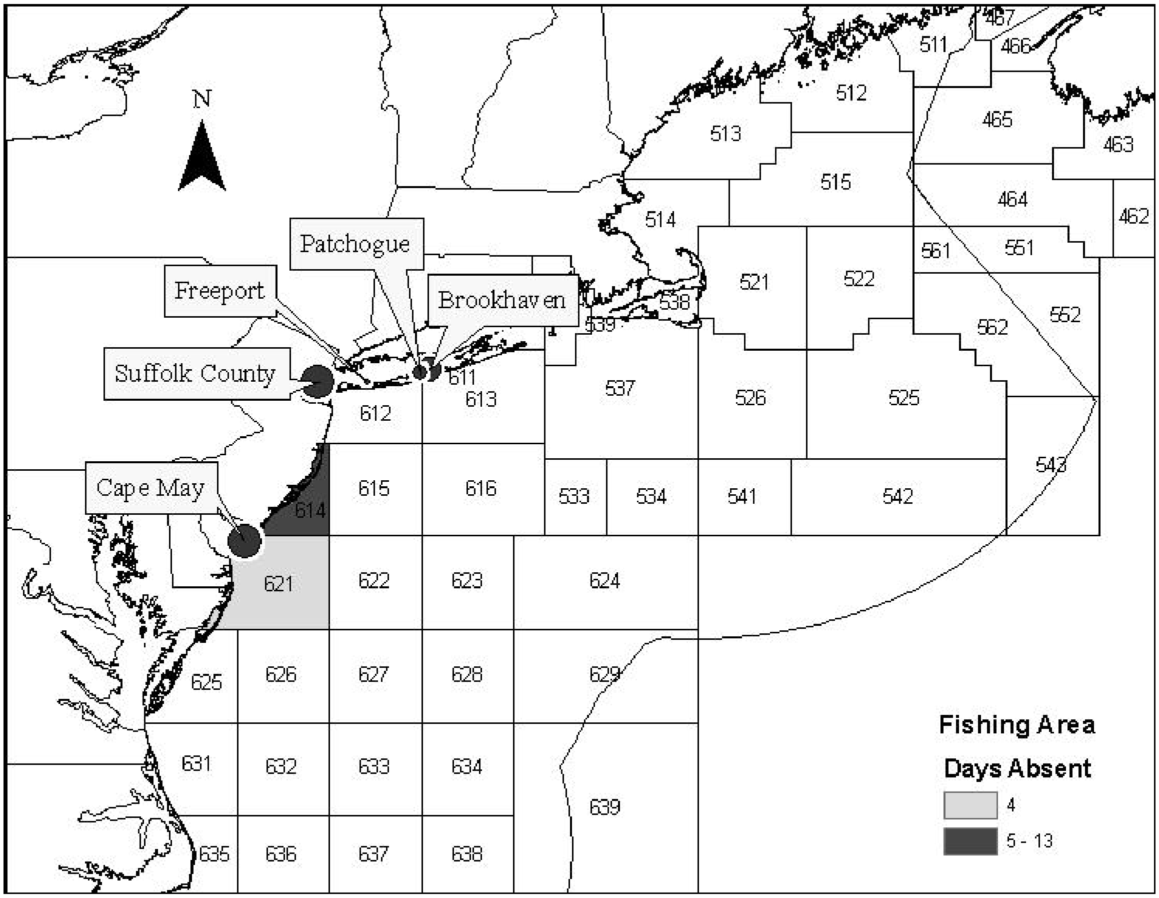

Figure 3. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic crab pot fishing mode.

Overall, the Mid-Atlantic crab fishery is the largest fishery in the region—in 2005, for example, over 25 million lb of blue crabs were landed in North Carolina, and blue crab landings from Chesapeake Bay averaged almost 70 million lb from 2000-2005. 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 Northeast Region 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 black sea bass, scup, and tautog, with approximately 42 participating vessels each year. These vessels make an average of nearly 20 short (less than ½ day, on average) fishing trips each year, although longer trips (as long as 28 days) do occur.

Although black sea bass is generally the top species landed by participants in this fishing mode, with an average of 220,000 lb landed annually, there were substantial amounts of hagfish landed and reported in two years (250,000 lb in 2000 and 970,000 lb in 2003). The hagfish landings could be indicative of an increase in fishing activity for this species, or it may be that most hagfish are being landed by vessels without Federal permits (hagfish is not currently subject to an FMP) and so most landings do not appear in the FVTR database. Absent the hagfish landings in 2000 and 2003, black sea bass account for almost 70 percent of the total annual landings in this fishing mode, and scup account for another 16 percent. Including hagfish, however, reduces the proportions by almost half, as the 2000 and 2003 hagfish landings comprise 43 percent of the total landings for this fishing mode during the years 2000-2004. The development of a Hagfish FMP is presently being considered by the New England Council, which may result in an increase in the amount of this species reported for this fishing mode.

It appears that most of the hagfish landings in 2000 and 2003 were made in Gloucester, MA. Absent the 2 years of hagfish landings, Cotuit, Edgartown, and Tisbury, MA, and Little Compton, RI, accounted for the majority of New England fish pot landings. If hagfish landings are included, Gloucester, MA, becomes the top New England fish pot port, with almost 46 percent of all landings from 2000-2004. Figure 4 displays the top ports and primary fishing areas utilized by participants in this fishing mode and includes all hagfish landings.

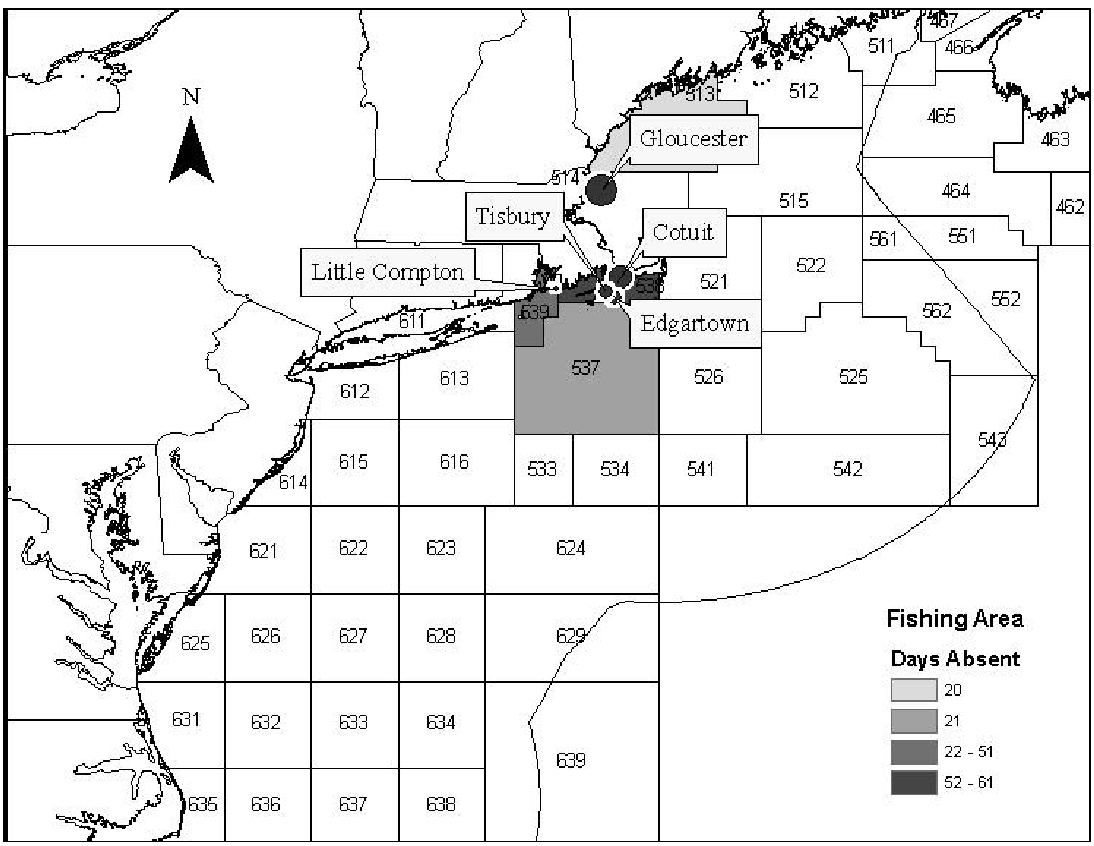

Figure 4. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England fish pot fishing mode. This information includes all hagfish landings.

3.3.2. Mid-Atlantic

Similar to its New England counterpart (absent the hagfish landings), the Mid-Atlantic fish pot fishing mode is primarily a black sea bass fishery, with almost 80 percent of all landings (total landings for this mode average 905,000 lb per year). Participation averaged almost 62 fishing vessels per year, each taking an average of 22 relatively short fishing trips (average trip length is less than ½ day, and the longest trips average only 6 days).

Although over 40 different species are landed each year in this mode, five species account for over 90 percent of all landings by weight. Black sea bass landings, as noted above, predominate, with an average of 723,000 lb per year. Tautog (49,000 lb per year), channeled whelks (35,000 lb per year), eels (21,000 lb per year), and lobster (17,000 lb per year) together comprise 13.5 percent of the total annual landings. Ocean City, MD, is the top port, with over 230,000 lb of landings each year (25 percent of the total landings). Virginia Beach, VA, and Sea Isle City, NJ, are also primary ports for this mode, and together take in 30 percent of the annual landings. Figure 5 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

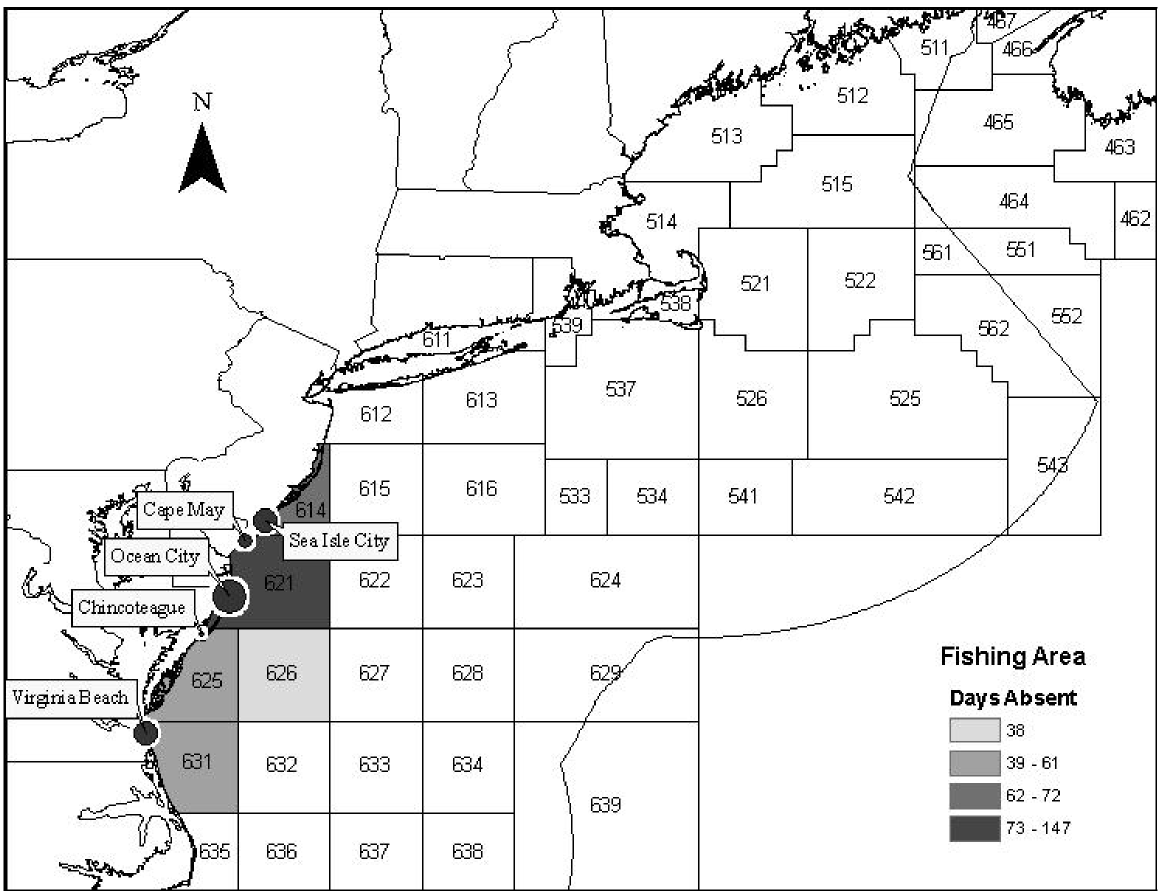

Figure 5. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic fish pot fishing mode.

3.4. 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.

3.4.1. Small-Mesh Gillnets

3.4.1.1. New England

The New England small-mesh gillnet fishery is a fairly small fishing mode, with a relatively small fleet that averaged 25 vessels participating in any one year (42 vessels participated in 2000, but since then the number has dropped with either 21 or 23 participating vessels). 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, but up to 5 days, in duration.

Total landings of fish for this fishing mode have averaged 103,700 lb, a very small component of the overall groundfish-type fisheries in the Northeast Region. Top species landed include pollock (just over 22,000 lb per year, on average), cod (under 18,000 lb per year), monkfish (just over 12,000 lb per year), and skates (just under 11,000 lb per year). Primary ports for this fishing mode include Gloucester and Chatham, MA, with just under half of all landings coming in to these two ports. Figure 6 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

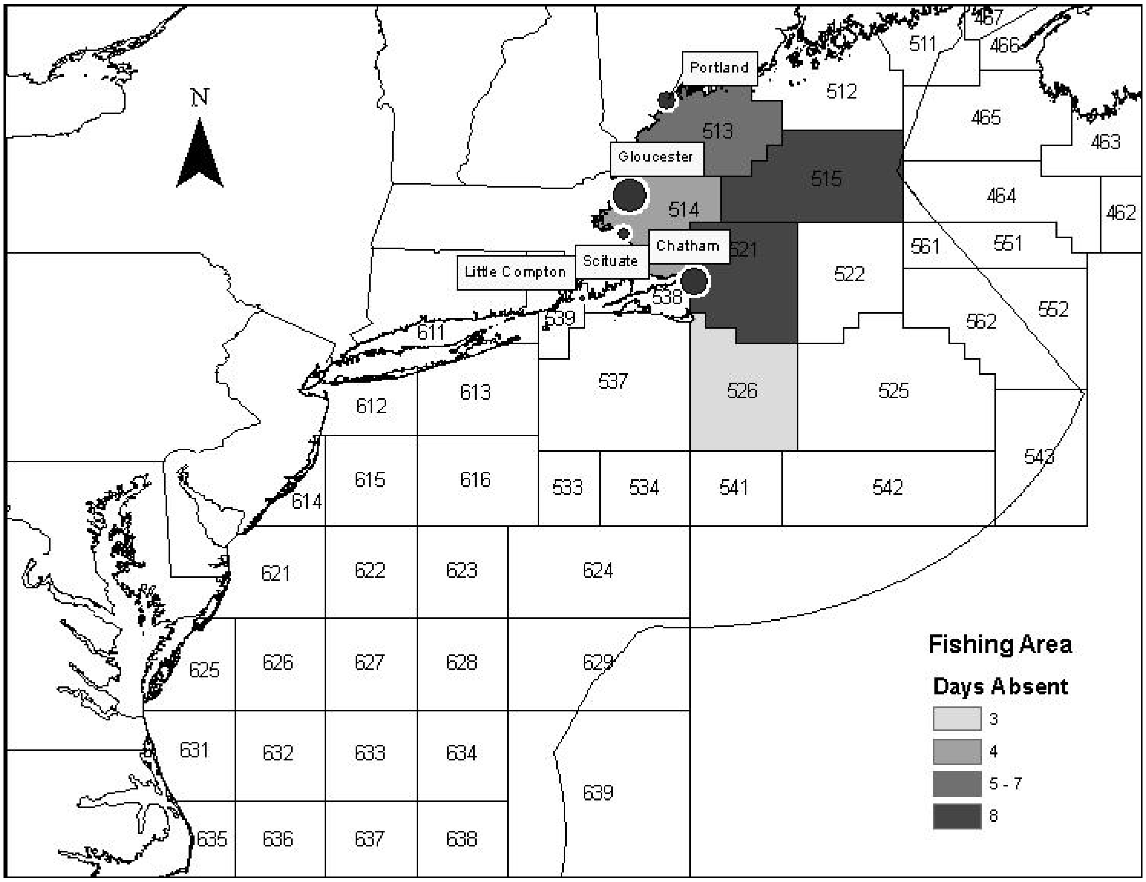

Figure 6. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England small-mesh gillnet fishing mode.

3.4.1.2. 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 almost 3.8 million lb. These vessels together take an average of over 2,700 fishing trips per year (for an average of more than 27 trips per vessel per year). Trips generally last less than 1 day, but can exceed 9 or 10 days in duration. Vessels participating in this fishery primarily land at ports in New Jersey (Long Beach and Point Pleasant), Virginia (Virginia Beach and Chincoteague), and New York (Shinnecock).

Atlantic croaker and bluefish are the primary species landed by participants in this fishing mode, together comprising almost two-thirds of all landings. Landings of croaker exceeded 1.3 million lb, on average, over the 5-year timeframe examined. Bluefish landings were just under 1.1 million lb per year. Landings of menhaden, spot, and weakfish together averaged another 800,000 lb. Figure 7 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

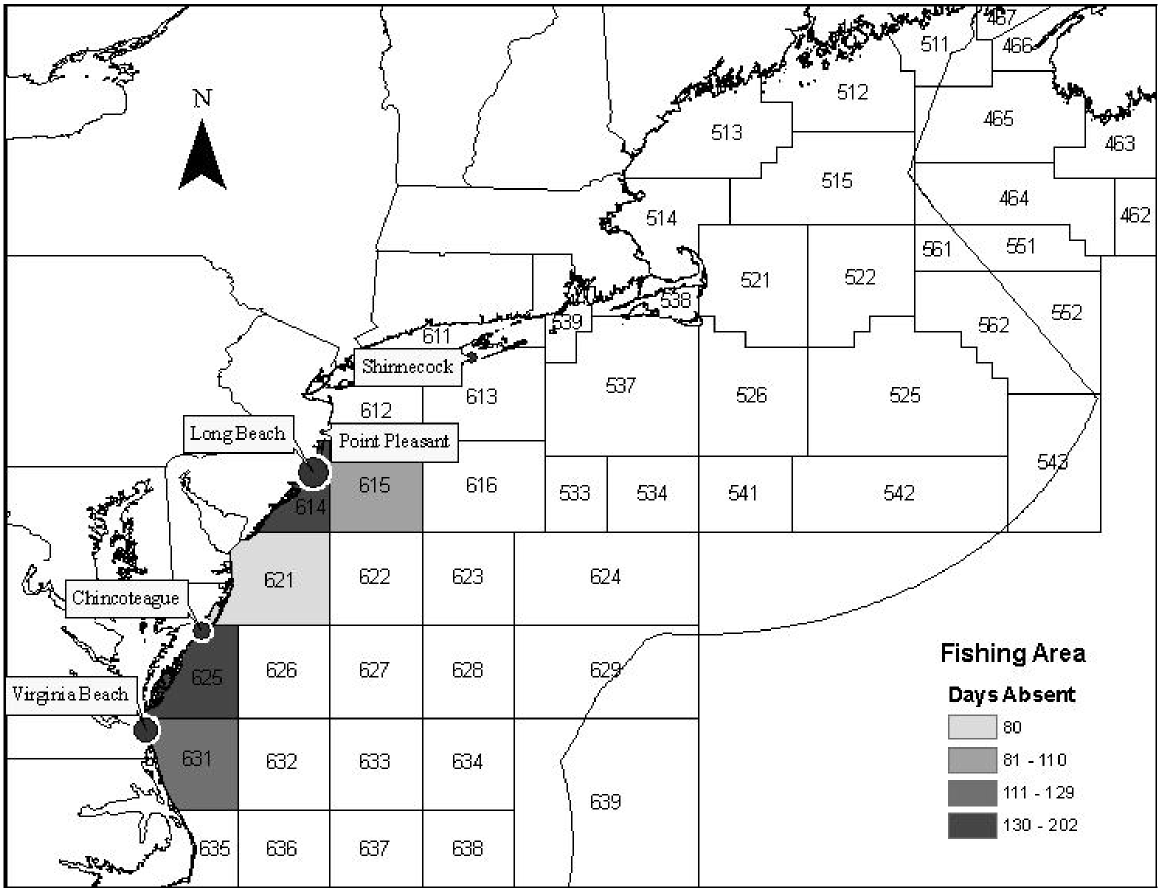

Figure 7. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic small-mesh gillnet fishing mode.

3.4.2. Large-Mesh Gillnets

3.4.2.1. New England

The biggest component of the New England gillnet fishery is the large-mesh gillnet fishing mode. Between 2000 and 2004, an average of 168 vessels participated, although this declined somewhat from 179 in 2000, to 150 in 2004. These vessels averaged 33 trips each year, landing almost 70 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 20-25 days in duration, also occurred.

Total landings of fish in this mode exceeded 12.7 million lb per year, with cod and pollock the primary species. Together, cod (4.1 million lb per year) and pollock (almost 3.4 million lb per year) accounted for almost 60 percent of total landings, and spiny dogfish, white hake, and monkfish comprised another 20 percent of total landings for the fishing mode. Most landings were made in Gloucester, MA (almost 27 percent), Chatham, MA (21 percent), and Portland, ME (almost 20 percent). Figure 8 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

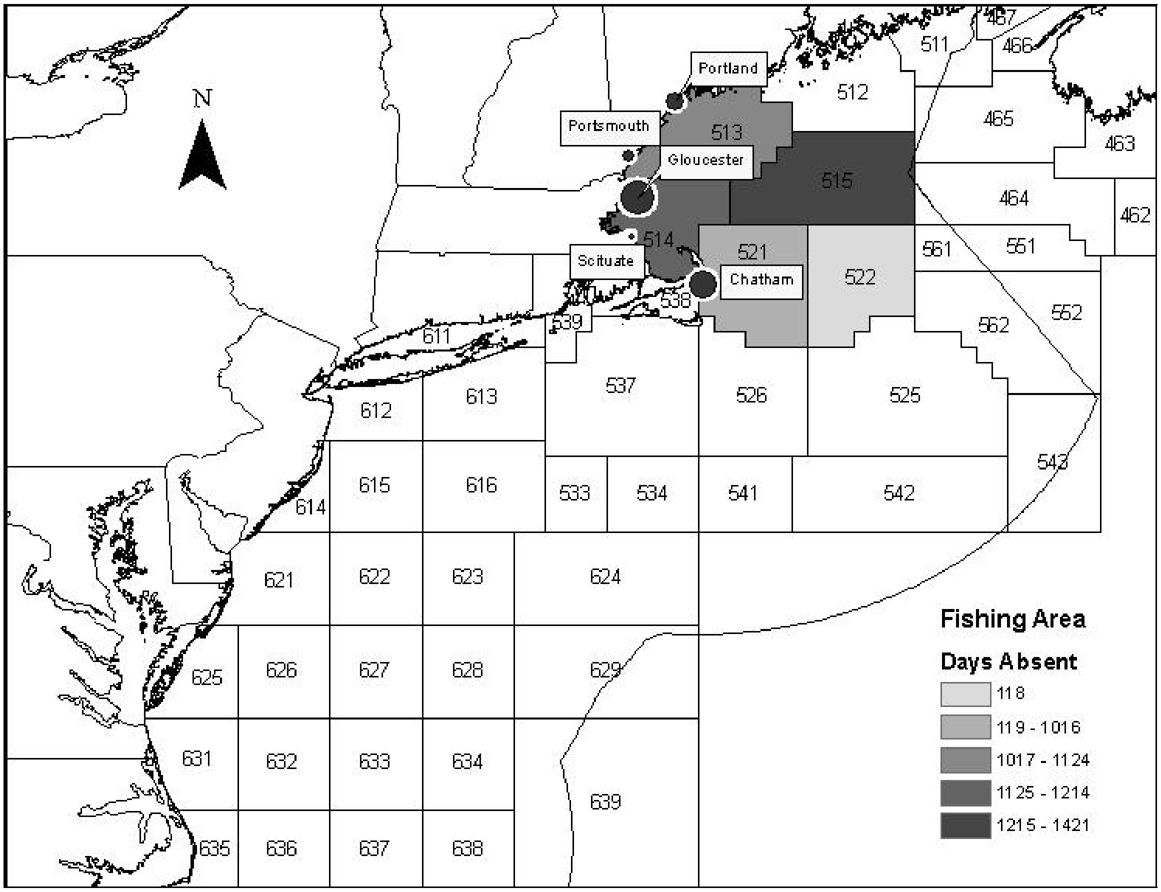

Figure 8. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England large-mesh gillnet fishing mode.

3.4.2.2. 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 83 vessels participate in this fishing mode each year, making an average of 12 trips each. Average trip duration is less than 1 day, but the longest trips are 10 days or less.

The majority of landings in this fishing mode are of either smooth or spiny dogfish (an average of 532,000 lb and 226,000 lb per year, respectively). Bluefish are also a substantial component of the landings (271,000 lb per year). Together, these three species comprise 69 percent of the 1.5 million lb in total annual landings. Similar to the small-mesh gillnet fishery, most landings are made in Chincoteague, VA (28 percent), Long Beach, NJ (21 percent), Virginia Beach, VA (11 percent), Point Pleasant, NJ (6 percent), or Ocean City, MD (6 percent). Figure 9 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

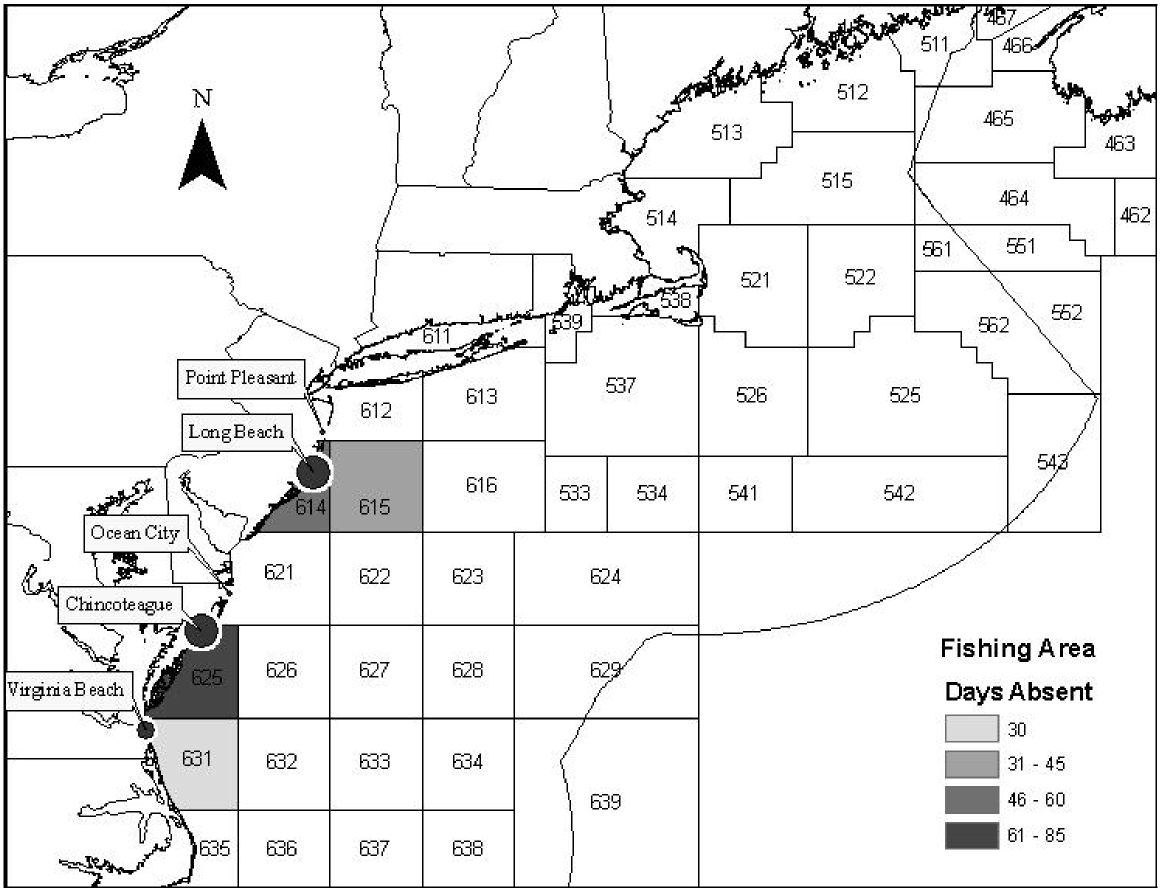

Figure 9. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic large-mesh gillnet fishing mode.

3.4.3. Extra-Large-Mesh Gillnets

3.4.3.1. New England

While participation in the large-mesh gillnet fishery has decreased, the New England extra-large mesh gillnet fishery has grown from 117 participating vessels in 2000 to 146 vessels in 2004. Over this time, participating vessels made an average of just under 33 fishing trips each per year. Trip duration for all participating vessels averaged just under 1 day, with some trips up to 20 days in duration in the last 3 years.

This is a fairly targeted fishing mode, with most landings (over 60 percent) of monkfish alone. There were over 8.5 million lb of monkfish landed, on average, between 2000 and 2004. Skates represented the second largest component of landings, with 3.8 million lb per year (24 percent of total landings). Some Northeast multispecies were also landed, but the primary groundfish species, cod and pollock, together comprised only 8 percent of total landings for this fishing mode. Although participating vessels made landings at an average of 28 ports each year, slightly less than half (45 percent) of the landings, by weight, were made at just three ports in Massachusetts (New Bedford, Chatham, and Gloucester). Figure 10 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

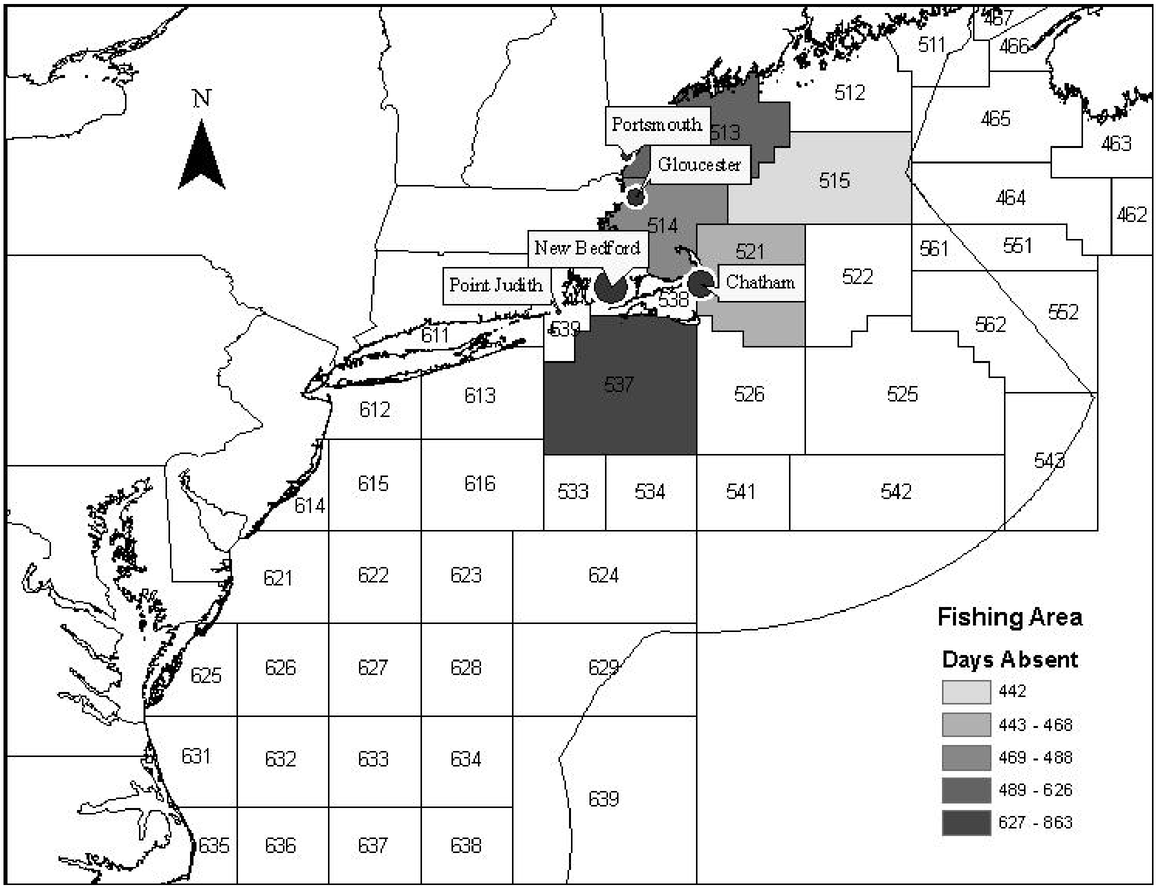

Figure 10. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England extra-large-mesh gillnet fishing mode.

3.4.3.2. 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 Mid-Atlantic, there were an average of 100 participating fishing vessels that made an average of over 30 trips each per year. Fishing trips, at just over a ½ day in average duration, were shorter in the Mid-Atlantic than in New England.

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 may be considered even more targeted than New England, because over 81 percent of all landings in this mode (over 5 million lb per year) are monkfish. Skates represent another 12 percent of landings, while the rest of the landings are striped bass, Atlantic mackerel, and bluefish (all under 2 percent).

Most of the Mid-Atlantic extra-large mesh gillnet landings are made in Long Beach and Point Pleasant, NJ (together 60 percent), but Chincoteague, VA (7 percent), Shinnecock, NY (5 percent), and Barnegat, NJ (5 percent), also factor among the top five ports of landing. Figure 11 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

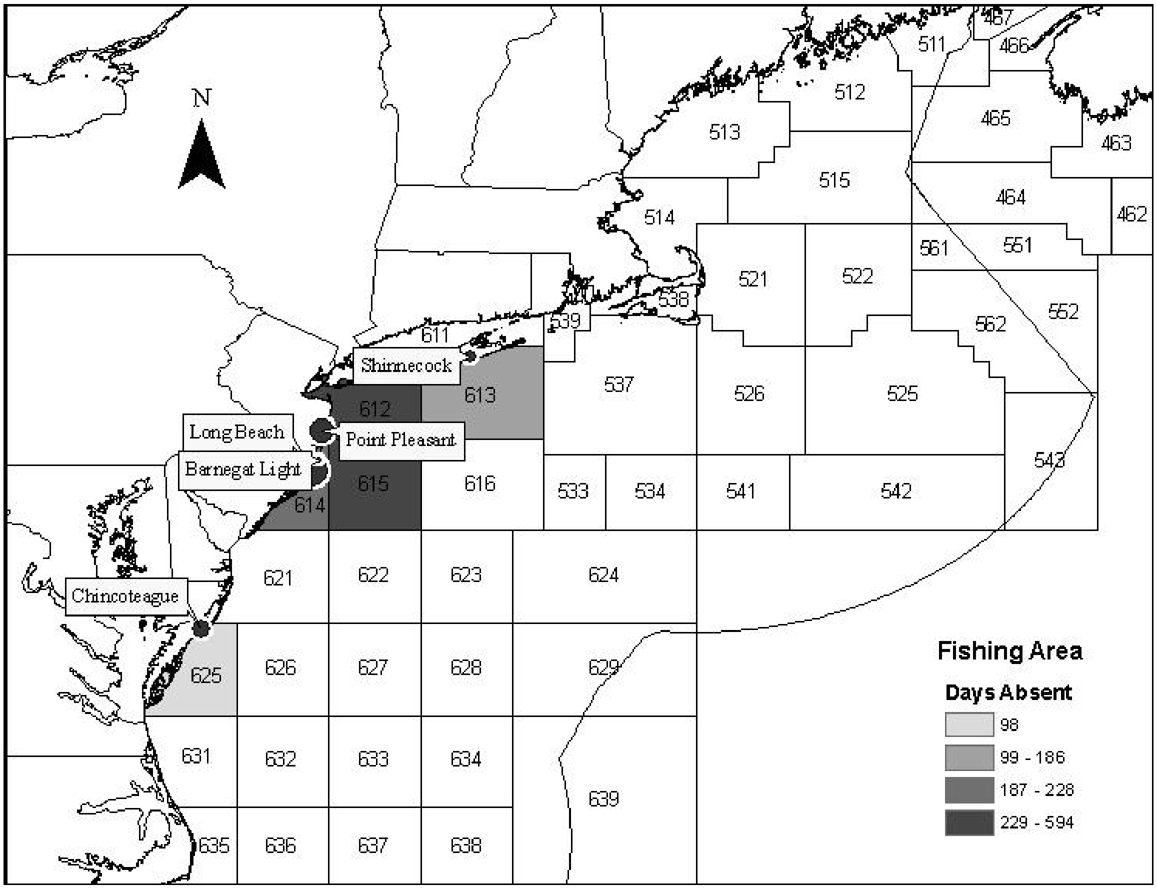

Figure 11. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic extra-large-mesh fishing mode.

3.5. Handline and Rod and Reel Fishery

3.5.1. New England

The New England handline and rod and reel fishing mode has more participants reporting via FVTRs than any other fishing mode, with almost 680 vessels, on average, per year. There has been a fair amount of variability in the number of participants over time, with as many as 766 in 2002, and as few as 585 in 2004. On average, participants in this fishing mode take 23 fishing trips per year, and trips averaged less than a ½ day in duration but longer trips, up to 20-25 days, did occur.

This is primarily a cod fleet (48 percent of landings), although a number of these vessels target bluefin tuna (almost 14 percent of landings). In spite of the substantial numbers of participants, the amount of cod landed (1.3 million lb per year) remains less than one-third of the cod landings of the large-mesh gillnet fleet. In addition to cod and bluefin tuna (375,000 lb per year), scup, pollock, and striped bass are also landed, albeit in smaller amounts.

The New England handline and rod and reel fleet, along with having a large number of participants, reports landings at over 100 ports per year (up to 144 ports in 2003), but 60 percent of landings are concentrated at just 5 ports: Harwichport, MA (622,000 lb per year); Chatham, MA (412,000 lb per year); Barnstable, MA (221,000 lb per year); Gloucester, MA (214,000 lb per year); and Point Judith, RI (126,000 lb per year). Figure 12 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

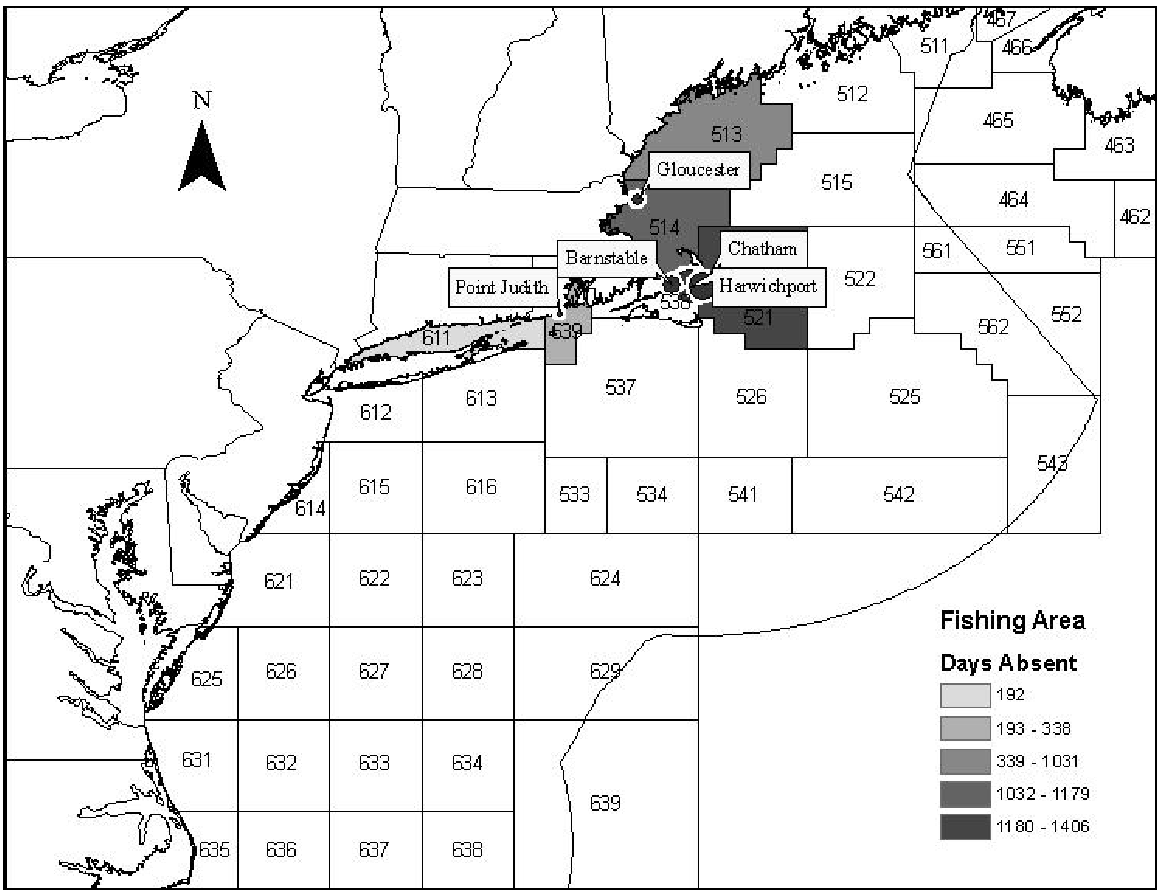

Figure 12. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England handline/rod and reel fishing mode.

3.5.2. Mid-Atlantic

A similarly large fleet, with over 500 participating vessels per year, the Mid-Atlantic handline and rod and reel fishing mode shares many functional characteristics with the New England mode, but targets completely different species. Each participating vessel, on average, made over 44 trips per year, landing at well over 100 ports (the number of ports has increased substantially in the last few years—in 2000, there were 82 reported ports of landing, but by 2003 this had increased to 209). Trips generally last less than ½ day, but trips over 20 days in duration have occurred each year.

As noted above, the similarities between the New England and Mid-Atlantic modes end when it comes to the species landed. Black sea bass dominates (over 1.0 million lb per year, 31 percent of total landings), but scup (almost 650,000 lb per year), bluefish (490,000 lb per year), mackerel (over 230,000 lb per year), and Atlantic mackerel (220,000 lb per year) are also important species to this fishing mode. Although over 115 species are landed per year by participants in this fishery, these five species represent almost 80 percent of total landings. One-fifth of all landings are made in Montauk, NY, but central New Jersey (Point Pleasant, Brielle, and Belmar) is also a primary area for this fishing mode, with almost one-third of all landings being fairly evenly divided among these three ports. Virginia Beach, VA, with 8 percent of landings, also ranks in the top five ports. Figure 13 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

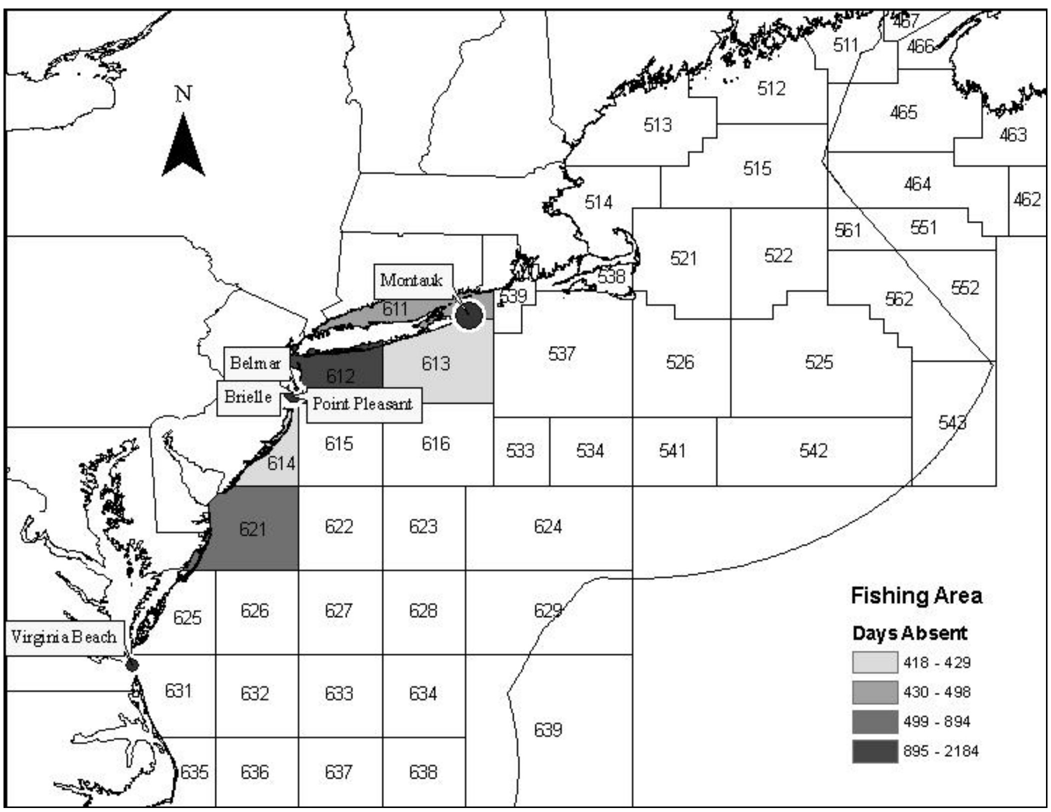

Figure 13. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic handline/rod and reel fishing mode.

3.6. 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.

3.6.1. 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 650 participants in the New England lobster pot fishing mode that submit FVTRs each year, and these participants take an average of 61 fishing trips each year. Most fishing trips are well under 1 day in duration, although trips lasting 20-30 days do occur each year.

American lobster is the primary species landed in this fishing mode, with an average of nearly 16 million lb landed each year by participants that submit FVTRs. This represents over 70 percent of the total landings by these participants. Jonah crab is also a significant component of this fishing mode, with an average of nearly 5 million lb landed annually. Together, lobster and Jonah crab comprise 95 percent of the total reported landings in this mode. Various crab species (rock, red, among others) also factor as landings, but in much smaller amounts.

Landings in this fishing mode are fairly spread out among over 150 ports in New England, and the top 5 ports (Sandwich, MA, Newport and Point Judith, RI, Newington, NH, and Gloucester, MA) together account for only 41 percent of the landings made by reporting participants. Sandwich, MA, averaged 2.5 million lb (11 percent of the total reported landings), while the other four each average 1.5-1.7 million lb (7-8 percent of total reported landings). Figure 14 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

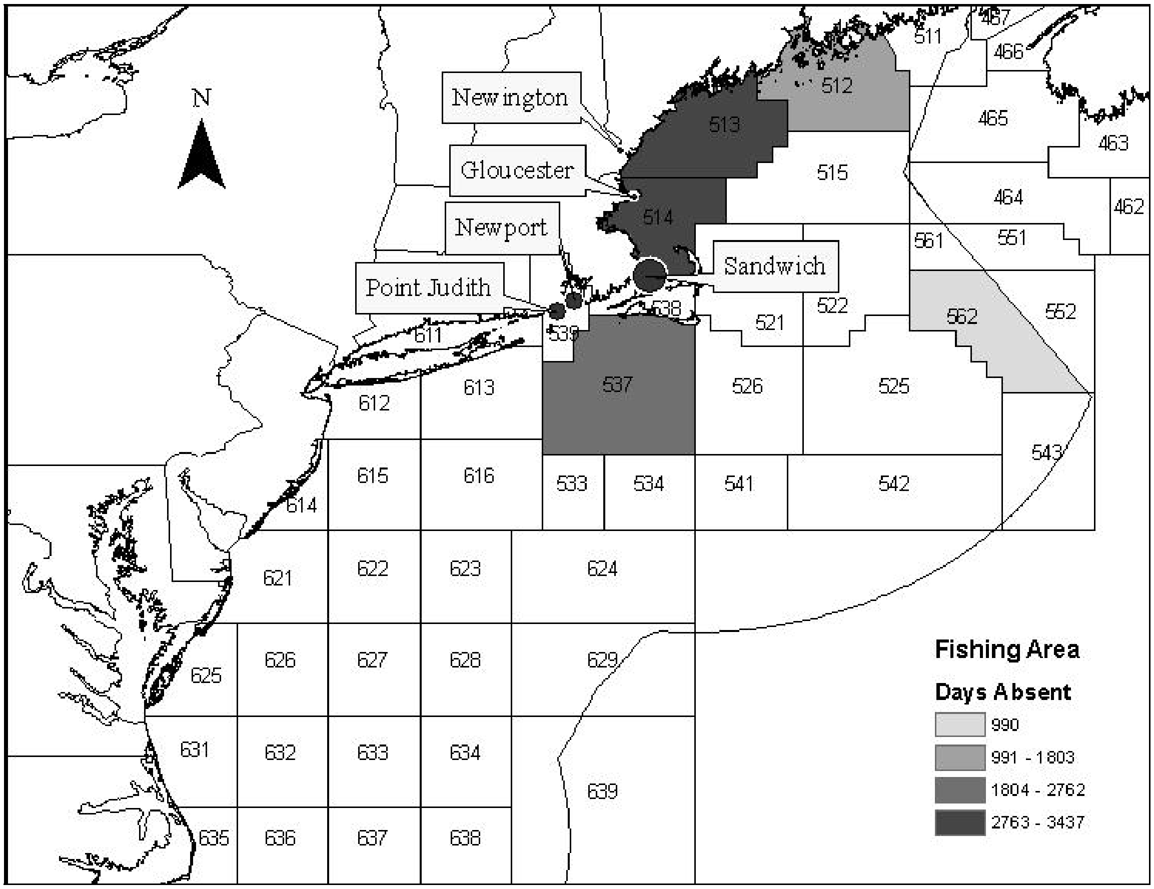

Figure 14. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England lobster pot fishing mode.

3.6.2. 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 100 per year. These participants take fewer fishing trips, about 30, per year. Most trips last well under 1 day, and the longest trips tend to be between 10 and 16 days in duration.

As expected, American lobster is the primary species landed, although at 1 million lb per year, these landings represent a small fraction of the 16 million lb per year landed in New England. Lobsters comprise almost 76 percent of the annual landings, with Jonah crab (195,000 lb) and black sea bass (45,000 lb) adding another 18 percent of total landings. Montauk, NY (360,000 lb per year), Point Pleasant, NJ (248,000 lb per year), and Sea Isle City, NJ (166,000 lb per year), are the top ports for participants in this fishing mode that report via FVTR. Together these three ports take in over 58 percent of the total reported landings for this mode. Freeport, NY, and Belford, NJ, together account for another 11 percent of the reported landings each year. Figure 15 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

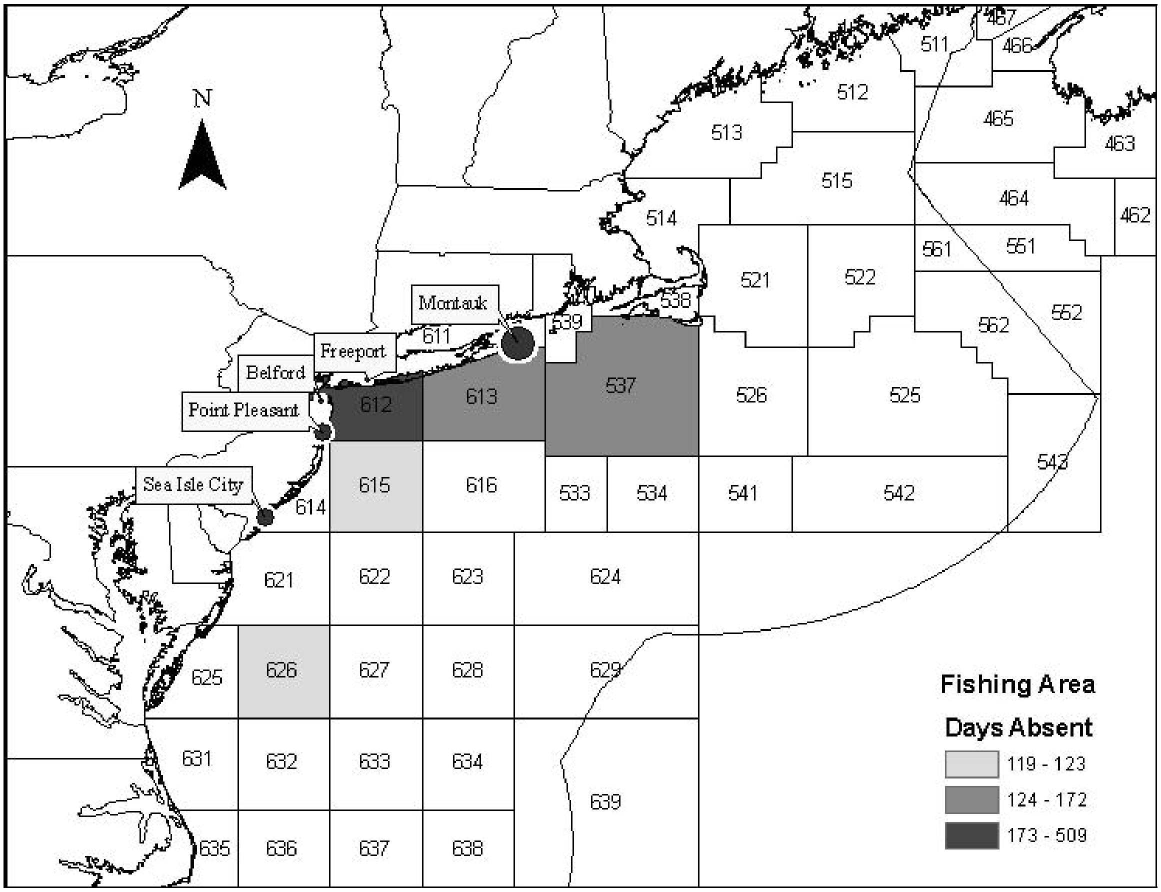

Figure 15. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic lobster pot fishing mode.

3.7. 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.

3.7.1. New England

The number of participants in the New England bottom longline fishing mode has decreased from 90 vessels in 2000 to 69 vessels in 2004, with an average of 77 participating vessels each year. These vessels take an average of 20 fishing trips each per year, each lasting an average of just under 1 day (the longest trip in the time series, over 21 days, occurred in 2003, and, by contrast, the longest trip in 2004 was 8.6 days in duration).

Spiny dogfish (almost 1.5 million lb per year) and cod (just over 1.3 million lb per year) are the primary species landed by participants in this fishing mode, together representing over 75 percent of the total mode landings, with haddock (almost 525,000 lb per year) representing another 14 percent. Most of the landings by the New England bottom longline fleet come to Chatham, MA (53 percent), but Harwichport, MA (22 percent) is also very important. Secondary ports include Gloucester, MA (8 percent), Portland, ME (4 percent), and Scituate, MA (3 percent). Figure 16 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

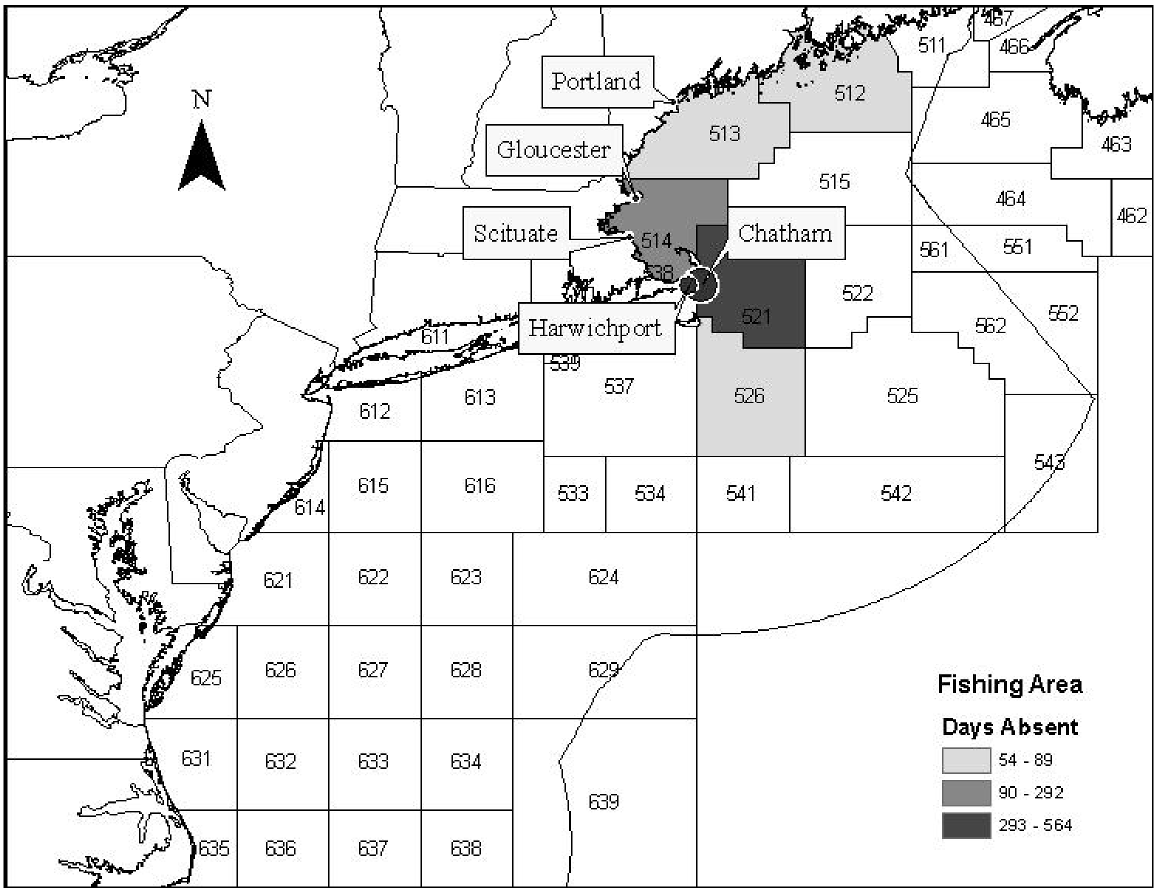

Figure 16. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England bottom longline fishing mode.

3.7.2. Mid-Atlantic

The Mid-Atlantic bottom longline fishery is a much smaller, much more focused fishing mode that primarily targets tilefish. On average, fewer than 16 vessels participate each year, making an average of just under 11 fishing trips per year. Fishing trips average just under 5.5 days in duration, but trips up to 15 days occur.

As noted, this is a much more focused fishing mode than many others, with 95 percent of landings being tilefish, of which at least 78 percent is golden tilefish. Similarly, nearly 85 percent of the landings are made on Long Island, NY, in Montauk

(68 percent), Hampton Bay (11 percent), and Shinnecock (4 percent), and the remaining landings (15 percent) come in to Long Beach, NJ. Figure 17 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

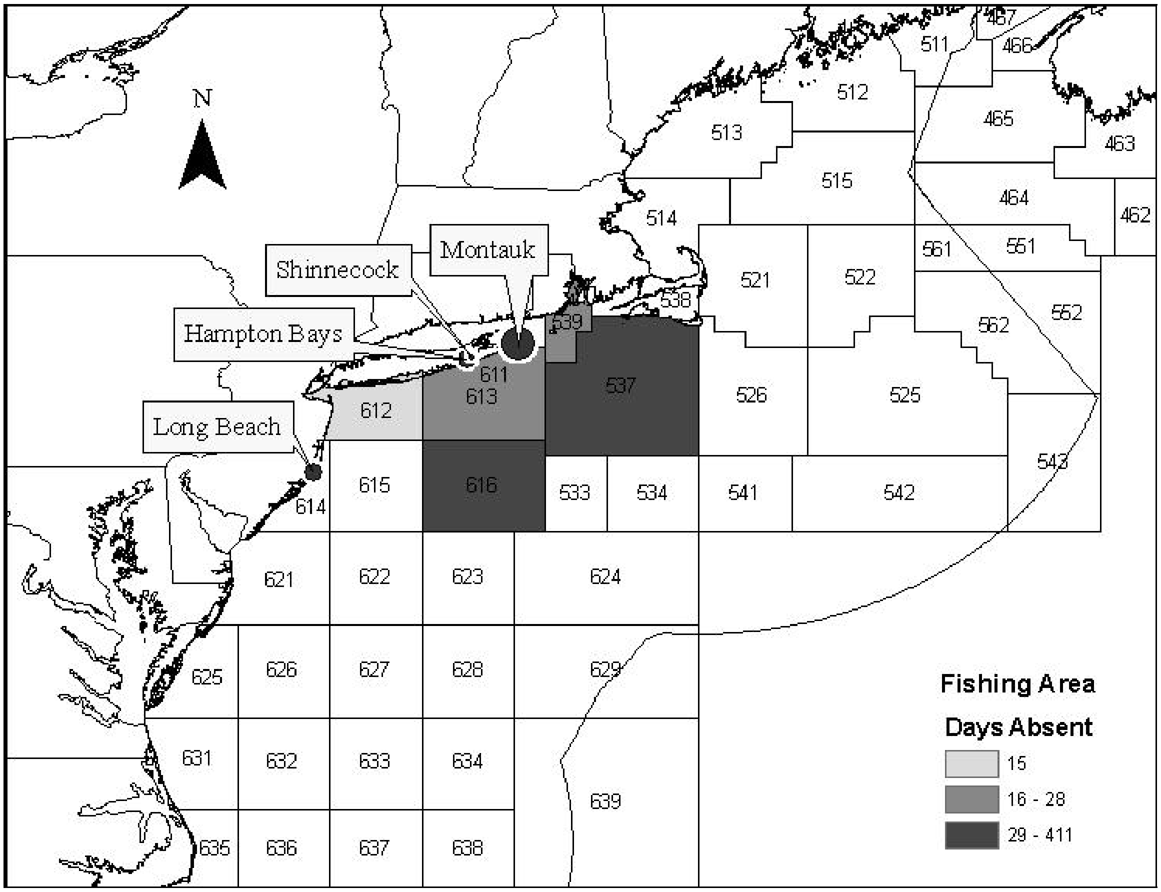

Figure 17. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic bottom longline fishing mode.

3.8. Mid-Water Single and Pair Trawl Fisheries

For the purposes of the development and application of the Northeast Region SBRM, paired and single midwater trawls are considered together in the stratification of observer data and the allocation of observer effort. However, this section discusses each type of trawl configuration separately and, within each type of configuration, the New England and Mid-Atlantic modes are separately addressed. This is done primarily for ease of analyzing the data from the FVTR database, and, as described below, there are many similarities between the two gear configurations that allow them to be treated together within the SBRM.

3.8.1. New England Midwater Pair Trawl

All of the midwater trawl fisheries are large volume fisheries with relatively few participants. The New England pair trawl mode averages less than 14 active participants each year, and each participants takes, on average, nearly 50 fishing trips per year. Most trips are relatively short, averaging just 1.5 days, but longer trips 7-15 days in duration do occur. The New England pair trawl fishing mode is an extremely targeted fishery, with no more than three species landed in any year from 2000-2004. Over 85 percent of the annual landings are Atlantic herring (nearly 121 million lb per year), and Atlantic mackerel (15 percent, or 21 million lb, per year) generally comprises the remainder. Occasional landings of spiny dogfish occur, but the amounts (11,000 lb per year) are negligible compared to the two primary species.

Gloucester, MA, is the top port for this fleet, receiving over 32 percent of the annual landings (45.7 million lb). Portland, ME, and New Bedford, MA, rank second and third, respectively, with 21.4 million lb (15 percent of the total) landed each year in Portland, and 19.8 million lb (14 percent) coming in each year to New Bedford. Portsmouth, NH, and Rockland, ME, complete the top five ports, with a total of 22.7 million lb (16 percent of the total) between them. Figure 18 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

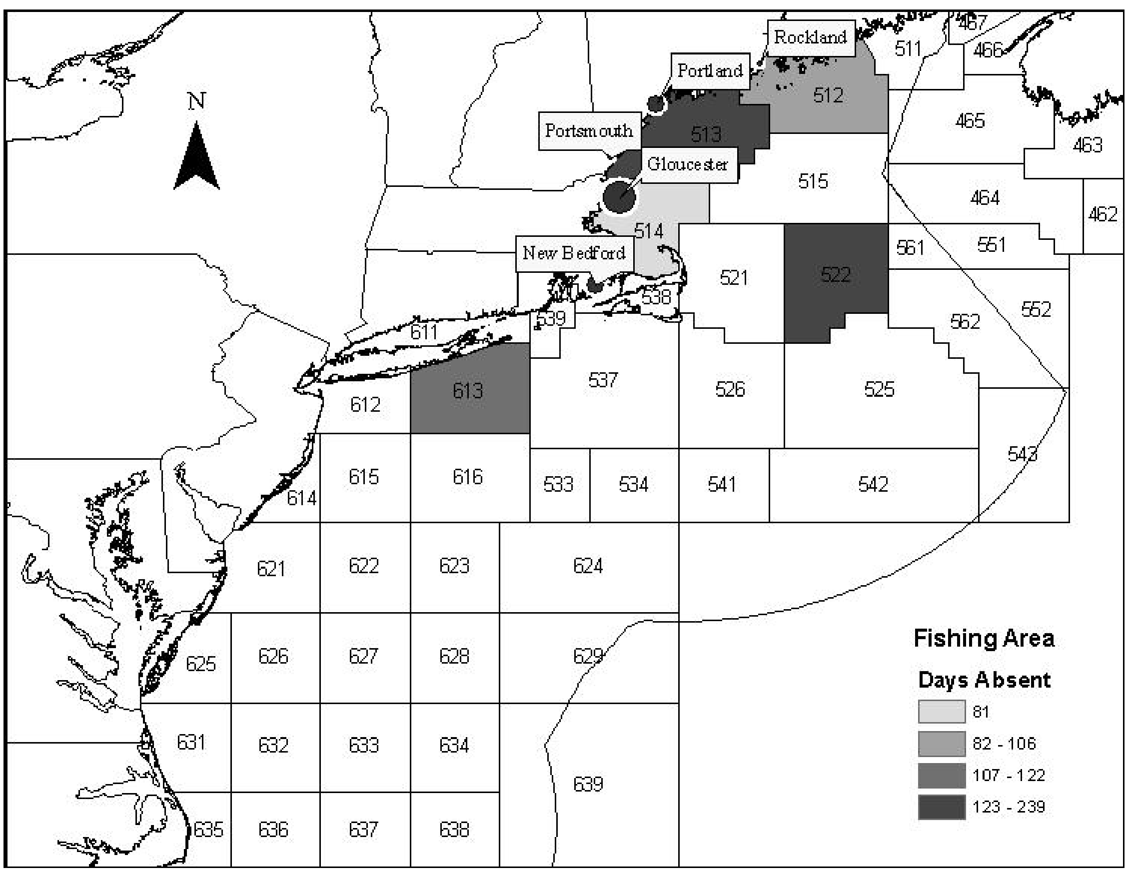

Figure 18. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England midwater pair trawl fishing mode.

3.8.2. New England Midwater Single Trawl

The New England midwater single trawl fishing mode is similar in size to the pair trawl, with an average of 17 participants per year. These vessels take an average of 23 trips each per year, less than half the number of trips taken by the New England pair trawls. The total annual landings of this fleet, at 68.2 million lb, is similarly about half that of the pair trawl fleet. Trip lengths are about the same, if slightly shorter on average, as the pair trawls, at 1.5 days in duration, although the longest trips average slightly longer for the single trawls than the pair trawls (13.4 days versus 10.5 days).

The species landed in this mode are largely the same as for New England pair trawls, with almost 84 percent of all landings being Atlantic herring and Atlantic mackerel comprising another 16 percent. The only other landings of note included almost 1.3 million lb of *Illex* squid in 2003, but this represents 96 percent of all *Illex* landed by this fleet, so this species is not a typical component of the landings. Although there are a variety of other species occasionally landed, the amounts (generally less than 10,000 lb per year) are negligible relative to herring and mackerel.

Portland, ME, is the primary port for the midwater single trawl fleet, with over 42 percent of the annual landings (nearly 29 million lb). Gloucester, MA, is second, with 16 percent of the landings (11 million lb per year). Point Judith, MA (9 million lb), and North Kingstown, RI (7 million lb), also receive substantial amounts of this fleet’s annual landings. Bath, ME, accounted for 32 percent (25 million lb) of the fleet landings in 2000, but landings in Bath declined to 3.8 million (5 percent) in 2001 and, since 2001, Bath has not been in the top 10 ports annually. Figure 19 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

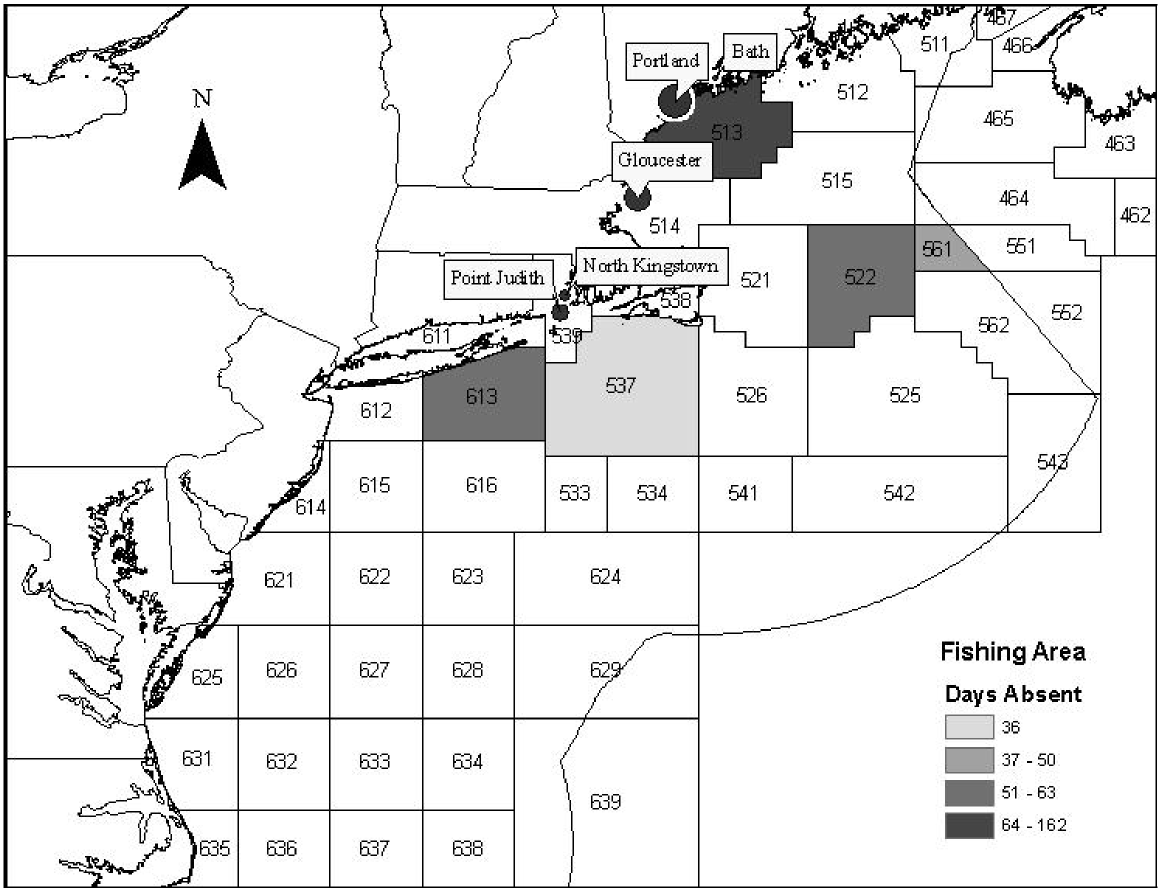

Figure 19. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England midwater single trawl fishing mode.

3.8.3. Mid-Atlantic Midwater Pair Trawl

The Mid-Atlantic midwater trawl modes, both paired and single trawl, are smaller than their New England counterparts. The Mid-Atlantic pair trawl mode has averaged just over six vessels per year for the last 3 years.[16] Trips averaged 2.5 days in duration, and each vessel took, on average, over 10 trips each year. In contrast to the New England midwater trawl fishing mode, for which Atlantic herring is the primary target species, in the Mid-Atlantic, Atlantic mackerel is the top species.

Nearly 95 percent of all landings by Mid-Atlantic midwater pair trawls is Atlantic mackerel, averaging over 22 million lb per year. Just over 1 million lb per year of Atlantic herring are landed by this fleet, and relatively insignificant amounts of chub mackerel, Atlantic croaker, and menhaden are also landed, although these last three species together account for less than 1 percent of total annual landings.

[16] There were no data for this sector in 2000 in the FVTR database, and only one trip was reported in 2001, so these years were excluded from the analysis.

Not only is Cape May, NJ, the top port for this fishing mode, it is the only port where the vessels participating in this fishery have landed their catch in the last 3 years. Figure 20 displays primary fishing areas utilized by participants in this fishing mode.

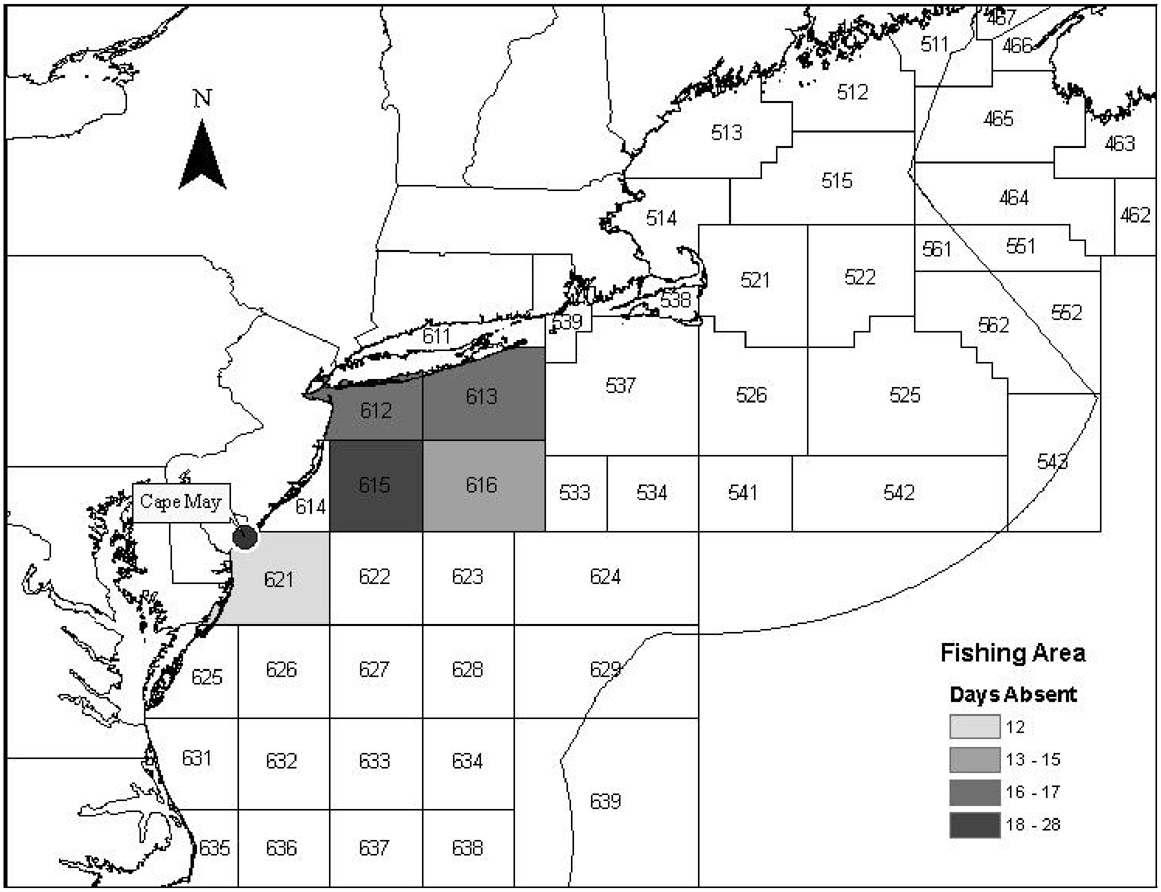

Figure 20. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic midwater pair trawl fishing mode.

3.8.4. Mid-Atlantic Midwater Single Trawl

The Mid-Atlantic midwater single trawl fishing fleet also has an average of six active vessels participate each year, and these vessels take, on average, approximately 10 trips per year, with the majority of trips lasting over 2 days. Longer trips, up to 20 days in duration, have occurred.

As with the pair trawl fleet, the primary species landed by the participants of the single trawl fishery are Atlantic mackerel (83 percent of the total landings) and Atlantic herring (11 percent of the total landings). However, the total landings by this sector represent less than half of the landings from the pair trawl fleet (10.7 million lb per year versus 23.4 million lb per year). In addition to Atlantic mackerel and Atlantic herring, blueback herring (250,000 lb per year), *Loligo* squid (124,000 lb per year), and bluefish (89,000 lb per year) are also landed. Together, these three species account for 4.3 percent of the total annual landings by this fishing mode.

While Cape May, NJ, is the top port for this fleet, with 98 percent of the annual landings, relatively small amounts of catch are landed in Greenport, NY, Hampton, VA, Newport News, VA, and Montauk, NY. Figure 21 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

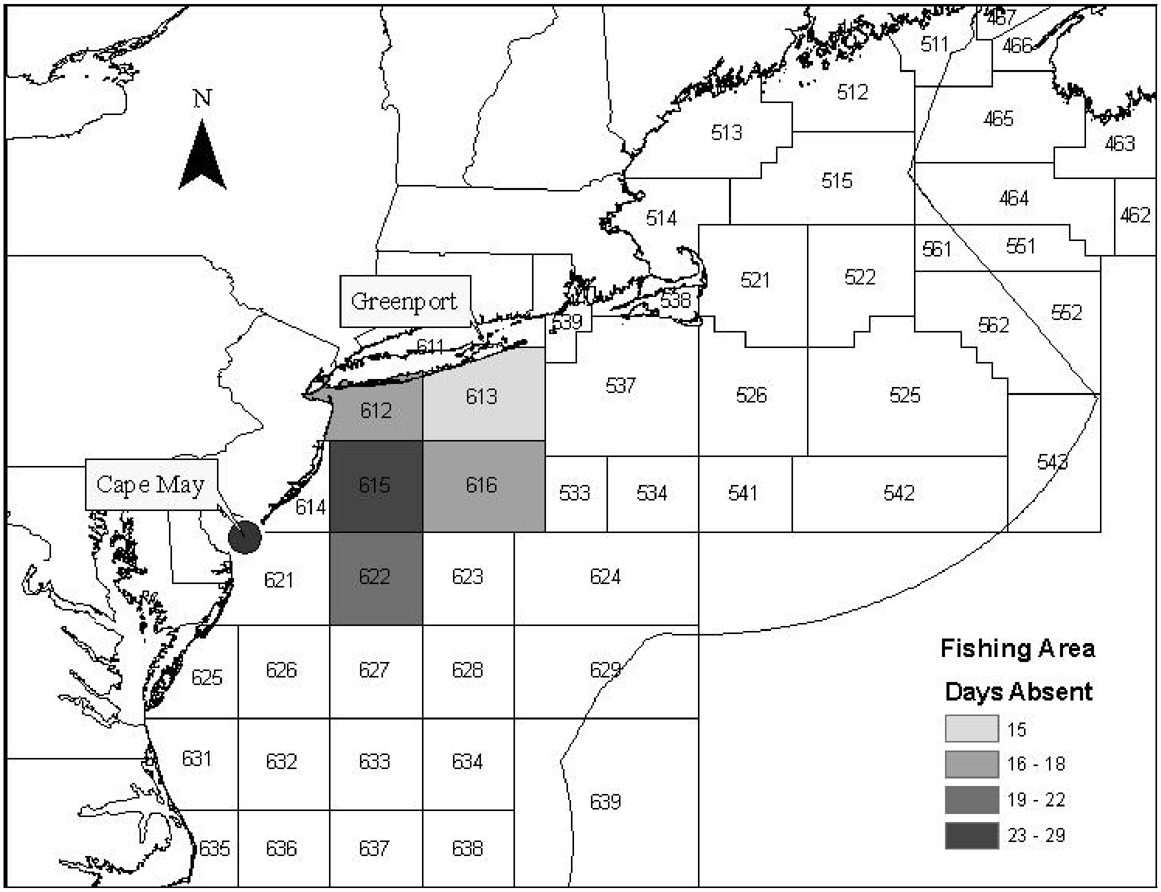

Figure 21. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic midwater single trawl fishing mode.

3.9. 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 large-mesh otter trawl trips.

3.9.1. Small-Mesh Otter Trawls

3.9.1.1. New England

The New England small-mesh otter trawl fishing mode has 225 participants, on average, landing almost 58.5 million lb of fish each year. These vessels take, on average, almost 19 fishing trips per year, and the trips average just under 2 days in duration (although longer trips up to 20-30 days do occur).

Squid comprise the majority of catch for the participants of this fishing mode, with more than 17 million lb and 10 million lb of *Loligo* and *Illex* squid, respectively, landed on average each year. Together, these two species account for 47 percent of all landings in this mode. Silver hake is also very important, with over 14.6 million lb (25 percent of the total landings) landed each year. In addition to these three species, Atlantic mackerel (4 million lb) and Atlantic herring (3 million lb) account for another 12 percent of annual landings.

The majority of landings made by participants in this fishing mode come into either Point Judith or North Kingstown, RI. Together, these two Rhode Island ports receive almost 30 million lb (66.5 percent) of all small-mesh otter trawl landings in New England each year. New Bedford, MA (5 million lb annually), New London, CT (4 million lb annually), and Newport, RI (under 3 million lb annually), also constitute major ports for this fishing mode. Figure 22 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

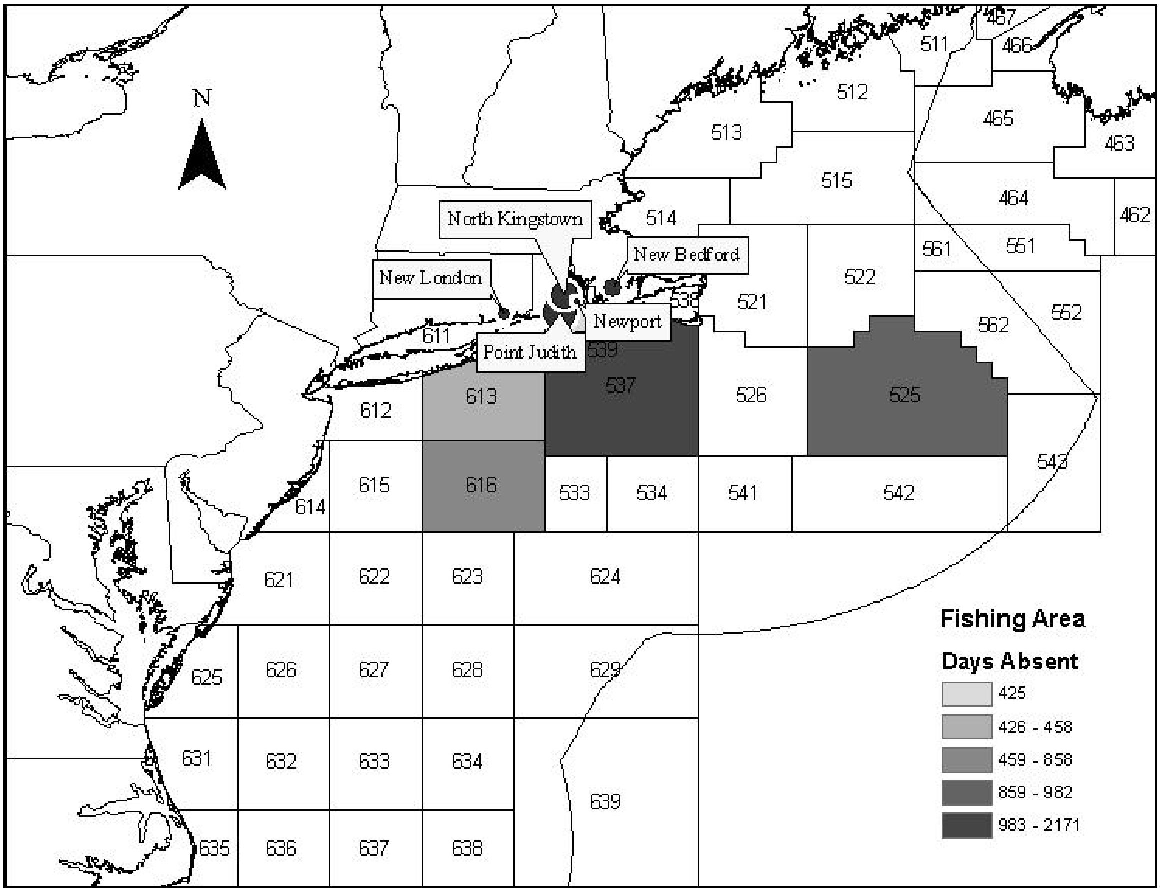

Figure 22. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England small-mesh otter trawl fishing mode.

3.9.1.2. <u>Mid-Atlantic</u>

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 22 and Figure 23). Participation in the Mid-Atlantic fishing mode averages over 170 vessels per year, slightly less than the number of New England participants. On average, each Mid-Atlantic vessel takes over 37 fishing trips per year, but unlike the New England mode, for which trips lasted almost 2 days on average, fishing trips taken by Mid-Atlantic small-mesh otter trawl vessels averaged less than 1 day in duration, although longer trips up to 20 days also occur. Mid-Atlantic small-mesh otter trawl vessels appear to take trips of about half the duration of New England vessels, but take twice as many trips. Thus, the overall fishing effort of each vessel appears, on average, to be about the same as for New England.

As in New England, squids comprise the majority (54.4 percent) of landings, with over 12 million lb of *Loligo* squid and almost 9 million lb of *Illex* squid landed each year. Silver hake also comprises a substantial amount of the annual catch, with almost 5 million lb. Atlantic mackerel (2 million lb) and Atlantic croaker (1.6 million lb) account for over 11 percent of annual landings.

Cape May, NJ, is the top port for this fishing mode, with over 16 million lb of landings (42 percent of total landings for this mode) each year. Montauk and Shinnecock, NY, together take in another 35 percent of annual landings, with Point Pleasant, NJ (2.3 million lb annually), and Hampton, VA (1.6 million lb annually) also accounting for another 10 percent of total landings. Figure 23 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

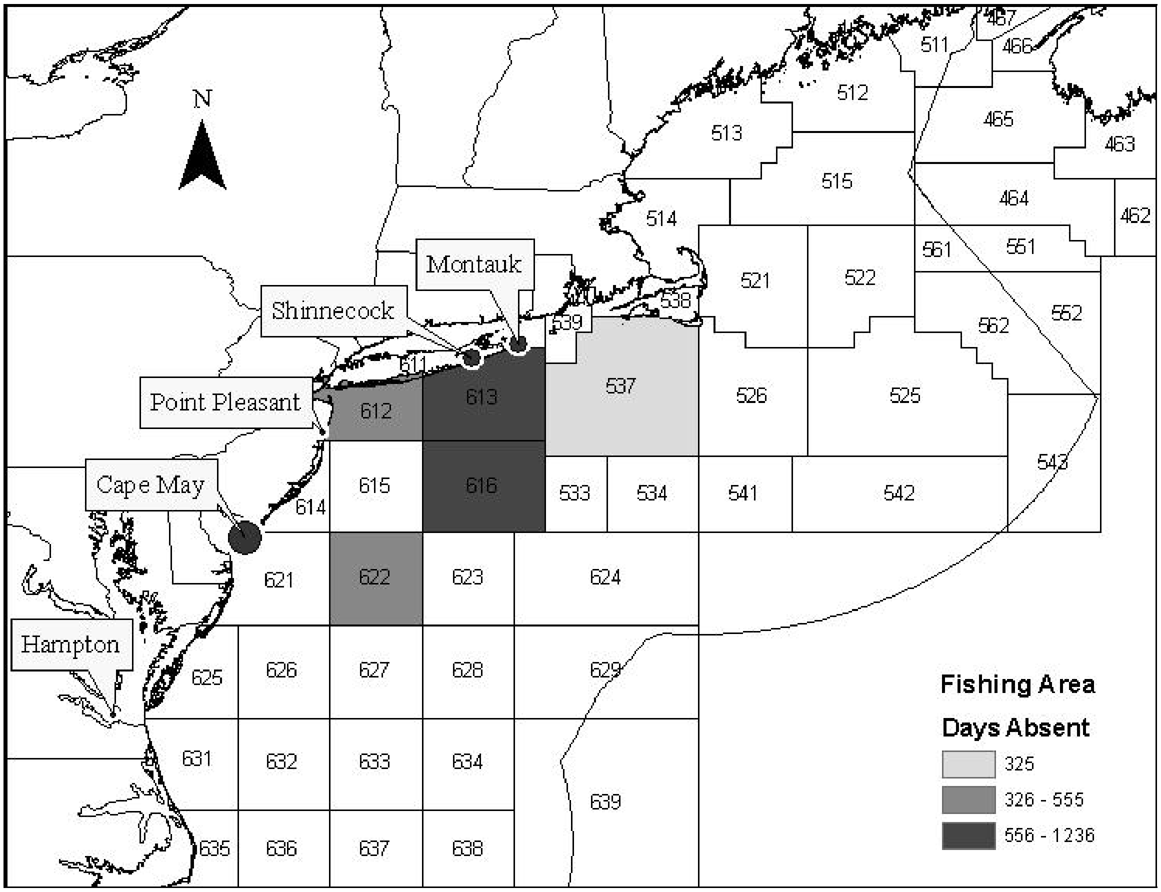

Figure 23. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic small-mesh otter trawl fishing mode.

3.9.2. Large-Mesh Otter Trawls

3.9.2.1. New England

The New England large-mesh otter trawl fishing mode is the third largest mode (behind the New England lobster pot and handline/rod and reel modes) of all Northeast Region fisheries, with an average of 533 active participating vessels. In total, the participants in this fishing mode land an average of 100.8 million lb of fish annually. Each of these participating vessels takes, on average, 32 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 almost 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 20-30 days.

In spite of the large-mesh otter trawl mode's association with the groundfish fishery, the top species landed are skates (over 17 million lb per year; 16 percent of total landings for the fishing mode) and monkfish (15.5 million lb per year; 14.5 percent of total landings). Landings of Atlantic cod, yellowtail flounder, haddock, and winter flounder also average over 10 million lb per year. Together, these four groundfish species comprise 45 percent of the total landings of the fishing mode.

New Bedford, MA, is the top port for this fishing mode, with over 41 million lb of fish (41 percent of the total annual landings) coming in each year. Portland, ME, Point Judith, RI, and Gloucester, MA, are also important ports, each taking in approximately 12 percent of the total landings for this mode each year. Figure 24 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

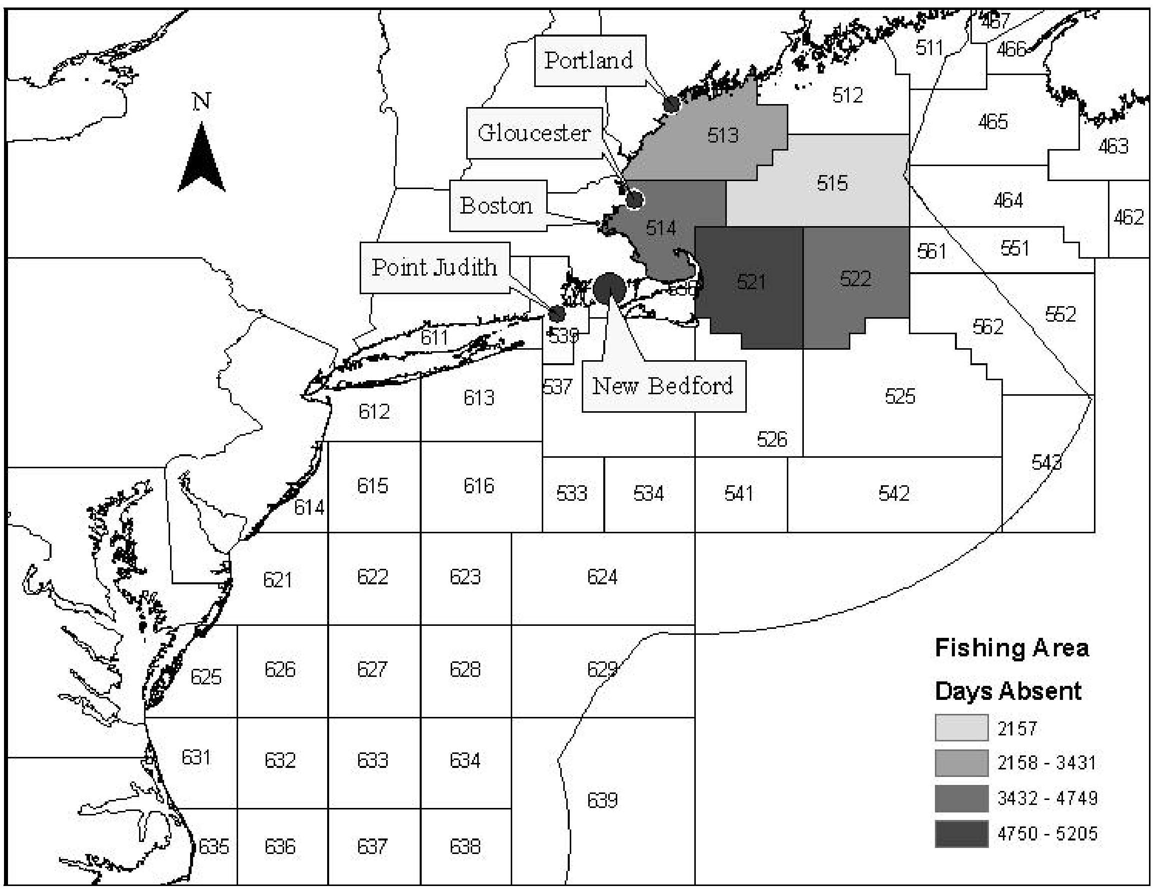

Figure 24. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England large-mesh otter trawl fishing mode.

3.9.2.2. Mid-Atlantic

With almost 225 vessels participating in this fishing mode each year, the Mid-Atlantic large-mesh otter trawl fishing mode is smaller than its New England counterpart as total landings average just over 11 million lb per year (just over 10 percent of the landings associated with the New England large-mesh otter trawl fleet). Mid-Atlantic vessels take, on average, 28 1-day fishing trips per year, although trips as long as 20 days have been taken in some years.

Summer flounder is the primary species landed, representing almost half—5.2 million lb—of the total annual landings. Winter flounder, skates, *Loligo* squid, and scup together account for another 27 percent of the total annual landings. Winter flounder landings average just under 1.1 million lb per year and skates average almost 900,000 lb annually, while *Loligo* squid and scup landings each average approximately 500,000 lb. Landings in this fishing mode are fairly evenly divided between a number of ports in New York, New Jersey, and Virginia. Shinnecock, NY, Hampton, VA, Point Pleasant, NJ, Montauk, NY, and Newport News, VA, comprise the top five ports each with over 1.1 million lb (10+ percent of the total) of landings each year. Figure 25 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

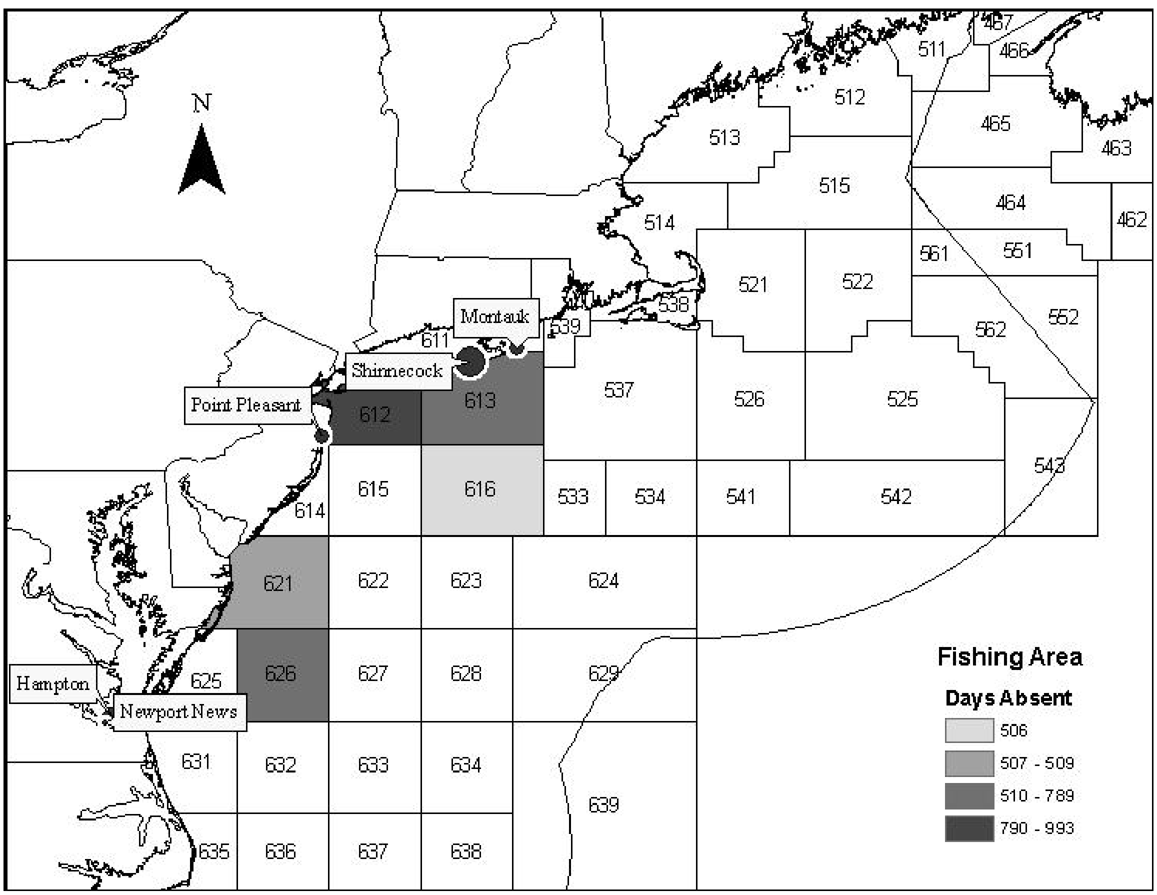

Figure 25. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic large-mesh otter trawl fishing mode.

3.10. Purse Seine Fishery

3.10.1. New England

The New England purse seine fishing mode primarily targets Atlantic herring. The number of active participants averages just over 9 vessels per year, and each vessel takes, on average, 37 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 47.7 million lb per year, third in herring catch after the midwater pair and single trawl modes. The purse seine fishing mode is the most directed of all New England modes, with herring comprising over 99 percent of total annual landings by weight. Although the amounts are much smaller, bluefin tuna landings are important, with over 225,000 lb per year. Other species landed include negligible amounts of menhaden, bluefish, and Atlantic mackerel.

Most of the landings made by vessels participating in this fishing mode come to Maine ports, with Rockland (19.3 million lb per year), Stonington (13.2 million lb per year), and Prospect Harbor (6.7 million lb per year) accounting for nearly 82 percent of the total landings. On average, another 10 percent of the total annual landings are split relatively evenly between Vinalhaven and Portland, ME. Figure 26 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

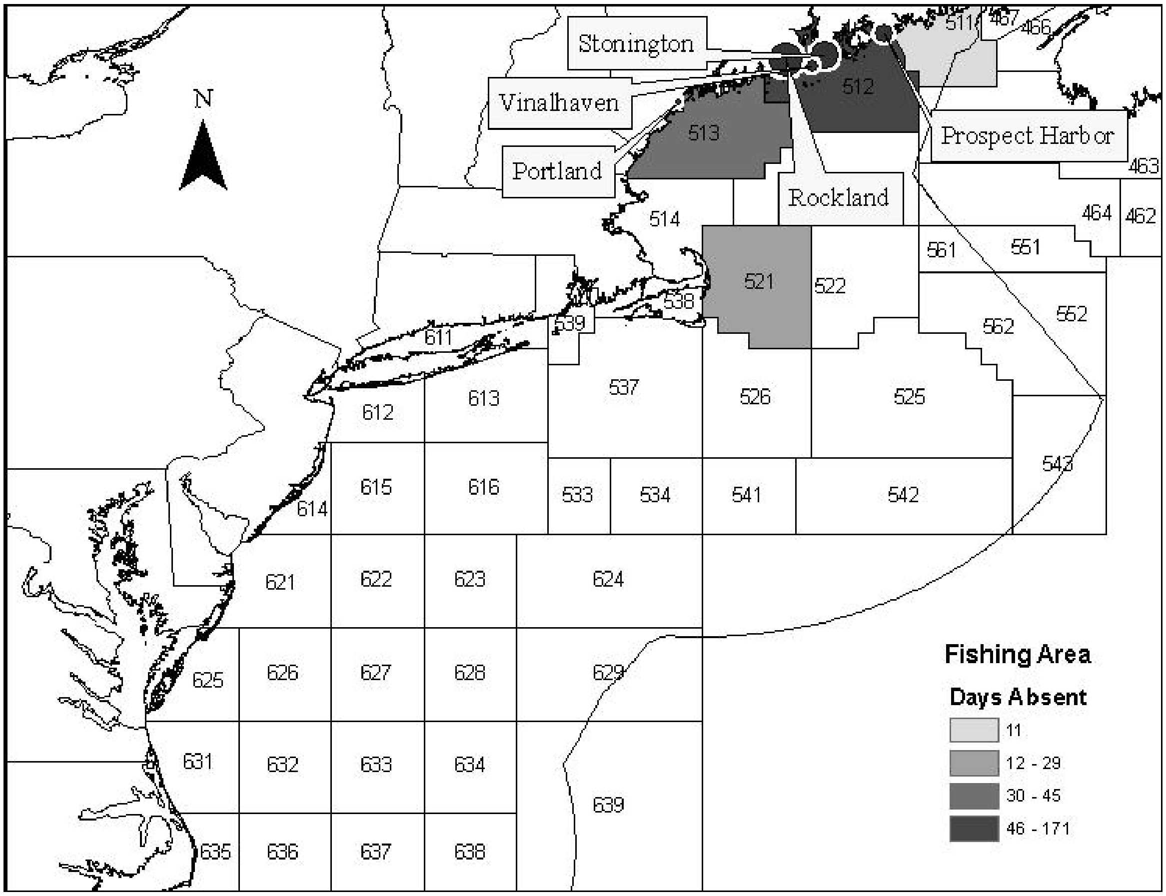

Figure 26. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England purse seine fishing mode.

3.10.2. Mid-Atlantic

As the New England purse seine fishing mode is the most targeted in New England, so is the Mid-Atlantic purse seine mode the most targeted in its region: Over 99.9 percent of all landings in this mode are menhaden. The four active participating vessels take, on average, 38 fishing trips each year, with most trips lasting less than a ½ day. Even the longest trips most years last less than 1 day, although there was a 5-day trip reported in 2004.

Menhaden landings in this fishery average almost 18.5 million lb annually. While other species (silversides, redfish, carp, etc.) are occasionally landed, the amounts tend to be limited to a few thousand lb at most in any year. Cape May, NJ, is the leading port of landing for this fishery, receiving over 11.3 million lb (61 percent of the total landings) each year. Point Pleasant, NJ, is also a primary port for these vessels, with landings averaging over 6.7 million lb (36 percent of the total). Together, these two ports account for 98 percent of the annual landings, but relatively small amounts are also landed in Belford, NJ, Greenport, NY, and Islip, NY. Figure 27 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

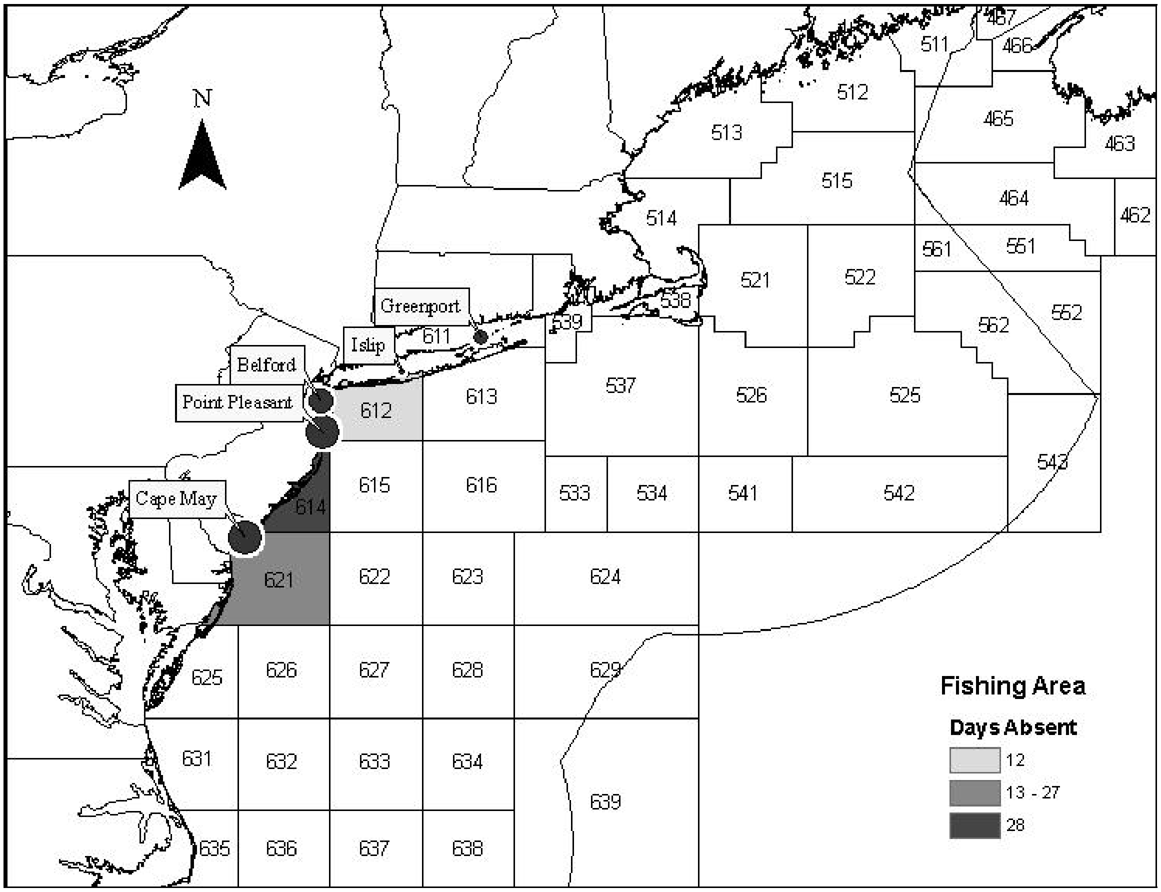

Figure 27. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic purse seine fishing mode.

3.11. 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.

3.11.1. New England

The New England scallop dredge fishing mode averages over 296 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 16 fishing trips per year. While the average trip length for all participating vessels is just under 4 days per trip, much longer trips, up to 45 days, do occur. On average, the participants in this fishing mode land over 27 million lb of fish each year, of which over 25 million (almost 93 percent) are sea scallops. Other than monkfish (nearly 1.3 million lb per year), only relatively negligible amounts of sea cucumbers, sculpins, and yellowtail flounder are landed each year.

New Bedford, MA, is the top scallop port in New England, accounting for almost 84 percent of the total annual landings for this fishing mode. Stonington, CT (1.4 million lb per year), Fairhaven, MA (nearly 500,000 lb per year), Sandwich, MA (280,000 lb per year), and Point Judith, RI (230,000 lb per year) also rank in the top five scallop dredge ports in New England. Figure 28 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

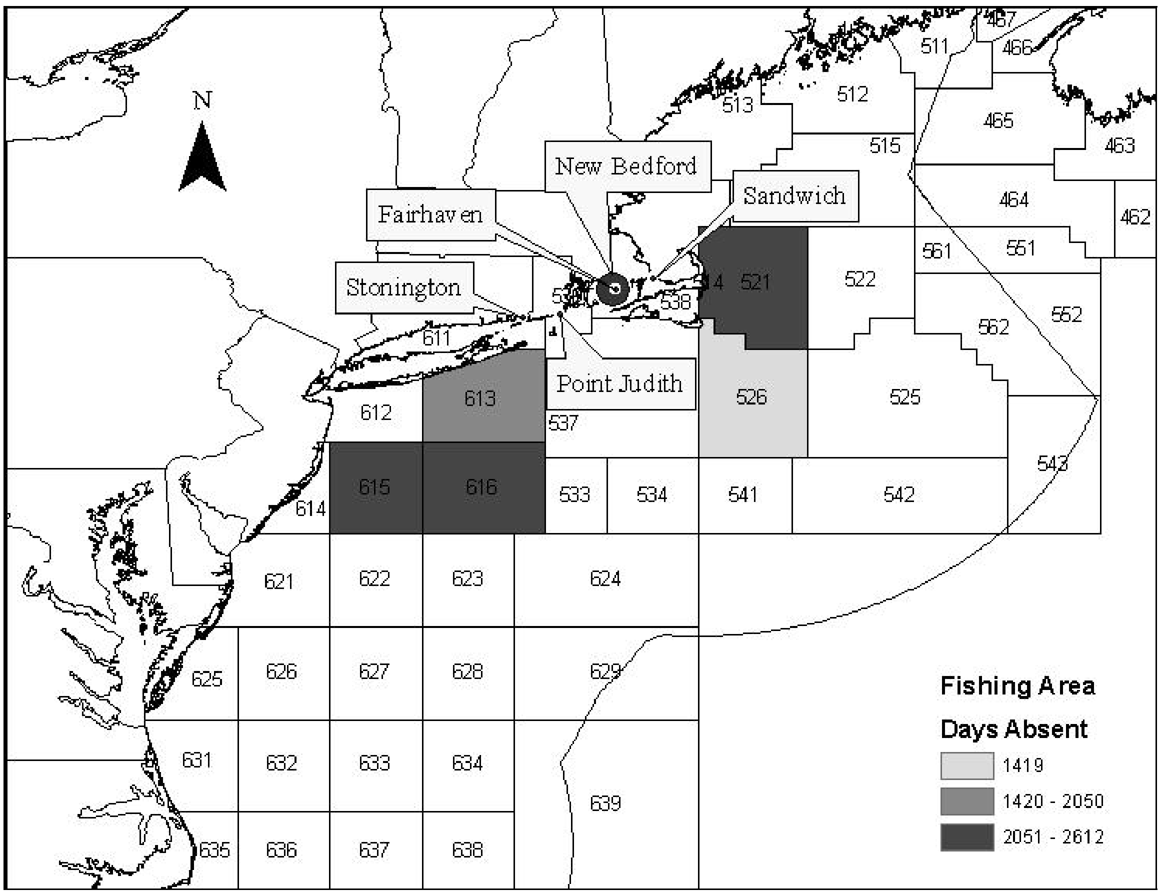

Figure 28. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England scallop dredge fishing mode.

3.11.2. Mid-Atlantic

Somewhat 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 almost 184 active vessels from 2000 to 2004, but the number of participants has been increasing (from 116 in 2000 to 278 in 2004). On average, participating vessels take 17 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 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 325,000 lb of monkfish is landed each year, along with small amounts of knobbed whelks and summer flounder (each less than 65,000 lb per year).

Mid-Atlantic scallop dredge vessels utilize several ports for landing their product. Newport News, VA, is the top port, with an average of 7.4 million lb of landings each year (34 percent of the total landings). Cape May, NJ, ranks second with 5.2 million lb of annual landings (24 percent of the total), and the City of Seaford, NY (3.1 million lb per year), Hampton, VA (2.4 million lb per year), and Long Beach, NJ (1.9 million lb per year), complete the top five ports for this fishing mode. Figure 29 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

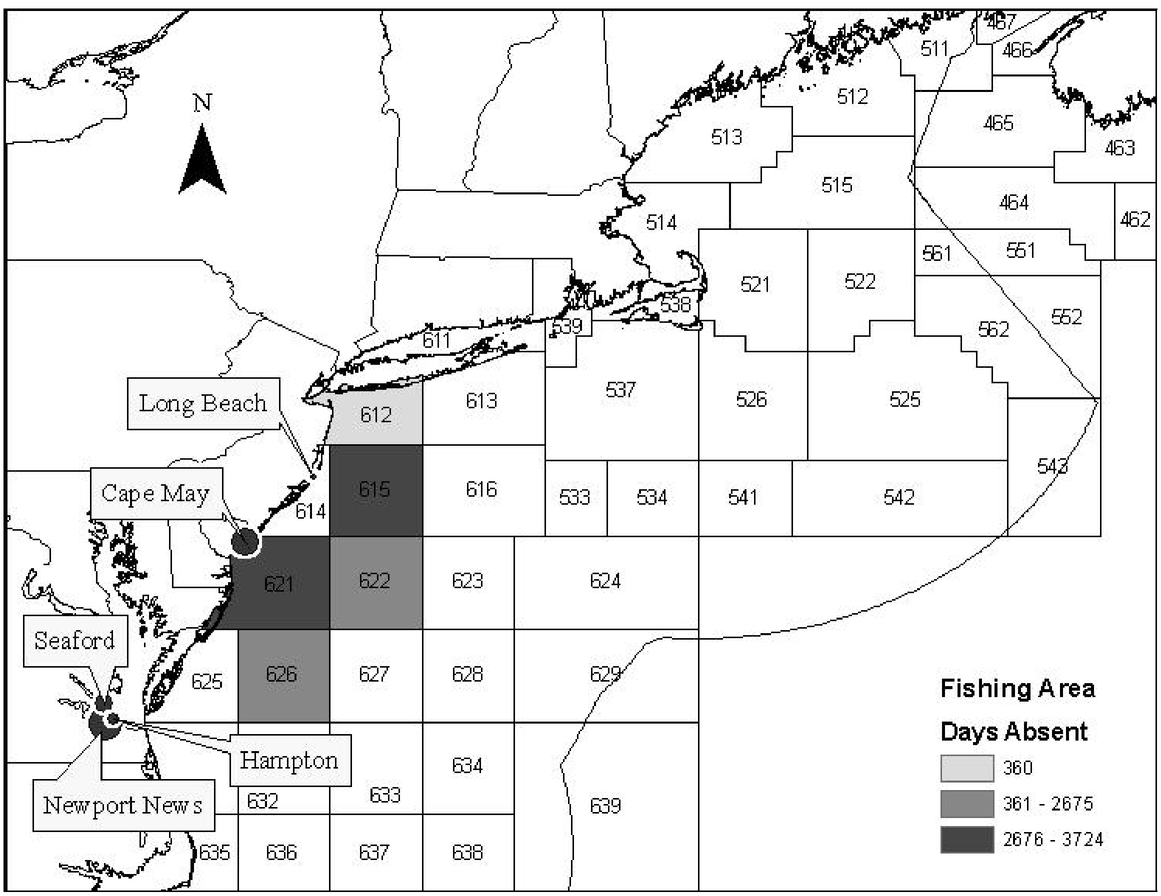

Figure 29. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic scallop dredge fishing mode.

3.12. Scallop Trawl Fishery

3.12.1. 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 nine fishing trips. Fishing trips average 1-2 days in length, and the longest trips average 8 days in duration.

Sea scallops are the top species landed, but these landings average less than 40,000 lb per year (less than 0.1 percent of the sea scallops landed using scallop dredges). Small amounts of monkfish, winter flounder, summer flounder, and yellowtail flounder are also landed by the participants of this fishing mode, but landings of these fish average less than 2,000 each per year. As with the New England scallop dredge mode, New Bedford, MA, is the top port, with over 87 percent of total scallop trawl landings. Newport, RI, Stonington, ME, Point Judith, RI, and Stonington, CT, each account for small amounts of the total landings by this fishing mode. Figure 30 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

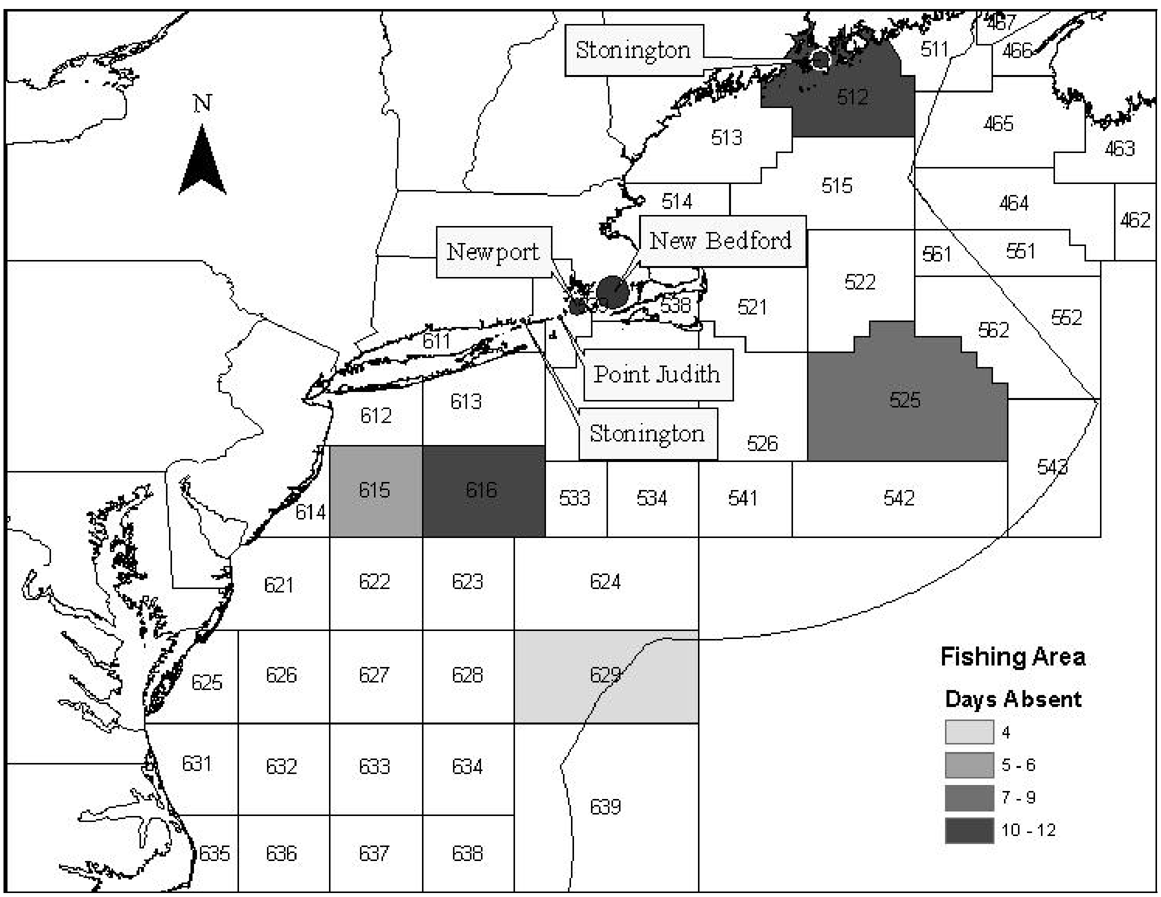

Figure 30. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England scallop trawl fishing mode.

3.12.2. 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 40 participating vessels each year. On average, each of these participating vessels takes almost 16 fishing trips each year, and the number of trips has been increasing in recent years. Trips average 4-5 days in duration, although longer trips of 30+ days occur.

As with every other sea scallop fishing mode, scallops account for over 90 percent of the annual landings. In the Mid-Atlantic scallop trawl mode, total annual landings are close to 3.1 million lb, of which almost 2.8 million lb are sea scallops. Other species landed by the participants in this fishing mode include horseshoe crabs (95,000 lb per year), summer flounder (83,000 lb per year), knobbed whelk (53,000 lb per year), and monkfish (29,000 lb per year). Cape May, NJ, is the top port for this fishing mode, receiving on average almost 1.1 million lb of landings each year. Hampton and Newport News, VA, together take in nearly 1.7 million lb each year. Chincoteague, VA, receives only 140,000 lb on average each year. Cape Charles, VA, ranks as the fifth scallop trawl port in the Mid-Atlantic, with approximately 56,000 lb of landings each year. Figure 31 displays the top ports and primary fishing areas utilized by participants in this mode.

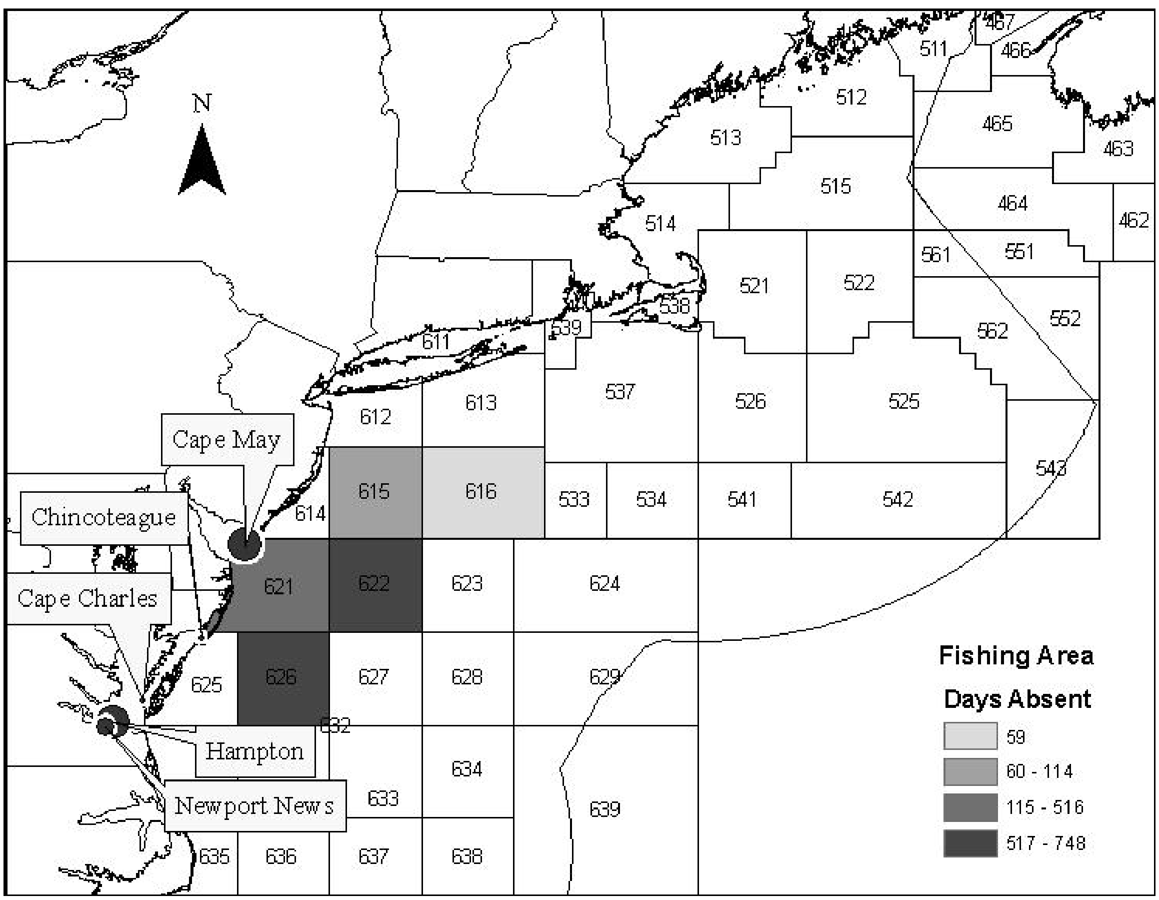

Figure 31. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic scallop trawl fishing mode.

3.13. Scottish Seine Fishery

Due to the small number of participants in the New England and Mid-Atlantic Scottish seine fishing modes, 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.

3.14. Shrimp Trawl

3.14.1. New England

The New England shrimp trawl fishing mode includes, on average, approximately 175 participating vessels per year. These vessels take, on average, approximately 14 fishing trips each year, and most fishing trips last less than 1 day, although longer trips occur, up to 22 days in duration.

The primary target for this fishing mode is Northern (pandalid) shrimp, and almost 84 percent of the 3.3 million lb of fish landed, on average, each year in this fishing mode are pandalid shrimp. Unspecified shrimp species and mantis shrimp comprise another 9 percent of annual landings, so, together, shrimp account for 93 percent of the total landings in this fishing mode. The remainder is largely American plaice, silver hake, and other groundfish species, although these species each account for 1 percent or less of total annual landings.

The primary ports for this fishing mode are all located in Maine, as landings in the top five ports (Portland, South Bristol, Cundys Harbor, New Harbor, and Port Clyde) account for 60 percent of the total landings. Half of these (31 percent of total landings, over 1 million lb per year) come in to Portland, ME. Figure 32 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

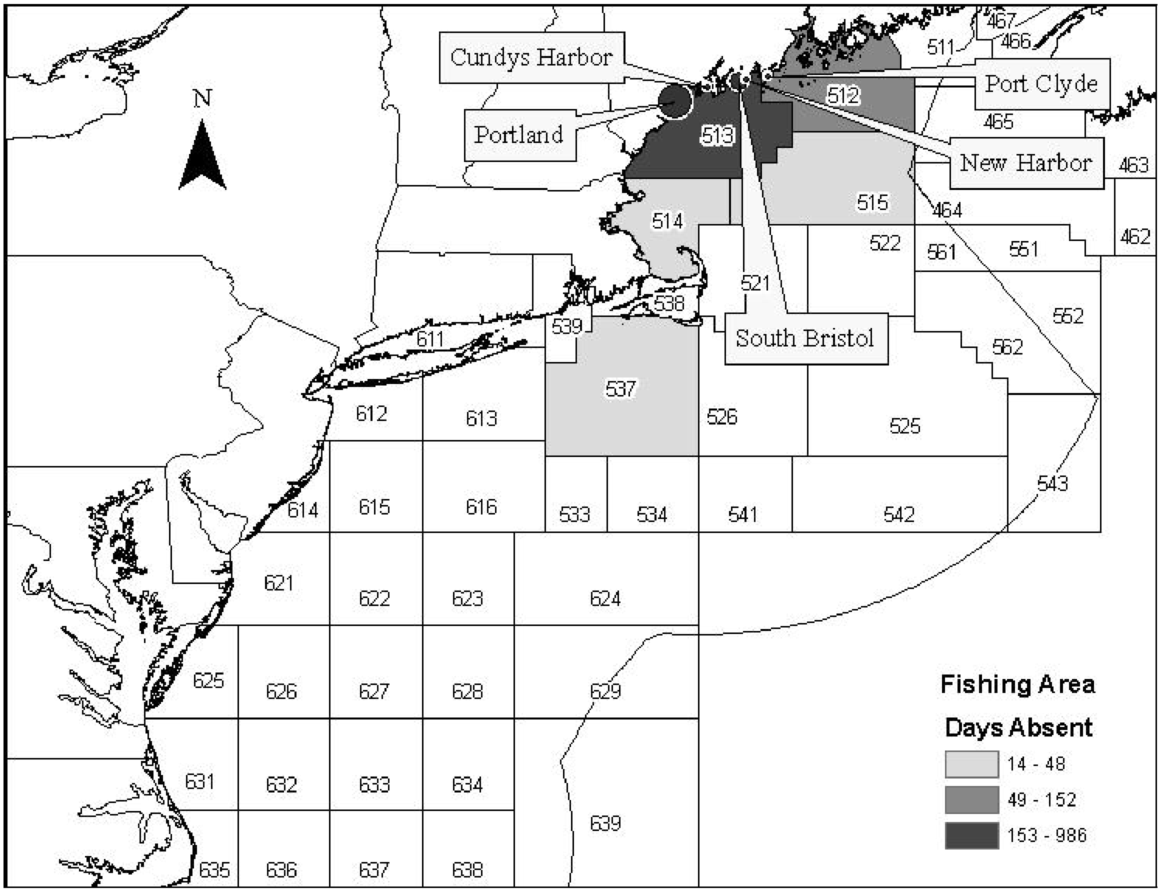

Figure 32. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the New England shrimp trawl fishing mode.

3.14.2. Mid-Atlantic

The Mid-Atlantic shrimp trawl fishing mode has fewer participants than the New England mode, with an average of 51 vessels participating over the years 2000-2004. These vessels take, on average, just under 11 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 14-16 days.

As with the New England shrimp trawl fishing mode, the primary target for this mode is Northern (pandalid) shrimp, although less of the total landings (48 percent, on average) of this mode are comprised of shrimp than in New England. Shrimp landings average just under 1.3 million lb per year, and summer flounder (660,000 lb per year, on average) and sea scallops (290,000 lb per year, on average) are also important components of this fishing mode. Total landings for the Mid-Atlantic shrimp trawl mode average 2.6 million lb per year, and almost 85 percent of these landings are composed of these three species.

The primary ports for this fishing mode are almost all located in North Carolina, with Beaufort (662,000 lb per year, on average), Wanchese (323,000 lb per year, on average), Engelhard (305,000 lb per year, on average), and Oriental (279,000 lb per year, on average), North Carolina, together accounting for almost 60 percent of annual landings, on average. Chincoteague, VA, takes in another 7 percent of annual landings, completing the top five ports for the fishing mode. Figure 33 displays the top ports and primary fishing areas utilized by participants in this fishing mode.

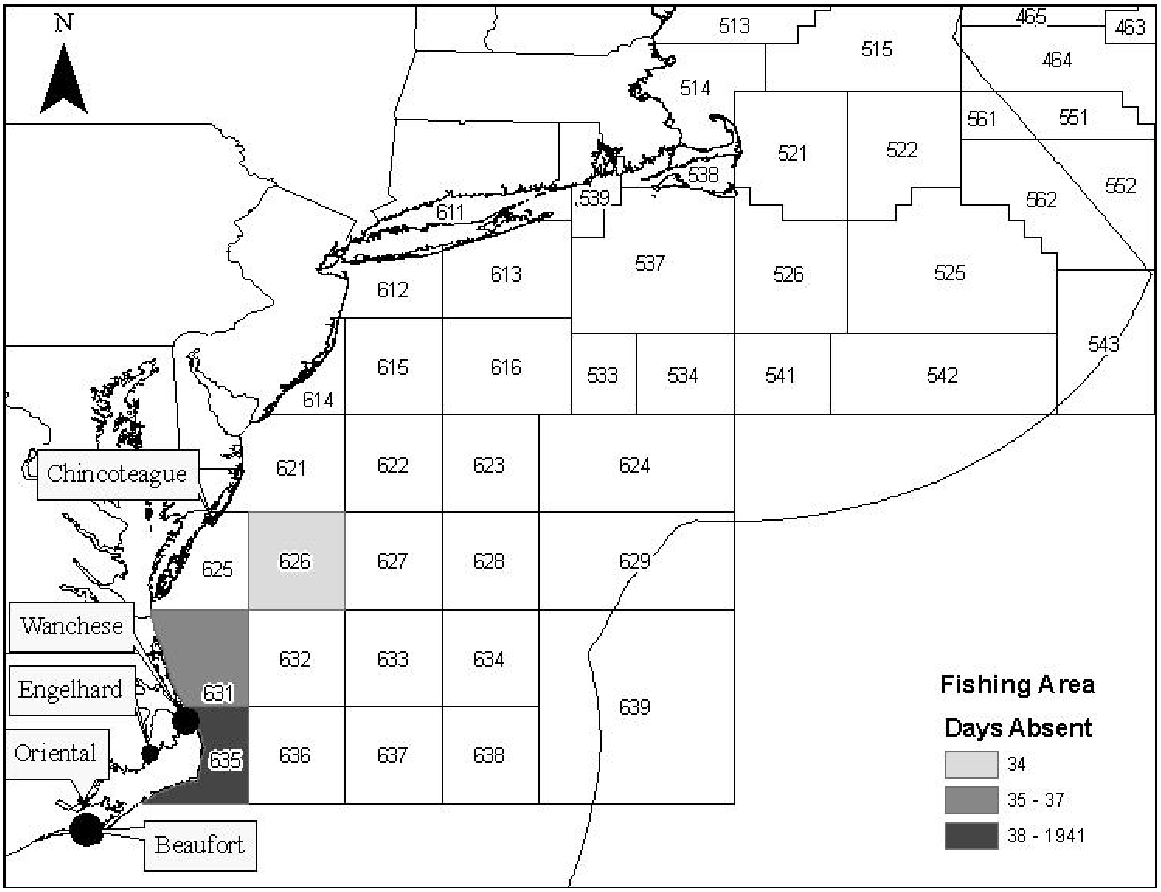

Figure 33. The primary ports of landings (dots are scaled proportional to the average percent of landings at each port), and the primary areas fished (reported as average days absent by statistical area) in the Mid-Atlantic shrimp trawl fishing mode.

Fishing Mode	Primary Regulating FMP(s) (includes only those Federal FMPs subject to the SBRM Amendment)	Average Number of Participating Vessels	Average Total Annual Landings (in million lb)	Top 3 Species Landed
MA/NE Clam Dredge	Surfclam and Ocean Quahog	87.0	6.82**	ocean quahog; surfclam
NE Crab Pot	Deep-Sea Red Crab	7.4	3.04	red crab; Jonah crab; other crabs
MA Crab Pot	(none)	8.2	0.08	blue crab; red crab; menhaden
NE Fish Pot	Summer Flounder, Scup, Black Sea Bass	41.8	0.56	hagfish; black sea bass; scup
MA Fish Pot	Summer Flounder, Scup, Black Sea Bass	61.8	0.90	black sea bass; tautog; whelks
NE Small-mesh Gillnet	Northeast Multispecies	25.6	0.10	pollock; cod; monkfish
MA Small-mesh Gillnet	Atlantic Bluefish	101.2	3.84	Atlantic croaker; bluefish; menhaden
NE Large-mesh Gillnet	Northeast Multispecies; Spiny Dogfish; Monkfish	168.0	12.75	cod; pollock; spiny dogfish
MA Large-mesh Gillnet	Spiny Dogfish; Atlantic Bluefish	83.4	1.49	smooth dogfish; bluefish; spiny dogfish
NE Extra-large-mesh Gillnet	Northeast Multispecies; Monkfish; Skate Complex	130.2	14.21	monkfish; skates; cod
MA Extra-large-mesh Gillnet	Monkfish; Skate Complex	100.2	6.20	monkfish; skates; striped bass
NE Handline/Rod & Reel	Northeast Multispecies; Summer Flounder, Scup, Black Sea Bass	679.2	2.69	cod; bluefin tuna; scup
MA Handline/Rod & Reel	Summer Flounder, Scup, Black Sea Bass; Atlantic Bluefish	513.0	2.88	black sea bass; scup; bluefish
NE Lobster Pot	(none)	657.0	22.16	lobster; Jonah crab; rock crab
MA Lobster Pot	(none)	103.4	1.32	lobster; Jonah crab; black sea bass
NE Bottom Longline	Spiny Dogfish; Northeast Multispecies	77.2	3.73	spiny dogfish; cod; haddock
MA Bottom Longline	Golden Tilefish	15.8	1.52	tilefish; cod; swordfish
NE Pair Trawl	Atlantic Herring; Mackerel, Squid, Butterfish	13.8	141.55	Atlantic herring; Atlantic mackerel; spiny dogfish
NE Midwater Trawl (single)	Atlantic Herring; Mackerel, Squid, Butterfish	17.0	68.19	Atlantic herring; Atlantic mackerel; *Illex* squid
MA Pair Trawl	Mackerel, Squid, Butterfish; Atlantic Herring	6.3	23.40	Atlantic mackerel; Atlantic herring; chub mackerel
MA Midwater Trawl (single)	Mackerel, Squid, Butterfish; Atlantic Herring	6.0	10.69	Atlantic mackerel; Atlantic herring; blueback herring
NE Small-mesh Otter Trawl	Mackerel, Squid, Butterfish; Northeast Multispecies	225.0	58.49	*Loligo* squid; silver hake; *Illex* squid
MA Small-mesh Otter Trawl	Mackerel, Squid, Butterfish; Northeast Multispecies	171.4	38.62	*Loligo* squid; *Illex* squid; silver hake
NE Large-mesh Otter Trawl	Northeast Multispecies; Monkfish; Skate Complex	533.2	100.85	skates; monkfish; cod
MA Large-mesh Otter Trawl	Summer Flounder, Scup, Black Sea Bass; Northeast Multispecies; Skate Complex	224.8	11.12	summer flounder; winter flounder; skates
NE Purse Seine	Atlantic Herring	9.2	48.09	Atlantic herring; bluefin tuna; menhaden
MA Purse Seine	(none)	4.4	18.48	menhaden; silversides; redfish
NE Scallop Dredge	Sea Scallop; Monkfish	296.2	27.12	sea scallops; monkfish; sea cucumbers
MA Scallop Dredge	Sea Scallop; Monkfish	183.8	21.69	sea scallops; monkfish; whelks
NE Scallop Trawl	Sea Scallop	3.0	0.04	sea scallops; monkfish; winter flounder
MA Scallop Trawl	Sea Scallop	42.2	3.10	sea scallops; horseshoe crabs; summer flounder
NE Scottish Seine	Northeast Multispecies	N/A	N/A	silver hake; cod; winter flounder
NE Shrimp Trawl	(none)	175.2	3.33	Pandalid shrimp; other shrimp; American plaice
MA Shrimp Trawl	(none)	51.4	2.63	Pandalid shrimp; summer flounder; sea scallops

Table 28. Summary information on the fishing modes addressed in Chapter 3. Averages reflect data from 2000-2004, except as noted in the text. Top species are based on the cumulative landings from 2000-2004. (Clam dredge landings are given in millions of bushels.)**

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Chapter 4
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 vessel trip reports), fishing-related 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 Northeast 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 Northeast 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 Northeast 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 NOAA Fisheries Service and state fisheries agencies in the Northeast 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 Northeast Region by NOAA Fisheries Service 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 Delaware II
Sea scallop dredge	Annual – Summer	R/V Albatross IV
Hydraulic clam dredge	Triennial	R/V Henry B. Bigelow (2006)
Gulf of Maine trawl	Annual – Summer	
Continental shelf trawl	Annual – Winter	
Marine mammal sighting	Variable – All surveys	
Fish egg and larvae	Several times per year	

Table 29. NOAA Fishery Independent Surveys in the Northeast 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 provide oversight and coordination of surveys in the Northeast Region. Some details of the resulting program, called the Northeast Area Monitoring and Assessment Program, 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 1979 - present 1987 - present 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, 1979-1984, 1990 - present
NJ Dept. of Fish and Wildlife	Ocean stock assessment trawl Delaware Bay trawl	1989 - present 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 Northeast 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. 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 NOAA Fisheries Service, 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*	Number discarded (by species)
	Loran station and bearings	
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 Northeast Region Fishing Vessel Trip Reports, 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 15th of the month following the month in which the trip ended. The Regional Administrator may authorize individuals to submit reports electronically, by using a VMS or other media.[17] 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 Northeast Region FVTRs (NMFS 2004). Thus, given the mandatory reporting requirement applied to all federally permitted vessels (with the exception of vessels holding only a Northeast 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.

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), under-reporting (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.

[17] To date, no electronic systems have been authorized for use as an alternative to the FVTR.

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 Northeast 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 NOAA Fisheries Service 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. Dealers 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

[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 purchases 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 on-line 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).

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 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 in-season 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 Northeast Region fisheries is monitored primarily through the Northeast Fisheries Observer Program (NEFOP). The Fisheries Observer Program 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 Fisheries Observer Program 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 Northeast Fisheries Observer Program 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 NOAA Fisheries Service 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 Fisheries Observer Program continues to work with non-compliant vessels to ensure compliance with safety and requirements (Amy Van Atten, pers. comm., NMFS).

The Fisheries Observer Program 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 NOAA Fisheries Service by Congress. While NOAA Fisheries Service 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, 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., 5 percent coverage in the Northeast multispecies fisheries). 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. The detailed methods currently used to optimize available observer coverage throughout certain Northeast Region commercial fisheries is described in Chapter 5 and Appendix A.

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 Northeast 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 NOAA Fisheries Service. Therefore, much of the information previously described in section 4.5.1.1 also applies to the state administered observer programs.

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 fishing-related 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 NOAA Fisheries Service staff located in the major fishing ports in the Northeast 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 weight-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. Description

NOAA Fisheries Service initiated a series of surveys in 1979 to obtain standardized and comparable estimates of participation, effort, and catch by recreational anglers in the marine waters of the United States. The purpose of the MRFSS is to establish a reliable data base for estimating the impact of marine recreational fishing on marine resources. The MRFSS is the only fishery independent data available on bycatch for recreational fisheries. Data collected through the MRFSS are used to produce estimates of recreational fishing effort, catch, discards/bycatch, and participation. MRFSS data are collected by two independent, but complementary, surveys: An intercept (i.e., interview) survey of anglers at fishing access sites, and a telephone survey of households in coastal counties. Trained interviewers are also deployed onboard party boat operations to collect direct recreational fisheries observation data.

Catch data are obtained from anglers intercepted by trained interviewers stationed at fishing access sites. Interviewers identify, enumerate, weigh, and measure fish that are available for inspection. Fish not brought ashore (i.e., discarded bycatch) are categorized through the interview as used for bait, filleted, discarded dead, or released alive. Interviewers onboard party boats document at-sea angler practices and collect detailed catch, bycatch, and discard data. The interviews are used to develop estimates of catch for recreational fishing trips, but this information alone cannot be used to scale recreational fishing effort to develop estimates of the total impacts of recreational fishing. Telephone surveys obtain 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	Telephone Household Survey
• Number, weights, and lengths of fish caught (by species)	• Presence of marine recreational anglers in household
• State and county of residence	• Number of anglers per household
• Avidity level (trips per year)	• Fishing trips in 2-month period
• Mode of fishing	• Mode of each trip
• Primary fishing area	• Location (county) of each trip

Table 32. Data collected by the complementary MRFSS methods.

Marine recreational fishing estimates of effort, participation, catch, and discards (not including shellfishing) are calculated for six 2-month periods (waves) by subregion, state, fishing mode, and primary fishing area using these complementary surveys. Total survey effort during a one-year period usually involves more than 76,000 intercept interviews and over 265,000 telephone interviews (Witzig et al. 2006). The following sections taken from Witzig et al. (2006) briefly summarize the methods and procedures employed in the telephone survey, the intercept survey, and the calculation of estimates from the information collected by the two surveys.

4.7.1.1. MRFSS Intercept Survey Methods

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). The intercept survey continuously samples angler catches during the six 2-month sampling periods from January through December. Intercept sampling is stratified by state, mode, and 2-month wave with a minimum of 30 intercepts in each stratum. Beyond this minimum, samples are allocated in proportion to average estimates of fishing pressure from the three previous survey years.

Complete coastwide lists of access sites for marine recreational fishing were created in 1979 and are continuously updated. Sites are chosen for interviewing assignments by randomly selecting from among the listed access sites 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.

Sampling is distributed among weekdays, weekends, and holidays in such a manner as to assure that about 60 percent of the interviews are collected on weekends and holidays on the Atlantic coast. Anglers are intercepted, screened, and interviewed at assigned access sites upon completion of their fishing trips. A small number of interviews (less than 5 percent) are conducted with beach/bank shore mode anglers who have not completed their trip. At heavy use sites, every n^{th} angler is intercepted and interviewed. For example, every second or third angler might be interviewed if the site is too busy to interview all anglers.

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 can not 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.

4.7.1.2. <u>MRFSS Telephone Survey Methods</u>

The telephone survey 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 January/February wave, households are called during the last week of February and the first week of March. Respondents are asked to recall on a trip-by-trip 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 MRFSS 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.
- All households are eligible for contact each wave, regardless of whether they were contacted in a previous wave.
- Telephone interviews are conducted between 10:00 a.m. and 9:30 p.m. (respondent's local time) on weekdays and weekends.
- Up to 10 attempts are made to reach each household.
- Repeated attempts are made to complete the questionnaire with all eligible anglers residing in each contacted household.
- Interviews are conducted in Spanish as required.
- 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 is used to adjust for nonrespondent anglers and households prior to estimation.

4.7.2. Evaluation and Applicability

In addition to FVTRs, MRFSS data provide a primary source of bycatch and discard information collected for recreational and party/charter fishing modes. Data from the MRFSS intercept survey and observations made onboard party boat vessels are used to document bycatch 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.

The 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 are available on the NOAA Fisheries Service Office of Science and Technology web site.[20] This site also outlines the current precision and accuracy of the MRFSS program data.

A recent comprehensive review of the MRFSS conducted by a committee of the National Research Council of the Academies of Sciences (NRC) has produced significant recommendations for redesigning the MRFSS. The NRC committee found that much in recreational fisheries, from participation levels to management goals, have changed since the design and implementation of the MRFSS in 1979 and that the survey has not kept pace with these changes (NRC 2006). The NRC review found that funding and staff support for the MRFSS was inadequate. The NRC committee has recommended changes to the MRFSS to improve the effectiveness and appropriateness of the sampling procedures, it's applicability for management measures, and the usefulness of the social and economic analysis provided by the survey data (NRC 2006). The NRC's

[20] See site at http://www.st.nmfs.gov/st1/recreational/overview/overview.html.

recommendations also apply to the many state-conducted recreational surveys designed to work in concert with 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, delineation of catch by target effort, catch effort, or directed effort, among other things (NRC 2006).

In response to the NRC findings, NOAA Fisheries Service has initiated a national working group tasked to act quickly upon the report's many recommendations. Because the MRFSS was and is designed to be a national program, the MRFSS working group will facilitate the changes in the MRFSS rather than changes being developed and implemented as part of this amendment. The full NRC committee report on the MRFSS is available for download from the National Academies Press web site.[21]

4.8. Industry-Based Surveys

4.8.1. Description

Industry-based surveys are marine resource assessment surveys conducted onboard commercial fishing vessels that are typically under the control of academic institutions, state fishery agencies, or other marine scientists or investigators (NMFS 2006d). Often, collaborations between some of the aforementioned groups and NOAA Fisheries Service may be involved with a specific industry-based survey. Industry-based surveys often have pre-defined sampling schemes and protocols that are more narrowly focused than fishery independent surveys described in section 4.2 of this chapter. Industry-based surveys may utilize the empirical knowledge of participating vessel operators and 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 NOAA Fisheries Service surveys (Earl Meredith, pers. comm., NMFS). In addition, industry-based surveys often use gear designed to optimize the catch of the specific species being targeted by the survey.

The primary purpose of some industry-based surveys is to supplement estimates of relative abundance for a specific finfish or shellfish species or species assemblage obtained in NOAA Fisheries Service surveys or 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).

[21] See site at http://www.nap.edu/.

Industry-Based Survey	Principal Investigator
ME/NH inshore trawl	ME Dept. of Marine Resources
Atlantic cod trawl	MA Division of Marine Fisheries
Yellowtail flounder trawl	RI Dept. of Environmental Management
Surf clam inventory	NJ Dept. of Environmental Protection
Sea scallop abundance	Coonamesset Farm
Sea scallop video	University of Massachusetts
Scup in non-trawlable areas	University of Rhode Island/Charles Borden
Mid-Atlantic supplemental finfish	National Fisheries Institute

Table 33. Industry-based surveys in the Northeast 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, compressed seasonality, and specialized fishing gears, industry-based surveys are poorly suited to replace or supplement current data sources for bycatch information. The data generated through industry-based surveys cannot be directly expanded to the commercial fishery, nor does it often present a complete picture of all species encountered, because gears used, areas and seasons fished, and sampling schemes may differ substantially from commercial fishing operations or other fishery-dependent data collections. The time series of industry-based survey data may be susceptible to lapses or compression pending research priorities and funding availability.

4.9. Study Fleets

4.9.1. Description

In collaboration with the New England groundfish fishing fleets, NOAA Fisheries Service has established a pilot project to develop and implement state-of-the-art electronic data reporting devices for use aboard groundfish fishing vessels in the Northeast (NMFS 2006d). The goal of the project has been to design and field test electronic reporting hardware for collecting, recording, and transferring more accurate and timely fishery-based data than is practicable to obtain through the FVTR.

Three distinct pilot fleets comprising different vessel size categories are included in the pilot project. The first fleet is large southern New England trawlers from New Bedford, MA, to Narragansett, RI. The second fleet is small hook vessels based out of Cape Cod, MA. The third fleet is medium-sized trawlers and gill-netters from Cape Ann, MA, to Mid-Coast Maine (NMFS 2006d). NOAA Fisheries Service, three regionally based fisheries associations, and a government support contractor assist in the management of the Study Fleet Program.

Specialized equipment is necessary for data transmittal; currently the equipment is paid for by NOAA Fisheries Service. 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 remainder of the data collected are self-reported and are similar in nature to the FVTR data described in chapter 4.3. The reporting system can automatically capture water conductivity (used to determine salinity), temperature, and depth information for use in profiling species abundance by depth or temperature. 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. 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 Northeast Region Study Fleet provides all of the self-reported data elements supplied in an FVTR, but the data are transmitted electronically and are provided on a tow-by-tow basis rather than at the trip level. 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. However, because the number of participants in the study fleet is relatively small, the amount of data available is also relatively small.

The same 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 associated with 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 representation 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. Attempts to deploy the study fleet technology into other fishery modes have yet to move beyond the proof-of-concept phase. Development of the reporting software continues in the hook and line and gillnet groundfish and *Illex* squid fishery modes.

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 ability to use fleet reported data for “hot spot” bycatch management is not feasible at this time. The personnel, infrastructure, and current regulations are insufficient to affect this type of management. 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 is currently undergoing a detailed evaluation and assessment. 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 for the groundfish trawl fishery mode. However, the goals for the next phase of the project have yet to be determined. The Research Steering Committee will have input as to the future design and data products of the study fleet.

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 Northeast 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 full beta testing program using electronic monitoring onboard longline vessels is scheduled for 2006. Two proof of concept projects are scheduled to occur in 2006 as well—one in the herring mid-water trawl fishery to monitor at-sea discards and one in the day gillnet fleet to identify and quantify bycatch.

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 world wide (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 Northeast 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 Northeast Region fishery mode.

In the Northeast 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 Northeast Region unless additional parameters such as weight or length can be associated with the visual data. To obtain such data, vessel crews would have 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 Northeast 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 organisms become stuck in shallow waters or on land. The most common occurrences involve ‘beached’ whales or sea turtles. 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). NOAA Fisheries Service 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 universities, state fish and wildlife agencies, or NOAA Fisheries Service. 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, common injuries, and often rehabilitation. Data on both marine mammal and turtle strandings are maintained by NOAA Fisheries Service 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 interaction with fishing gear may have occurred well before or some distance from the stranding location.

During a stranding investigation, every effort is made to determine if human interaction of any sort was a contributing factor to the stranding or mortality event. In some instances, this may be very clear as the animal may be entangled in man made debris, have wounds or scarring from propellers, entangled in fishing gear, or have fishing lures imbedded in their mouth or esophagus. In other cases, only a necropsy can determine if human impacts contributed to the incident. To determine if human interaction was related to the event, a determination must be made that an interaction with commercial or recreational fishing gear has occurred. Even if it becomes clear that fishing gear was involved, determining the specific type of gear is unlikely due to the similarities of many gear types, particularly the components of fishing gear most likely to be evidence of a fishery interaction (such as a line that could be from a crab pot, lobster pot, or even a gillnet). When it is possible to make a determination regarding the type of fishing gear with which the animal has interacted, this information may be most useful in providing insights about which general gear types may need further consideration regarding the likelihood of interacting with, injuring, or killing marine mammals and protected species.

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 NOAA Fisheries Service in the Northeast 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. NOAA Fisheries Service 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 Northeast 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 NOAA Fisheries Service law enforcement or other officials. VMS is currently required in several Northeast Region fisheries or fishery programs (Table 34). As of April 7, 2006, there were 1,281 vessels using VMS in the Northeast Region. Several Council actions under development may increase the number of participants.

Permit Category	Number
Full-time and part-time sea scallop	290
General category1A sea scallop	597
Northeast multispecies (under a DAS)	322
Combination Northeast multispecies-sea scallop	46
Atlantic herring category 1 (> 500 mt annually)	26

Table 34. Number of VMS users, by permit category (as of April 7, 2006).

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 proposes that all limited access DAS vessels participating in the Northeast multispecies fishery be required 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 two fold. 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.

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Chapter 5
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 Northeast Region fisheries. These analyses include: (1) A comprehensive summarization of 2004 data collected by the NEFOP; (2) an estimation of bycatch 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 currently used to allocate sea day coverage to account for all monitoring objectives. These secondary analyses are briefly described in this document and can be undertaken sequentially in the future, but are not the primary focus for this analysis.

The methods used in this analysis generally follow those recommended by the National Working Group on Bycatch (NWGB) (NMFS 2004) and further developed the work by Rago et al. (2005, and in 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 Northeast Region.

The NEFOP observer data are a key element of the Northeast Region 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 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 that can be 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 are 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.

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 are 300 million people living in the United States as of October 17, 2006, can be considered reasonably accurate, but the actual number varies 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 measure of accuracy that can be quantified.

Data collected through a sampling program may be generally 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, in the preceding paragraph, 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 Northeast 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. <u>Sampling Unit, Response Variables, and Precision Goals</u>

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.[22] 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 post-stratification, 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)[23] for the bycatch estimate is a useful goal. They stated:

> 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.

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[22] The discard-to-kept ratio is abbreviated as d/k, and the discard-to-days-absent ratio is abbreviated as d/da.

[23] 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.

> 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 can not 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 sector. 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. <u>Definition of Strata—Fishery Identification</u>

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 sectors with similar characteristics. For the Northeast Region SBRM, fleet sectors (fishing modes) are defined as strata within the overall survey design.

Commercial fishing trips are partitioned into fleet sectors using six classification variables: Calendar quarter; geographical region; fishing gear type; mesh size; access area; and trip category. Some fleet sectors 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, 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. 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 since 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 since 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 Mid-Atlantic 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 2004 FVTR records that departed and fished in the New England and Mid-Atlantic 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 Magnuson-Stevens 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 Mid-Atlantic Councils, an all species combined group, and five protected species groups. The fisheries encompassing these 60 species/species groups required 45 different fleet sectors to account for all regional, gear type, mesh size, and quota-monitoring status combinations (Table 38).

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 vessel trip reports 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).[24]

[24] 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).

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 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, since 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 sector, 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 sector, 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 weight in the two databases is 4.7 percent.

Species Group	FVTR Landings (mt, live)	Dealer Landings (mt, live)	Difference (mt, live)	Percent 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 lb, 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 d/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.[25] 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) 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. 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 can not 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

[25] 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.

might not be collected. For the protected species dataset, all on-watch hauls are included in the dataset, regardless if discarded fish species were recorded. Since 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;[26] 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 sector, the number of observed trips, number of observed hauls, average trip length (in days), kept weight of all species in the trip, the discard weight of each species, and the discarded weight of all species (combined) in the trip are calculated.

A summary of the number of 2004 observed trips and sea days and 2004 commercial FVTR trips and sea days by fleet sector and calendar quarter is presented in Table 38 and Table 39. 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.

[26] 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.

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 40). 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 41). 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 40 and Table 41 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 is 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. Imputation procedures have been 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) recognizing that seasonal variation can occur for some species (Table 38 and Table 39). 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 use 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 are indicated in Table 38 and Table 39.

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.

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 NOAA Fisheries Service.

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 (d/k) vs. discard/days absent (d/da)) for two different pooling strategies (separate vs. combined). In addition, the discard per trip estimator (3) was applied individually to the datasets for d/k and d/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 (d/k) and discard to days absent (d/da) (equations 1a and 1b, respectively).

(1a) $\hat{R}_{jh} = \dfrac{\sum_{i=1}^{n_h} d_{ijh}}{\sum_{i=1}^{n_h} k_{ih}}$ and (1b) $\hat{R}_{jh} = \dfrac{\sum_{i=1}^{n_h} d_{ijh}}{\sum_{i=1}^{n_h} da_{ih}}$

where R_{jh} is the bycatch rate of species group j in stratum h; d_{ijh} 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; k_{ih} is the kept weight, in pounds, of all species within trip i in stratum h; and da_{ih} is the days absent of trip i in stratum h.

The approximate variance of the estimate of R_{jh} is obtained from a first order Taylor series expansion about the mean. The computational formula for these quantities can be expressed as:

(2a) $$V\left(\hat{R}_{jh}\right) = \frac{1}{(n_h - 1) n_h \bar{k}_h^2}\left[\left(\sum_{i=1}^{n_h} d_{ijh}^2\right) + \hat{R}_{jh}^2\left(\sum_{i=1}^{n_h} k_{ih}^2\right) - 2\hat{R}_{jh}\left(\sum_{i=1}^{n_h} d_{ijh} k_{ih}\right)\right]$$

and

(2b) $$V\left(\hat{R}_{jh}\right) = \frac{1}{(n_h - 1) n_h \overline{da}_h^2}\left[\left(\sum_{i=1}^{n_h} d_{ijh}^2\right) + \hat{R}_{jh}^2\left(\sum_{i=1}^{n_h} da_{ih}^2\right) - 2\hat{R}_{jh}\left(\sum_{i=1}^{n_h} d_{ijh} da_{ih}\right)\right]$$

where d_{ijh} is the total discard weight of species group j in trip i within stratum h; k_{ih} is the total kept weight of all species in trip i within stratum h; n_h is the sample size (number of observed trips) in stratum h; and k_h bar is the mean kept landings of all species within the stratum. Note that in this formulation of the variance, the finite population correction factor (fpc), i.e., 1 minus the sampling fraction within the stratum, has been omitted. This has been done to improve readability. However, the fpc is included however, in equations 12, 16, and 19 for the total variance of the bycatch ratios.

The coefficient of variation for the bycatch ratio for species group j in stratum h is defined as:

(3) $$CV(\hat{R}_{jh}) = \frac{\sqrt{V(\hat{R}_{jh})}}{\hat{R}_{jh}}$$

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

(4) $$\hat{T}_{jh} = \frac{N_h\left(\dfrac{n_h N_h}{N_h - n_h}\right) s_D^2}{(0.09)\hat{R}^2 N_h + \left(\dfrac{n_h N_h}{N_h - n_h}\right) s_D^2}$$

where n_h is the number of observed trips in stratum h; N_h is the number of FVTR trips in stratum h; s_D is the standard error of the total discard of species group j in stratum h; and Rhat is 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:

$$(5) \quad \hat{S}_{jh} = \hat{T}_{jh} * \overline{da_h}$$

where da_h bar is the average trip length of observed trips in stratum h.

5.4.1.2. Ratio Assumptions

Equations 2a and 2b 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 (ρ) 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 Y=(y/x)X where X is the total value of the covariate. The approximate variance of Y based on a ratio estimator can be written as:

$$(5.1) \quad V\left(\hat{Y}_R\right) = \frac{N^2(1-f)}{n}\left(S_y^2 + R^2 S_x^2 - 2R\rho S_y S_x\right)$$

where S_y and S_x are the standard errors of y and x. Note that increases in the correlation coefficient (ρ) will decrease the variance of the total. Increases in ρ 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 ρ 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 ρ (the correlation of the ratio estimate, rho) was examined.

The correlation of the ratio estimate is defined as:

$$(6) \quad L_{xy,j} = n_h \sum_{i=1}^{n_h} x_{i,j} y_{i,j} - \left(\sum_{i=1}^{n_h} x_{i,j}\right)\left(\sum_{i=1}^{n_h} y_{i,j}\right)$$

$$(7) \quad L_{xx,j} = n_h \sum_{i=1}^{n_h} x_{i,j}^2 - \left(\sum_{i=1}^{n_h} x_{i,j}\right)^2$$

(8) $$L_{yy,j} = n_h \sum_{i=1}^{n_h} y_{i,j}^2 - \left(\sum_{i=1}^{n_h} y_{i,j} \right)^2$$

(9) $$\rho_j^{\ 2} = \frac{L_{xy,j}^2}{L_{xx,j} L_{yy,j}}$$

where x_{ij} is days absent or kept pounds for species j in trip i; y_{ij} is discarded pounds of species j on trip i; n_h is number of observed trips in stratum h; and ρ^2 is squared correlation coefficient for species j.

The results of the correlation analyses are summarized in Table 42 and Table 43 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 large- and 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 Mid-Atlantic 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.[27] These two illustrative plots (Figure 34 and Figure 35) 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 B-2a to B-2j**)**. 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

[27] The fourth root transformation approximates a natural logarithm transformation without the difficulty of adding a constant (Green 1979).

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 (d/k or d/da).

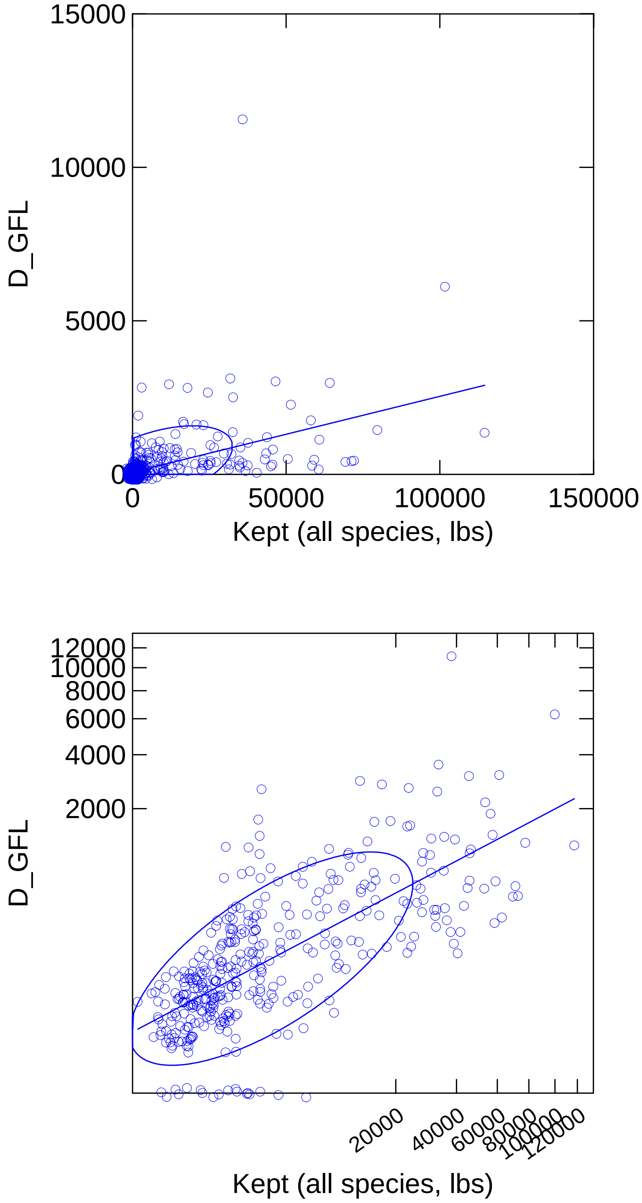

Figure 34. Comparison of nominal scale (top) and fourth root transformation (bottom) of Northeast multispecies (large-mesh) discards and kept weight of all species from 2004 observed large-mesh otter trawl trips in New England; each dot represents one fishing trip.

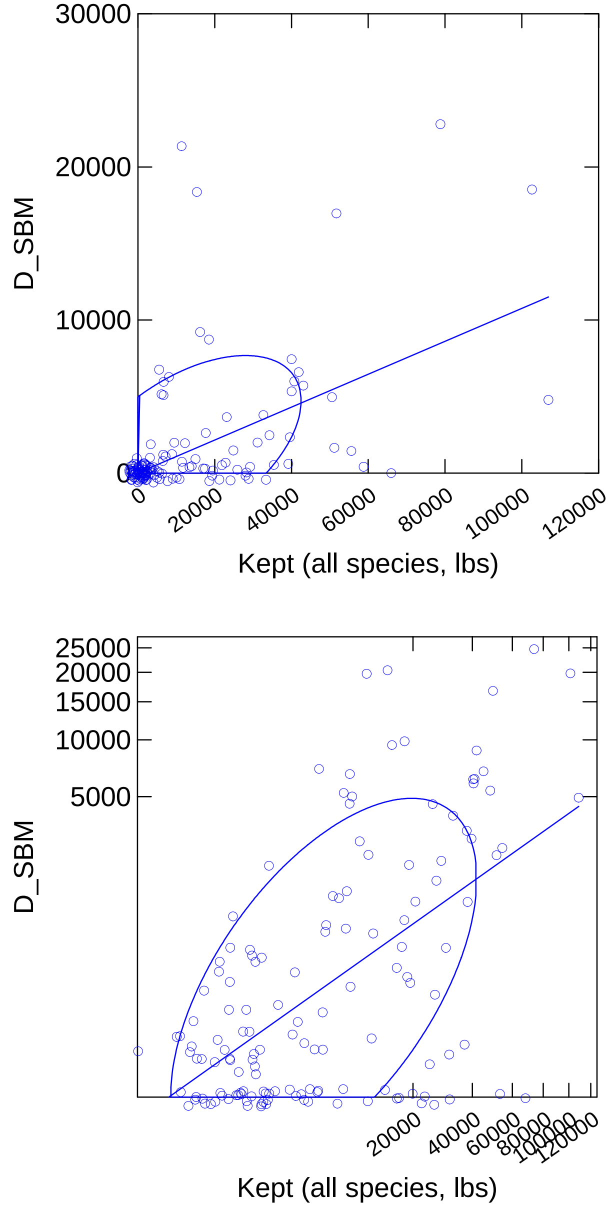

Figure 35. Comparison of nominal scale (top) and fourth root transformation (bottom) of squid, butterfish, and mackerel discards and kept weight of all species from 2004 observed small-mesh otter trawl trips in New England; each dot represents one fishing trip.

5.4.2. Estimation of Total Discards

Three methods were examined to estimate 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 (d/k and d/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.

5.4.2.1. Separate Ratio Method (Method 1)

The total discarded pounds of species j using method 1 are given by:

(10a) $\hat{D}_{1,j} = \sum_{h=1}^{L} K_h r_{s,jh}$ and (10b) $\hat{D}_{1,j} = \sum_{h=1}^{L} DA_h r'_{s,jh}$

where

(11a) $r_{s,jh} = \dfrac{\sum_{i=1}^{n_h} d_{jih}}{\sum_{i=1}^{n_h} k_{ih}}$ and (11b) $r'_{s,jh} = \dfrac{\sum_{i=1}^{n_h} d_{jih}}{\sum_{i=1}^{n_h} da_{ih}}$

where $D_{1,j}$ hat is the total discarded pounds for species j; K_h is the FVTR total kept pounds in stratum h; DA_h is the FVTR total days absent in stratum h; $r_{s,jh}$ is the separate ratio for species j in stratum h; d_{jih} is discards of species j from trip i in stratum h; k_{ih} is kept pounds of all species on trip i in stratum h; and da_{ih} = days absent from trip i in stratum h.

The variance of $D_{1,j}$ hat is given by:

(12a)

$$V(\hat{D}_{1,j}) = \sum_{h=1}^{L} K_h^2 \left(\frac{N_h - n_h}{n_h N_h} \right) \frac{1}{\left(\dfrac{\sum_{i=1}^{n_h} k_{ih}}{n_h} \right)^2} \left[\frac{\sum_{i=1}^{n_h} \left(d_{jih}^2 + \left(\dfrac{\sum_{i=1}^{n_h} d_{jih}}{\sum_{i=i}^{n_h} k_{ih}} \right)^2 k_{ih}^2 - 2 r_{s,jh} d_{jih} k_{ih} \right)}{n_h - 1} \right]$$

and

(12b)

$$V(\hat{D}_{1,j}) = \sum_{h=1}^{L} DA_h^2 \left(\frac{N_h - n_h}{n_h N_h} \right) \frac{1}{\left(\frac{\sum_{i=1}^{n_h} da_{ih}}{n_h} \right)^2} \left[\frac{\sum_{i=1}^{n_h} \left(d_{jih}^2 + \left(\frac{\sum_{i=1}^{n_h} d_{jih}}{\sum_{i=i}^{n_h} da_{ih}} \right)^2 da_{ih}^2 - 2r'_{s,jh} d_{jih} da_{ih} \right)}{n_h - 1} \right]$$

where $D_{1,j}$ hat is the total discarded pounds for species j; K_h is the FVTR total kept pounds in stratum h; DA_h is the FVTR total days absent in stratum h; $r_{s,jh}$ is the separate ratio for species j in stratum h; d_{jih} is discards of species j from trip i in stratum h; k_{ih} is kept pounds of all species on trip i in stratum h; da_{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 $D_{1,j}$ hat is defined as:

(13) $$CV(\hat{D}_{1,j}) = \frac{\sqrt{V(\hat{D}_{1,j})}}{\hat{D}_{1,j}}$$

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:

(14a) $$\hat{D}_{2,j} = \sum_{h=1}^{L} K_h r_{c,j}$$ and (14b) $$\hat{D}_{2,j} = \sum_{h=1}^{L} DA_h r'_{c,j}$$

where

(15a) $$r_{c,j} = \frac{\sum_{h=1}^{L} N_h \sum_{i=1}^{n_h} \frac{d_{jih}}{n_h}}{\sum_{h=1}^{L} N_h \sum_{i=1}^{n_h} \frac{k_{ih}}{n_h}}$$ and (15b) $$r'_{c,j} = \frac{\sum_{h=1}^{L} N_h \sum_{i=1}^{n_h} \frac{d_{jih}}{n_h}}{\sum_{h=1}^{L} N_h \sum_{i=1}^{n_h} \frac{da_{ih}}{n_h}}$$

where $D_{2,j}$ hat is total discarded pounds for species j; K_h is FVTR total kept pounds in stratum h; DA_h is FVTR total days absent in stratum h; $r_{c,j}$ is the combined ratio of species j in stratum h; d_{jih} is discards of species j from trip i in stratum h; k_{ih} is kept pounds of all species on trip i in stratum h; da_{ih} is 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 variance of $D_{2,j}$ hat for species j is given by:

$$(16a)\quad V(\hat{D}_{2,j}) = \sum_{h=1}^{L} K_h^2 \left(\frac{N_h - n_h}{n_h N_h} \right) \frac{1}{\left(\frac{\sum_{i=1}^{n_h} k_{ih}}{n_h} \right)^2} \left[\frac{\sum_{i=1}^{n_h} \left(d_{jih}^2 + \left(r_{c,j} \right)^2 k_{ih}^2 - 2 r_{c,j}\ d_{jih} k_{ih} \right)}{n_h - 1} \right]$$

and

(16b)

$$V(\hat{D}_{2,j}) = \sum_{h=1}^{L} DA_h^2 \left(\frac{N_h - n_h}{n_h N_h} \right) \frac{1}{\left(\frac{\sum_{i=1}^{n_h} da_{ih}}{n_h} \right)^2} \left[\frac{\sum_{i=1}^{n_h} \left(d_{jih}^2 + \left(r'_{c,j} \right)^2 da_{ih}^2 - 2 r'_{c,j}\ d_{jih} da_{ih} \right)}{n_h - 1} \right]$$

where $D_{2,j}$ hat is total discarded pounds for species j; K_h is FVTR total kept pounds in stratum h; DA_h is FVTR total days absent in stratum h; $r_{c,jh}$ is the combined ratio of species j in stratum h; d_{jih} is discards of species j from trip i in stratum h; k_{ih} is kept pounds of all species on trip i in stratum h; da_{ih} is 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 $D_{2,j}$ hat is given by:

$$(17)\quad CV(\hat{D}_{2,j}) = \frac{\sqrt{V(\hat{D}_{2,j})}}{\hat{D}_{2,j}}$$

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:

$$(18)\quad \hat{D}_{3,j} = \sum_{h=1}^{L} N_h \left(\frac{\sum_{i=1}^{n_h} d_{jih}}{n_h} \right)$$

where d_{jih} 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. Note that D_3 hat will differ between d/da and d/kall sets due to expansion of discards to account for non-observed hauls in the d/da set.

The variance of $D_{3,j}$ hat for total discarded pounds using Method 3 for species j is given by:

$$(19)\quad V(\hat{D}_{3,j}) = \sum_{h=1}^{L} N_h^2 \left(\frac{N_h - n_h}{N_h}\right)\left[\frac{\sum_{i=1}^{n_h} d_{jih}^2 - \frac{\left(\sum_{i=1}^{n_h} d_{jih}\right)^2}{n_h}}{n(n_h - 1)}\right]$$

where $D_{3,j}$ hat is total discarded pounds for species j; d_{jih} 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 given by:

$$(20)\quad CV(\hat{D}_{3,j}) = \frac{\sqrt{V(\hat{D}_{3,j})}}{\hat{D}_{3,j}}.$$

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

$$(21)\quad \hat{S}_{30,jh} = \sum_{q=1}^{4} \hat{S}_{30,jhq}.$$

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:

$$(22)\quad \hat{S}_{30,jhq} = \hat{T}_{hq} * \overline{DA_{hq}}$$

where T hat is 2 percent of the FVTR trips in stratum h and quarter q, and 3 <= T_{hq} hat <= 100 trips.

The composite number of sea days and trips necessary to achieve a 30 percent CV is independent of the three methods to estimate total discards.

5.5. Additional Analyses

5.5.1. 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.

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 B-4g). 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 d/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 than for gillnet and longline, they remain relatively narrow, indicating not much variability and a strong association. In general, results in Figures B-5h 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. Since 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 (d/da and d/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 d/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 44 and Table 45), ranking of total discards (Table 46, Table 47, Table 48, and Table 49), and the sea days and trips necessary to achieve a CV of 30 percent (Table 50, Table 51, Table 52, Table 53, Table 54, and Table 55) are based upon the combined ratio method (method 2) and the discard-to-kept ratio.

The precision of the total discards by fleet and species is presented in Table 44 and Table 45 (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 all species combined, CVs were estimated for 28 fleets, 19 of these fleets (68 percent) had CVs less than or equal to 30 percent (Table 44 and Table 45). For tilefish, three of the four fleets where discarded tilefish occurred had a CV above 30 percent. Of the 600 cells in the fleet by species matrix, 30 percent of the cells had 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 (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.

To provide insight into which species are discarded in each fleet, the total discard of each species group was ranked (highest pounds = 1, lowest pound = n) within a fishing mode. The rank indicates the relative magnitude of the discarded species group within a mode. Ranking of total discard weight within a fishing mode for fish species groups are presented in Table 46, and the ranking of total number of incidental takes of turtles, marine mammals, and sea birds within a mode are presented in Table 47 (see Appendix B, Table B-2 for individual species). In the gillnet fleets, 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/porpoise are encountered more often in otter trawl modes than other protected species, while sea birds and turtles are encountered more frequently than other protected species in the gillnet and scallop modes. Ranking of total discard weight for fish species and ranking of total numbers of incidental takes were also ranked within species group (Table 48 and Table 49, 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. Turtles are taken most often in the Mid-Atlantic scallop trawl modes.

The sea days and trips necessary to achieve a 30 percent CV for each species group and fleet are presented in Table 50 and Table 51 (sea days) and Table 52 and Table 53 (trips) (see Appendix B, Tables B-4 and B-5 for individual species). The sea days and trips are additive across fleets within species groups (i.e., column sums); however, the days and trips are not additive across species group within fleets (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 Northeast region due to exceptions to the 30 percent CV standard and the relative magnitude of the discards. For example, the need for 6,058 observer 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 over-sample by a factor of about 10 the estimated days necessary to obtain a CV of 30 percent for large-mesh groundfish species.

To determine the number of sea days needed to achieve a 30 percent CV within a fleet, 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 upon this approach, Table 54 and Table 55 present the number of sea days and trips needed for each fleet for: (1) All 20 species groups considered in this analysis; (2) the 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 cells (gray-shaded cells); and (4) the 15 Magnuson-Stevens Act species groups filtering out the unlikely cells. In Table 54 and Table 55, 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 33,602 to 38,882 days; for comparative purposes, approximately 8,000 observer sea days were utilized by the NEFOP in 2004.

Given that the low utility of allocating relatively high numbers of observer sea days to cases where the implications of the discards are expected to be trivial, further refinements in the number of sea days will be necessary. This could be accomplished by applying a series of filters in Table 50 and Table 51. These filters are explained in detail in Chapter 6 and they are based on considerations such as: (1) The importance of the discards with respect to the stock assessment or resource status for a given species; (2) elimination of cells in which the CV is already below 30 percent at current levels of observer coverage; (3) elimination of cells in which discards are a minor component of

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[29] 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 since 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.

the total discards for that species group; and (4) elimination of cells in which discards are a minor component of the total landings for that species group.

5.5.2. 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.[29]

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 56). 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 56 and Appendix B, Figure B-11). However, the difference in stratum-specific standard deviations of trip length was significantly different from zero ($p = 0.002$). 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 j (E_{jh}) as the product of the proportion of FVTR trips in statistical area j and stratum h (V_{jh}) and the number of observed trips in stratum n_h. Thus, $E_{jh}= V_{jh} * n_h$. These expectations can then be compared to the actual frequencies (O_{jh}) 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 57). It was possible to compute chi-square statistics for 86 strata. The null hypothesis of observer proportions equal to FVTR proportions was rejected ($P<0.05$) 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 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.

5.5.3. 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 can be expanded and applied to all the species groups and fishing modes subject to the SBRM.

5.5.4. Optimization Tool

The optimization model described by Rago et al. (2005) can 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 measure of the precision of the 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 36. 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.

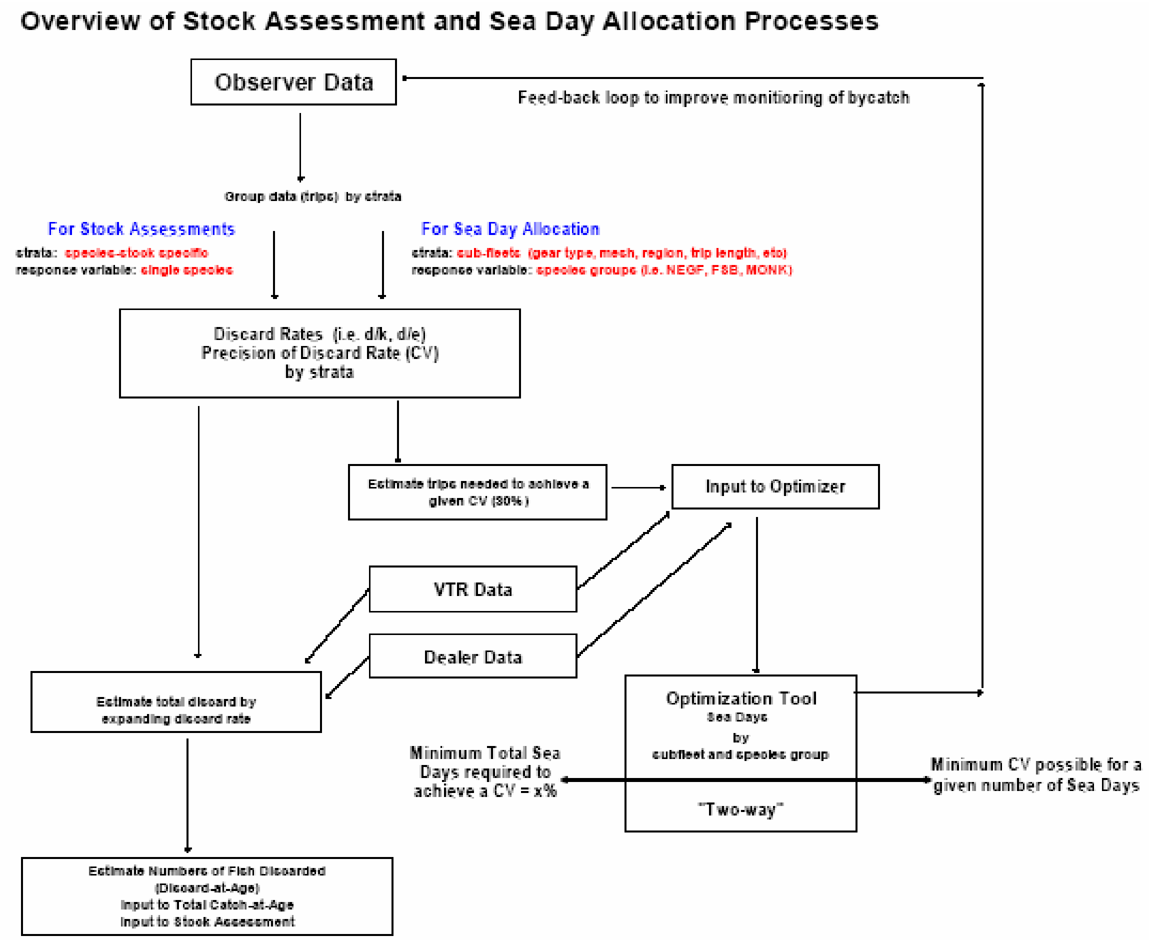

Figure 36. Overview of feedback loop used to improve bycatch monitoring in the Northeast Region (status quo).

5.6. 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. improving the relationship between design and model based estimators;
6. the influence over-stratification may have estimation (potential bias);
7. the lack of persistence in fishing behavior over years;
8. addressing the influence of fishing regulations on fishing operations and vessel behavior;
9. the imprecise estimation of location reported on the FVTR;
10. the utility of using aggregate species measures of discards;
11. improving the correspondence between FVTR and dealer data;
12. incorporating more advanced statistical estimators that explicitly account for zero observations and over-dispersion; and
13. 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 NOAA Fisheries Service should retain enough flexibility to accommodate/support using many of these newer methods.

Gear Type	Access Area (Open/ Closed)	Trip Category (General/ Limited)	Region	mesh groups	NUMBER OF TRIPS IN 2004 OBSERVER PROGRAM — FISH SET QTR 1	QTR 2	QTR 3	QTR 4	TOTAL	PROTECTED SPECIES SET QTR 1	QTR 2	QTR 3	QTR 4	TOTAL	NUMBER OF TRIPS IN 2004 VTR (commercial) — INDUSTRY ACTIVITY QTR1	QTR 2	QTR 3	QTR 4	VTR TOTAL	Comments
Longline	all	all	NE	all	5	1	3	3	12	8	1	8	102	119	470	63	277	424	1234	impute
Longline	all	all	MA	all	0	0	0	0	0	0	0	0	2	2	84	51	38	32	205	Pilot
Otter Trawl	all	all	NE	small	19	27	41	55	142	21	40	54	85	200	851	941	882	810	3484	
Otter Trawl	all	all	NE	large	75	69	119	123	386	81	99	176	183	539	2778	3714	5965	3699	16156	
Otter Trawl	all	all	MA	small	41	33	51	69	194	42	34	53	76	205	733	1517	1830	1142	5222	
Otter Trawl	all	all	MA	large	24	9	16	26	75	25	9	16	26	76	1406	3198	2579	1667	8850	
Scallop Trawl	open	limited	MA	all	0	0	0	1	1	0	0	2	1	3	23	62	68	45	198	Pilot
Scallop Trawl	open	general	MA	all	0	0	24	7	31	0	1	29	9	39	12	311	599	166	1088	Pilot
Shrimp Trawl	all	all	NE	all	12	0	0	0	12	12	0	0	0	12	1805	36	0	127	1968	impute
Shrimp Trawl	all	all	MA	all	0	0	2	0	2	0	0	2	0	2	1	45	214	74	334	Pilot
Sink, Anchor, Drift Gillnet	all	all	NE	small	0	1	0	0	1	0	1	0	0	1	5	3	18	16	42	Pilot
Sink, Anchor, Drift Gillnet	all	all	NE	large	84	90	232	171	577	157	119	277	219	772	1183	975	2004	1027	5189	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	25	72	206	142	445	42	101	231	195	569	610	1245	1587	1270	4712	
Sink, Anchor, Drift Gillnet	all	all	MA	small	1	0	1	1	3	53	96	77	132	358	536	688	1115	585	2924	Pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	0	1	0	3	4	12	25	15	29	81	95	424	264	510	1293	Pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	1	0	0	26	27	21	52	3	66	142	546	1073	148	801	2568	Pilot for fish
Scallop Dredge	open	limited	NE	all	4	5	5	12	26	5	5	11	15	36	277	420	345	187	1229	
Scallop Dredge	open	limited	MA	all	7	8	31	23	69	7	14	33	24	78	359	584	560	319	1822	
Scallop Dredge	open	general	NE	all	1	0	1	7	9	1	0	2	17	20	620	1291	1166	489	3566	Pilot
Scallop Dredge	open	general	MA	all	0	5	13	4	22	0	6	22	11	39	228	1103	1343	759	3433	impute
Scallop Dredge	closed	limited	NE	all	8	23	20	35	86	8	23	20	35	86	2	4	3	283	292	
Scallop Dredge	closed	limited	MA	all	2	14	12	7	35	2	14	12	7	35	7	6	9	56	78	
Scallop Dredge	closed	general	NE	all	0	0	0	0	0	0	0	0	0	0	1	31	15	3	50	Pilot
Scallop Dredge	closed	general	MA	all	0	0	0	1	1	0	0	0	1	1	8	66	231	241	546	Pilot
Mid-water paired & single Trawl	all	all	NE	all	5	13	19	29	66	9	21	32	37	99	248	250	330	233	1061	
Mid-water paired & single Trawl	all	all	MA	all	5	0	6	2	13	5	0	7	2	14	103	9	8	1	121	impute
Fish Pots/ Traps	all	all	NE	all	0	0	0	0	0	0	0	0	0	0	0	289	531	153	973	Pilot
Fish Pots/ Traps	all	all	MA	all	0	5	1	0	6	1	6	1	0	8	44	619	556	531	1750	Pilot
Purse Seine	all	all	NE	all	0	2	11	3	16	0	3	19	4	26	0	34	185	45	264	
Purse Seine	all	all	MA	all	0	0	0	0	0	0	2	0	0	2	0	31	21	24	76	Pilot
Hand Line	all	all	NE	all	0	0	4	2	6	0	0	6	3	9	251	709	1857	561	3378	Pilot
Hand Line	all	all	MA	all	0	0	0	0	0	0	2	1	0	3	141	1466	3122	1554	6283	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	700	1132	800	834	3466	Pilot
Clam Quahog Dredge	all	all	MA	all	0	0	0	0	0	0	0	0	0	0	763	1018	933	747	3461	Pilot
Crab Pots	all	all	NE	all	0	0	0	0	0	0	0	0	0	0	10	17	37	39	103	Pilot
Crab Pots	all	all	MA	all	0	0	0	0	0	0	0	0	0	0	7	392	642	92	1133	Pilot
Lobster Pots	all	all	NE	all	0	0	0	0	0	0	0	0	0	0	2638	6039	14487	10937	34101	Pilot
Lobster Pots	all	all	MA	all	0	0	0	0	0	0	0	1	2	3	165	1218	1718	649	3750	Pilot
Quota Monitored Longline	all	all	NE	all	0	0	0	96	96											
Quota Monitored Otter Trawl (U/C)	all	all	NE	large	0	24	43	25	92											
Quota Monitored Otter Trawl (U/C)	all	all	NE	small	0	1	4	2	7											
Quota Monitored Otter Trawl (B)	all	all	NE	large	0	0	0	20	20											
Quota Monitored Otter Trawl (B)	all	all	NE	small	0	0	0	1	1											
TOTAL									2488					3587	17713	31114	46526	31145	126498	

Table 38. Number of trips in the 2004 Northeast Fisheries Observer Program and Vessel Trip Reports, 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.

					NUMBER OF SEA DAYS IN 2004 OBSERVER PROGRAM										NUMBER OF SEA DAYS IN 2004 VTR (commercial)					
					FISH SET					PROTECTED SPECIES SET					INDUSTRY ACTIVITY					
Gear Type	Access Area (Open/ Closed)	Trip Category (General/ Limited)	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	VTR TOTAL	Comments
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 Trawl	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 39. Number of sea days in the 2004 Northeast Fisheries Observer Program and Vessel Trip Reports, 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.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	Total Trips (FISH)	BLUEFISH	HERRING	SALMON	RED CRAB	SCALLOP	MACK-/SQUID-/BUTTERFISH	MONKFISH	NE MULTI-SPP (LARGE-MESH)	NE MULTI-SPP (SMALL-MESH)	SKATE COMPLEX	DOGFISH	FLUKE/-SCUP/-BLK SEA BASS	SURF CLAM/-OCEAN QUAHOG	TILEFISH	ALL SPECIES
Longline	all	all	NE	all	12	100%	100%	100%	100%	100%	100%	100%	0%	92%	25%	33%	100%	100%	100%	0%
Longline	all	all	MA	all	0															
Otter Trawl	all	all	NE	small	142	85%	74%	100%	90%	89%	35%	36%	4%	35%	14%	21%	41%	99%	87%	0%
Otter Trawl	all	all	NE	large	386	98%	90%	100%	82%	88%	70%	49%	5%	53%	6%	28%	72%	99%	99%	0%
Otter Trawl	all	all	MA	small	194	90%	96%	100%	99%	90%	55%	67%	44%	73%	23%	37%	28%	96%	99%	5%
Otter Trawl	all	all	MA	large	75	92%	96%	100%	100%	80%	59%	44%	35%	77%	5%	31%	20%	93%	100%	0%
Scallop Trawl	open	limited	MA	all	1	100%	100%	100%	100%	0%	0%	0%	0%	100%	0%	100%	0%	100%	100%	0%
Scallop Trawl	open	general	MA	all	31	97%	100%	100%	97%	35%	58%	29%	32%	77%	3%	77%	74%	100%	100%	0%
Shrimp Trawl	all	all	NE	all	12	100%	0%	100%	100%	92%	92%	17%	0%	50%	50%	92%	100%	100%	100%	0%
Shrimp Trawl	all	all	MA	all	2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	0%	100%	100%	100%	0%
Sink, Anchor, Drift Gillnet	all	all	NE	large	577	93%	93%	100%	99%	99%	95%	81%	22%	81%	44%	28%	98%	100%	100%	2%
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	445	85%	96%	100%	100%	97%	95%	57%	48%	88%	30%	29%	92%	100%	98%	2%
Sink, Anchor, Drift Gillnet	all	all	MA	small	3	100%	100%	100%	100%	100%	67%	100%	100%	100%	100%	33%	67%	100%	100%	0%
Sink, Anchor, Drift Gillnet	all	all	MA	large	4	75%	100%	100%	100%	100%	100%	100%	75%	100%	50%	25%	100%	100%	100%	0%
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	27	56%	100%	100%	100%	81%	100%	37%	100%	100%	4%	11%	74%	100%	100%	0%
Scallop Dredge	open	limited	NE	all	26	100%	100%	100%	96%	19%	50%	8%	0%	38%	0%	46%	35%	62%	100%	0%
Scallop Dredge	open	limited	MA	all	69	100%	100%	100%	99%	26%	42%	1%	25%	57%	0%	62%	33%	81%	100%	0%
Scallop Dredge	open	general	NE	all	9	100%	100%	100%	100%	67%	89%	33%	0%	56%	11%	78%	89%	89%	100%	0%
Scallop Dredge	open	general	MA	all	22	100%	100%	100%	100%	41%	95%	18%	41%	77%	9%	86%	73%	95%	100%	5%
Scallop Dredge	closed	limited	NE	all	86	99%	97%	100%	98%	20%	43%	5%	1%	16%	0%	51%	26%	85%	100%	0%
Scallop Dredge	closed	limited	MA	all	35	97%	91%	100%	97%	17%	26%	0%	9%	23%	0%	46%	29%	91%	100%	0%
Scallop Dredge	closed	general	NE	all	0															
Scallop Dredge	closed	general	MA	all	1	100%	100%	100%	100%	0%	100%	0%	100%	100%	0%	100%	0%	100%	100%	0%
Mid-water paired & single Trawl	all	all	NE	all	66	89%	86%	100%	100%	98%	62%	85%	73%	79%	95%	30%	97%	100%	100%	9%
Mid-water paired & single Trawl	all	all	MA	all	13	92%	92%	100%	100%	100%	69%	77%	38%	77%	100%	54%	85%	100%	100%	0%
Fish Pots/ Traps	all	all	NE	all	0															
Fish Pots/ Traps	all	all	MA	all	6	100%	100%	100%	100%	100%	100%	83%	100%	100%	100%	100%	0%	100%	100%	0%
Purse Seine	all	all	NE	all	16	100%	88%	100%	100%	100%	88%	100%	94%	100%	100%	44%	100%	100%	100%	31%
Purse Seine	all	all	MA	all	0															
Hand Line	all	all	NE	all	6	100%	100%	100%	100%	100%	100%	100%	67%	100%	100%	100%	100%	100%	100%	67%
Hand Line	all	all	MA	all	0															
Scottish Seine	all	all	NE	all	5	100%	100%	100%	100%	100%	100%	100%	0%	80%	40%	100%	60%	100%	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	0															
Lobster Pots	all	all	MA	all	0															
Quota Monitored Longline	all	all	NE	all	92	92%	63%	100%	71%	54%	26%	9%	0%	9%	0%	45%	47%	88%	100%	0%
Quota Monitored Otter Trawl (U/C)	all	all	NE	large	7	100%	71%	100%	86%	86%	43%	14%	0%	14%	0%	43%	86%	100%	100%	0%
Quota Monitored Otter Trawl (U/C)	all	all	NE	small	96	100%	100%	100%	100%	100%	100%	98%	3%	57%	11%	1%	100%	100%	100%	0%
Quota Monitored Otter Trawl (B)	all	all	NE	large	20	100%	80%	100%	70%	70%	80%	40%	0%	45%	0%	0%	70%	95%	100%	0%
Quota Monitored Otter Trawl (B)	all	all	NE	small	1	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	100%	0%

Table 40. 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.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	Total Trips (PSPP)	TURTLES	SEALS	WHALES	DOLPHINS/-PORPOISE	SEA BIRDS (ALL)
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 Trawl	open	limited	MA	all	3	66.7%	100.0%	100.0%	100.0%	100.0%
Scallop Trawl	open	general	MA	all	39	100.0%	100.0%	100.0%	100.0%	100.0%
Shrimp Trawl	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 Trawl	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 41. Number of observed trips in 2004 and the percent of observed trips with zero incidental takes, by fishing mode, for protected species groups.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	BLUEFISH	HERRING	SALMON	RED CRAB	SCALLOP	MACK-/SQUID-/BUTTERFISH	MONKFISH	NE MULTI-SPP (LARGE-MESH)	NE MULTI-SPP (SMALL-MESH)	SKATE	DOGFISH	FLUKE/-SCUP/-BLK SEA BASS	SURF CLAM/-OCEAN QUAHOG	TILEFISH
Longline	all	all	NE	all								0.418	0.364	0.444	0.139			
Longline	all	all	MA	all														
Otter Trawl	all	all	NE	small	0.338	0.066		0.158	0.059	0.530	0.118	0.178	0.407	0.040	0.047	0.035	0.009	0.277
Otter Trawl	all	all	NE	large	0.116	0.107		0.437	0.069	0.059	0.650	0.479	0.511	0.353	0.312	0.024	0.020	0.016
Otter Trawl	all	all	MA	small	0.090	0.022		0.013	0.020	0.205	0.015	0.096	0.198	0.220	0.028	0.000	0.056	0.149
Otter Trawl	all	all	MA	large	0.080	0.084			0.418	0.420	0.468	0.010	0.239	0.319	0.111	0.185	0.135	
Scallop Trawl	open	limited	MA	all														
Scallop Trawl	open	general	MA	all	0.164			0.067	0.034	0.337	0.238	0.397	0.204	0.210	0.167	0.108		
Shrimp Trawl	all	all	NE	all		0.783			0.034	0.136	0.420	0.099	0.255	0.153	0.004			
Shrimp Trawl	all	all	MA	all														
Sink, Anchor, Drift Gillnet	all	all	NE	small														
Sink, Anchor, Drift Gillnet	all	all	NE	large	0.020	0.167		0.455	0.005	0.005	0.015	0.315	0.136	0.002	0.233	0.032		
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	0.303	0.048		0.013	0.174	0.029	0.362	0.086	0.038	0.481	0.055	0.244		0.162
Sink, Anchor, Drift Gillnet	all	all	MA	small						0.993					0.981	0.993		
Sink, Anchor, Drift Gillnet	all	all	MA	large	0.575							0.507		0.652	0.644			
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	0.381				0.071		0.251			0.199	0.078	0.130		
Scallop Dredge	open	limited	NE	all				0.199	0.537	0.055	0.452	0.016	0.177	0.228	0.194	0.225	0.278	
Scallop Dredge	open	limited	MA	all				0.078	0.097	0.144	0.262	0.185	0.056	0.275	0.309	0.206	0.004	
Scallop Dredge	open	general	NE	all					0.375	0.112	0.126	0.658	0.174	0.001	0.809	0.491	0.064	
Scallop Dredge	open	general	MA	all					0.295	0.168	0.555	0.332	0.032	0.439	0.103	0.155	0.417	
Scallop Dredge	closed	limited	NE	all	0.035	0.082		0.099	0.115	0.005	0.006	0.172	0.015	0.124	0.058	0.267	0.078	
Scallop Dredge	closed	limited	MA	all	0.022	0.155		0.105	0.429	0.122	0.205	0.064	0.085	0.211	0.239	0.144	0.093	
Scallop Dredge	closed	general	NE	all														
Scallop Dredge	closed	general	MA	all														
Mid-water paired & single Trawl	all	all	NE	all	0.157	0.142			0.133	0.383	0.152	0.148	0.008	0.140	0.030	0.387		
Mid-water paired & single Trawl	all	all	MA	all	0.243	0.214				0.234	0.465	0.437	0.244		0.854	0.371		
Fish Pots/ Traps	all	all	NE	all														
Fish Pots/ Traps	all	all	MA	all							0.377					0.658		
Purse Seine	all	all	NE	all		0.235				0.095		0.085			0.003			
Purse Seine	all	all	MA	all														
Hand Line	all	all	NE	all								0.521						
Hand Line	all	all	MA	all														
Scottish Seine	all	all	NE	all								0.007	0.859	0.083		0.734		
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 42. Summary of correlation (rho) of the ratio estimate (discard to kept estimator), by fish species group and fishing mode.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	TURTLES	SEALS	WHALES	DOLPHINS/-PORPOISE	SEA BIRDS (ALL)	ALL SPECIES	PILOT coverage
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 43. Summary of correlation (rho) of the ratio estimate (discard to kept estimator), by protected species group and fishing mode.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	2004 OB FISH TRIPS	BLUEFISH	HERRING	SALMON	RED CRAB	SCALLOP	MACK-/SQUID-/BUTTERFISH	MONKFISH	NE MULTI-SPP (LARGE-MESH)	NE MULTI-SPP (SMALL-MESH)	SKATE	DOGFISH	FLUKE/-SCUP/-BLK SEA BASS	SURF CLAM/-OCEAN QUAHOG	TILEFISH	PILOT coverage
Longline	all	all	NE	all	12	*	*	*	*	*	*	*	0.335	0.910	0.614	0.654	*	*	*	
Longline	all	all	MA	all	0															pilot
Otter Trawl	all	all	NE	small	142	0.508	0.437	*	0.428	0.710	**0.227**	0.405	**0.233**	**0.235**	0.691	0.322	0.309	1.028	0.304	
Otter Trawl	all	all	NE	large	386	2.474	1.313	*	**0.280**	0.350	0.572	**0.088**	**0.101**	**0.182**	**0.175**	**0.245**	0.319	1.512	0.529	
Otter Trawl	all	all	MA	small	194	0.903	0.784	*	1.394	0.574	0.561	0.354	0.326	0.508	**0.222**	0.367	0.386	0.464	1.155	
Otter Trawl	all	all	MA	large	75	1.906	0.775	*	*	0.444	0.390	**0.295**	**0.251**	0.827	**0.209**	0.557	**0.246**	0.609	*	
Scallop Trawl	open	limited	MA	all	1	*	*	*	*	**0.000**	**0.000**	**0.000**	**0.000**	*	**0.000**	*	**0.000**	*	*	pilot
Scallop Trawl	open	general	MA	all	31	1.141	*	*	0.640	**0.224**	0.354	**0.194**	**0.170**	0.496	0.347	0.675	0.505	*	*	pilot
Shrimp Trawl	all	all	NE	all	12	*	0.479	*	*	0.965	0.981	**0.235**	**0.224**	0.557	0.799	0.960	*	*	*	
Shrimp Trawl	all	all	MA	all	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	*	*	*	*	*	**0.000**	*	*	*	*	**0.000**	*	*	*	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	large	577	**0.220**	**0.229**	*	0.625	0.969	0.841	**0.210**	**0.092**	**0.183**	**0.228**	**0.106**	0.845	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	445	**0.181**	0.378	*	0.998	0.421	0.498	**0.174**	**0.159**	0.624	**0.117**	**0.162**	**0.233**	*	**0.256**	
Sink, Anchor, Drift Gillnet	all	all	MA	small	3	*	*	*	*	*	**0.000**	*	*	*	*	**0.000**	**0.000**	*	*	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	4	1.216	*	*	*	*	*	*	0.868	*	1.118	1.083	*	*	*	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	27	0.304	*	*	*	0.587	*	**0.273**	*	*	**0.115**	**0.129**	0.303	*	*	pilot for fish
Scallop Dredge	open	limited	NE	all	26	*	*	*	0.842	**0.159**	0.689	0.319	0.480	0.414	**0.236**	0.515	0.458	0.391	*	
Scallop Dredge	open	limited	MA	all	69	*	*	*	1.304	**0.200**	0.305	**0.174**	**0.242**	0.758	**0.126**	**0.230**	**0.259**	0.771	*	
Scallop Dredge	open	general	NE	all	9	*	*	*	*	**0.094**	1.274	0.560	0.358	**0.104**	**0.177**	0.318	**0.092**	1.287	*	pilot
Scallop Dredge	open	general	MA	all	22	*	*	*	*	0.359	0.865	**0.202**	0.311	0.482	**0.202**	0.550	0.461	0.830	*	
Scallop Dredge	closed	limited	NE	all	86	0.934	**0.160**	*	0.793	**0.170**	0.425	**0.252**	**0.137**	0.374	**0.134**	0.349	0.344	0.412	*	
Scallop Dredge	closed	limited	MA	all	35	0.992	0.580	*	**0.295**	**0.202**	0.318	**0.262**	0.631	**0.264**	**0.135**	0.364	0.311	**0.295**	*	
Scallop Dredge	closed	general	NE	all	0															pilot
Scallop Dredge	closed	general	MA	all	1	*	*	*	*	**0.000**	*	**0.000**	*	*	**0.000**	*	**0.000**	*	*	pilot
Mid-water paired & single Trawl	all	all	NE	all	66	0.770	0.770	*	*	1.464	0.429	0.724	0.669	0.994	1.177	0.418	0.628	*	*	
Mid-water paired & single Trawl	all	all	MA	all	13	0.539	0.982	*	*	*	0.546	1.108	0.742	0.539	*	**0.246**	1.172	*	*	
Fish Pots/ Traps	all	all	NE	all	0															pilot
Fish Pots/ Traps	all	all	MA	all	6	*	*	*	*	*	*	0.408	*	*	*	*	**0.161**	*	*	pilot
Purse Seine	all	all	NE	all	16	*	0.981	*	*	*	0.935	*	0.973	*	*	0.972	*	*	*	
Purse Seine	all	all	MA	all	0															pilot
Hand Line	all	all	NE	all	6	*	*	*	*	*	*	*	4.030	*	*	*	*	*	*	pilot
Hand Line	all	all	MA	all	0															pilot
Scottish Seine	all	all	NE	all	5	*	*	*	*	*	*	*	**0.289**	**0.279**	0.319	*	**0.253**	*	*	pilot
Clam Quahog Dredge	all	all	NE	all	0															pilot
Clam Quahog Dredge	all	all	MA	all	0															pilot
Crab Pots	all	all	NE	all	0															pilot
Crab Pots	all	all	MA	all	0															pilot
Lobster Pots	all	all	NE	all	0															pilot
Lobster Pots	all	all	MA	all	0															pilot

Table 44. The coefficient of variation (CV) of total discards, by fleet and species group (bold font indicates CV is less or equal to 30 percent) derived from 2004 Northeast Fisheries Observer Program data; see Appendix B, Table B-1 for all species. Note, when bycatch ratio = 0, CV = null (*); blank = no observer coverage.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	2004 OB PSPP TRIPS	TURTLES	SEALS	WHALES	DOLPHINS/- PORPOISE	SEA BIRDS (ALL)	ALL SPECIES	PILOT coverage
Longline	all	all	NE	all	119	*	*	*	*	0.425	0.489	
Longline	all	all	MA	all	2	*	*	*	*	*		pilot
Otter Trawl	all	all	NE	small	200	*	*	0.931	0.650	0.548	**0.193**	
Otter Trawl	all	all	NE	large	539	*	*	1.089	0.389	0.489	**0.124**	
Otter Trawl	all	all	MA	small	205	0.573	*	*	0.557	0.706	**0.247**	
Otter Trawl	all	all	MA	large	76	*	*	*	*	0.672	**0.185**	
Scallop Trawl	open	limited	MA	all	3	0.381	*	*	*	*	**0.000**	pilot
Scallop Trawl	open	general	MA	all	39	*	*	*	*	*	**0.243**	pilot
Shrimp Trawl	all	all	NE	all	12	*	*	*	*	*	0.310	
Shrimp Trawl	all	all	MA	all	2	*	*	*	*	*	**0.052**	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	*	*	*	*	*	**0.000**	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	large	772	*	**0.206**	*	0.359	0.342	**0.092**	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	569	*	**0.215**	*	**0.288**	0.602	**0.085**	
Sink, Anchor, Drift Gillnet	all	all	MA	small	358	0.626	*	*	*	0.582	**0.000**	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	81	1.052	*	*	*	0.618	1.078	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	142	0.495	0.692	*	0.924	0.693	**0.052**	pilot for fish
Scallop Dredge	open	limited	NE	all	36	0.551	*	*	*	0.896	**0.197**	
Scallop Dredge	open	limited	MA	all	78	0.770	*	*	*	*	**0.112**	
Scallop Dredge	open	general	NE	all	20	*	*	*	*	*	0.325	pilot
Scallop Dredge	open	general	MA	all	39	*	*	*	*	*	**0.184**	
Scallop Dredge	closed	limited	NE	all	86	**0.157**	*	*	*	**0.157**	**0.132**	
Scallop Dredge	closed	limited	MA	all	35	*	*	*	*	*	**0.118**	
Scallop Dredge	closed	general	NE	all	0							pilot
Scallop Dredge	closed	general	MA	all	1	*	*	*	*	*	**0.000**	pilot
Mid-water paired & single Trawl	all	all	NE	all	99	*	*	1.114	0.786	0.554	0.317	
Mid-water paired & single Trawl	all	all	MA	all	14	*	*	*	*	*	0.412	
Fish Pots/ Traps	all	all	NE	all	0							pilot
Fish Pots/ Traps	all	all	MA	all	8	*	*	*	*	*	**0.137**	pilot
Purse Seine	all	all	NE	all	26	*	*	*	*	*	0.715	
Purse Seine	all	all	MA	all	2	*	*	*	*	*		pilot
Hand Line	all	all	NE	all	9	*	*	*	*	*	4.030	pilot
Hand Line	all	all	MA	all	3	*	*	*	*	*		pilot
Scottish Seine	all	all	NE	all	8	*	*	*	*	*	0.423	pilot
Clam Quahog Dredge	all	all	NE	all	0							pilot
Clam Quahog Dredge	all	all	MA	all	0							pilot
Crab Pots	all	all	NE	all	0							pilot
Crab Pots	all	all	MA	all	0							pilot
Lobster Pots	all	all	NE	all	3	*	*	*	*	*		pilot
Lobster Pots	all	all	MA	all	0							pilot

Table 45. The coefficient of variation (CV) of total discard, by fleet and species group (bold font indicates CV is less or equal to 30%) derived from 2004 Northeast Fisheries Observer Program data; see Appendix B, Table B-1 for all species. Note, when bycatch ratio = 0, CV = null (*); blank = no observer coverage.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	BLUEFISH	HERRING	SALMON	RED CRAB	SCALLOP	MACK-/SQUID-/BUTTERFISH	MONKFISH	NE MULTI-SPP (LARGE-MESH)	NE MULTI-SPP (SMALL-MESH)	SKATE	DOGFISH	FLUKE/-SCUP/-BLK SEA BASS	SURF CLAM/-OCEAN QUAHOG	TILEFISH	
Longline	all	all	NE	all	5	5	*	5	5	5	5	2	4	3	1	5	5	5	
Longline	all	all	MA	all															
Otter Trawl	all	all	NE	small	9	8	*	10	12	1	7	6	3	2	4	5	13	11	
Otter Trawl	all	all	NE	large	9	10	*	6	8	11	4	3	7	1	2	5	13	12	
Otter Trawl	all	all	MA	small	8	11	*	12	9	2	7	6	5	1	3	4	10	13	
Otter Trawl	all	all	MA	large	10	11	*	12	5	7	6	4	8	1	2	3	9	12	
Scallop Trawl	open	limited	MA	all	7	7	*	7	1	6	4	3	7	2	7	5	7	7	
Scallop Trawl	open	general	MA	all	10	11	*	9	2	8	4	5	7	1	3	6	11	11	
Shrimp Trawl	all	all	NE	all	9	1	*	9	6	8	5	2	3	4	7	9	9	9	
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	small	3	3	*	3	3	2	3	3	3	3	1	3	3	3	
Sink, Anchor, Drift Gillnet	all	all	NE	large	5	8	*	10	11	7	4	2	6	3	1	9	12	12	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	6	11	*	12	10	7	3	4	8	2	1	5	13	9	
Sink, Anchor, Drift Gillnet	all	all	MA	small	4	4	*	4	4	2	4	4	4	4	1	3	4	4	
Sink, Anchor, Drift Gillnet	all	all	MA	large	2	5	*	5	5	5	5	4	5	3	1	5	5	5	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	4	7	*	7	6	7	3	7	7	2	1	5	7	7	
Scallop Dredge	open	limited	NE	all	11	11	*	10	1	9	3	5	7	2	8	4	6	11	
Scallop Dredge	open	limited	MA	all	11	11	*	10	1	9	3	5	8	2	6	4	7	11	
Scallop Dredge	open	general	NE	all	10	10	*	10	3	9	1	4	7	2	5	6	8	10	
Scallop Dredge	open	general	MA	all	10	10	*	10	2	9	3	4	8	1	7	5	6	10	
Scallop Dredge	closed	limited	NE	all	10	12	*	11	1	8	3	4	6	2	7	5	9	13	
Scallop Dredge	closed	limited	MA	all	10	9	*	12	1	8	3	6	7	2	5	4	11	13	
Scallop Dredge	closed	general	NE	all															
Scallop Dredge	closed	general	MA	all	5	5	*	5	1	5	3	5	5	2	5	4	5	5	
Mid-water paired & single Trawl	all	all	NE	all	6	3	*	11	10	1	8	4	5	7	2	9	11	11	
Mid-water paired & single Trawl	all	all	MA	all	8	6	*	9	9	2	3	7	5	9	1	4	9	9	
Fish Pots/ Traps	all	all	NE	all															
Fish Pots/ Traps	all	all	MA	all	3	3	*	3	3	3	2	3	3	3	3	1	3	3	
Purse Seine	all	all	NE	all	5	2	*	5	5	4	5	3	5	5	1	5	5	5	
Purse Seine	all	all	MA	all															
Hand Line	all	all	NE	all	2	2	*	2	2	2	2	1	2	2	2	2	2	2	
Hand Line	all	all	MA	all															
Scottish Seine	all	all	NE	all	5	5	*	5	5	5	5	2	3	4	5	1	5	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 46. Rank of total discard weight within fleet for fish species groups derived from 2004 Northeast Fisheries Observer Program data; see Appendix B, Table B-2 for all species. Note, "*" indicates no discards of these species occurred.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	TURTLES	SEALS	WHALES	DOLPHINS/- PORPOISE	SEA BIRDS (ALL)	
Longline	all	all	NE	all	2	2	2	2	1	
Longline	all	all	MA	all	*	*	*	*	*	
Otter Trawl	all	all	NE	small	4	4	3	1	2	
Otter Trawl	all	all	NE	large	4	4	3	1	2	
Otter Trawl	all	all	MA	small	2	4	4	1	3	
Otter Trawl	all	all	MA	large	2	2	2	2	1	
Scallop Trawl	open	limited	MA	all	1	2	2	2	2	
Scallop Trawl	open	general	MA	all	*	*	*	*	*	
Shrimp Trawl	all	all	NE	all	*	*	*	*	*	
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	small	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	large	4	2	4	3	1	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	4	1	4	2	3	
Sink, Anchor, Drift Gillnet	all	all	MA	small	2	3	3	3	1	
Sink, Anchor, Drift Gillnet	all	all	MA	large	1	3	3	3	2	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	1	3	5	2	3	
Scallop Dredge	open	limited	NE	all	1	3	3	3	2	
Scallop Dredge	open	limited	MA	all	1	2	2	2	2	
Scallop Dredge	open	general	NE	all	*	*	*	*	*	
Scallop Dredge	open	general	MA	all	*	*	*	*	*	
Scallop Dredge	closed	limited	NE	all	2	3	3	3	1	
Scallop Dredge	closed	limited	MA	all	*	*	*	*	*	
Scallop Dredge	closed	general	NE	all						
Scallop Dredge	closed	general	MA	all	*	*	*	*	*	
Mid-water paired & single Trawl	all	all	NE	all	4	4	3	2	1	
Mid-water paired & single Trawl	all	all	MA	all	*	*	*	*	*	
Fish Pots/ Traps	all	all	NE	all						
Fish Pots/ Traps	all	all	MA	all	*	*	*	*	*	
Purse Seine	all	all	NE	all	*	*	*	*	*	
Purse Seine	all	all	MA	all	*	*	*	*	*	
Hand Line	all	all	NE	all	*	*	*	*	*	
Hand Line	all	all	MA	all	*	*	*	*	*	
Scottish Seine	all	all	NE	all	*	*	*	*	*	
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 47. Rank of total number of incidental takes within fleet for protected species groups derived from 2004 Northeast Fisheries Observer Program data; see Appendix B, Table B-2 for all species. Note, "*" indicates no discards of these species occurred.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	BLUEFISH	HERRING	SALMON	RED CRAB	SCALLOP	MACK-/SQUID-/BUTTERFISH	MONKFISH	NE MULTI-SPP (LARGE-MESH)	NE MULTI-SPP (SMALL-MESH)	SKATE	DOGFISH	FLUKE/SCUP/-BLK SEA BASS	SURF CLAM/-OCEAN QUAHOG	TILEFISH
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	xlg	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	xlg	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 48. Rank of total discard weight within species group for fish species groups derived from 2004 Northeast Fisheries Observer Program data; see Appendix B, Table B-3 for all species. Note, "*" indicates no discards of these species occurred.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	TURTLES	SEALS	WHALES	DOLPHINS/-PORPOISE	SEA BIRDS (ALL)	
Longline	all	all	NE	all	9	4	4	8	12	
Longline	all	all	MA	all	*	*	*	*	*	
Otter Trawl	all	all	NE	small	9	4	1	3	6	
Otter Trawl	all	all	NE	large	9	4	2	2	5	
Otter Trawl	all	all	MA	small	6	4	4	4	11	
Otter Trawl	all	all	MA	large	9	4	4	8	3	
Scallop Trawl	open	limited	MA	all	1	4	4	8	14	
Scallop Trawl	open	general	MA	all	*	*	*	*	*	
Shrimp Trawl	all	all	NE	all	*	*	*	*	*	
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	small	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	large	9	2	4	5	1	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	9	1	4	1	9	
Sink, Anchor, Drift Gillnet	all	all	MA	small	7	4	4	8	8	
Sink, Anchor, Drift Gillnet	all	all	MA	large	5	4	4	8	7	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	3	3	4	6	10	
Scallop Dredge	open	limited	NE	all	2	4	4	8	4	
Scallop Dredge	open	limited	MA	all	4	4	4	8	14	
Scallop Dredge	open	general	NE	all	*	*	*	*	*	
Scallop Dredge	open	general	MA	all	*	*	*	*	*	
Scallop Dredge	closed	limited	NE	all	8	4	4	8	13	
Scallop Dredge	closed	limited	MA	all	*	*	*	*	*	
Scallop Dredge	closed	general	NE	all						
Scallop Dredge	closed	general	MA	all	*	*	*	*	*	
Mid-water paired & single Trawl	all	all	NE	all	9	4	3	7	2	
Mid-water paired & single Trawl	all	all	MA	all	*	*	*	*	*	
Fish Pots/ Traps	all	all	NE	all						
Fish Pots/ Traps	all	all	MA	all	*	*	*	*	*	
Purse Seine	all	all	NE	all	*	*	*	*	*	
Purse Seine	all	all	MA	all	*	*	*	*	*	
Hand Line	all	all	NE	all	*	*	*	*	*	
Hand Line	all	all	MA	all	*	*	*	*	*	
Scottish Seine	all	all	NE	all	*	*	*	*	*	
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 49. Rank of total number of incidental takes within species group for protected species groups derived from 2004 Northeast Fisheries Observer Program data; see Appendix B, Table B-3 for all species. Note, "*" indicates no discards of these species occurred.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	2004 OB FISH sea days	BLUEFISH	HERRING	SALMON	RED CRAB	SCALLOP	MACK-/SQUID-/BUTTERFISH	MONKFISH	NE MULTI-SPP (LARGE-MESH)	NE MULTI-SPP (SMALL-MESH)	SKATE	DOGFISH	FLUKE/-SCUP/-BLK SEA BASS	SURF CLAM/-OCEAN QUAHOG	TILEFISH	PILOT coverage
Longline	all	all	NE	all	12	35	35	35	35	35	35	35	54	55	84	187	35	35	35	
Longline	all	all	MA	all	0	76	76	76	76	76	76	76	76	76	76	76	76	76	76	pilot
Otter Trawl	all	all	NE	small	449	1879	2021	211	2769	2712	666	680	864	1001	1157	1093	1431	1634	1678	
Otter Trawl	all	all	NE	large	1076	5680	4817	730	2808	3439	1557	374	501	890	906	1017	3726	6058	3827	
Otter Trawl	all	all	MA	small	471	1727	1781	196	685	2054	1875	1337	1005	1307	794	1231	974	3316	929	
Otter Trawl	all	all	MA	large	183	437	892	342	342	726	537	392	386	702	203	710	395	831	342	
Scallop Trawl	open	limited	MA	all	11	95	95	95	95	95	95	95	95	95	95	95	95	95	95	pilot
Scallop Trawl	open	general	MA	all	56	103	51	51	404	100	132	89	82	280	78	430	404	51	51	pilot
Shrimp Trawl	all	all	NE	all	12	42	101	42	42	388	400	25	22	136	272	384	42	42	42	
Shrimp Trawl	all	all	MA	all	2	76	76	76	76	76	76	76	76	76	76	76	76	76	76	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	large	657	1342	754	141	2808	414	2096	1156	281	1011	772	408	2022	141	141	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	533	576	1065	144	1208	1314	2244	425	504	1890	274	419	1245	144	384	
Sink, Anchor, Drift Gillnet	all	all	MA	small	3	62	62	62	62	62	62	62	62	62	62	62	62	62	62	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	4	103	29	29	29	29	29	29	19	29	97	93	29	29	29	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	30	113	68	68	68	246	68	92	68	68	53	55	105	68	68	pilot for fish
Scallop Dredge	open	limited	NE	all	344	269	269	269	1268	896	1839	685	1468	1191	337	1540	1331	1817	269	
Scallop Dredge	open	limited	MA	all	591	329	329	329	706	589	1129	462	1142	2949	305	2421	606	2446	329	
Scallop Dredge	open	general	NE	all	11	92	92	92	92	180	157	110	81	125	112	112	92	169	92	pilot
Scallop Dredge	open	general	MA	all	33	96	96	96	96	257	268	81	198	118	77	136	270	235	96	
Scallop Dredge	closed	limited	NE	all	805	1583	3147	139	3810	475	1393	439	415	1332	198	2841	1149	4242	139	
Scallop Dredge	closed	limited	MA	all	373	477	1722	108	1470	497	766	164	612	994	337	1778	996	2662	108	
Scallop Dredge	closed	general	NE	all	0	24	24	24	24	24	24	24	24	24	24	24	24	24	24	pilot
Scallop Dredge	closed	general	MA	all	2	21	21	21	21	21	21	21	21	21	21	21	21	21	21	pilot
Mid-water paired & single Trawl	all	all	NE	all	165	420	749	56	56	467	752	484	531	924	764	280	544	56	56	
Mid-water paired & single Trawl	all	all	MA	all	39	66	235	35	35	35	51	335	379	82	35	49	319	35	35	
Fish Pots/ Traps	all	all	NE	all	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	pilot
Fish Pots/ Traps	all	all	MA	all	6	40	40	40	40	40	40	100	40	40	40	40	40	40	40	pilot
Purse Seine	all	all	NE	all	33	19	169	19	19	19	157	19	164	19	19	176	19	19	19	
Purse Seine	all	all	MA	all	0	9	9	9	9	9	9	9	9	9	9	9	9	9	9	pilot
Hand Line	all	all	NE	all	6	72	72	72	72	72	72	72	131	72	72	72	72	72	72	pilot
Hand Line	all	all	MA	all	0	133	133	133	133	133	133	133	133	133	133	133	133	133	133	pilot
Scottish Seine	all	all	NE	all	5	12	12	12	12	12	12	12	14	12	12	12	30	12	12	pilot
Clam Quahog Dredge	all	all	NE	all	0	50	50	50	50	50	50	50	50	50	50	50	50	50	50	pilot
Clam Quahog Dredge	all	all	MA	all	0	84	84	84	84	84	84	84	84	84	84	84	84	84	84	pilot
Crab Pots	all	all	NE	all	0	101	101	101	101	101	101	101	101	101	101	101	101	101	101	pilot
Crab Pots	all	all	MA	all	0	28	28	28	28	28	28	28	28	28	28	28	28	28	28	pilot
Lobster Pots	all	all	NE	all	0	439	439	439	439	439	439	439	439	439	439	439	439	439	439	pilot
Lobster Pots	all	all	MA	all	0	89	89	89	89	89	89	89	89	89	89	89	89	89	89	pilot
Total Sea Days					5,913	16,828	19,864	4,573	20,193	16,314	17,592	8,916	10,282	16,544	8,316	16,802	17,193	25,472	10,109	
Total Sea Days excluding shaded cells						12,727	12,914	4,573	11,488	12,209	15,957	7,906	10,020	15,314	6,522	15,359	15,235	133	6,946	

Table 50. Number of sea days needed to achieve a 30 percent CV for estimates of total discard 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 Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	2004 OB PSPP sea days	TURTLES	SEALS	WHALES	DOLPHINS/-PORPOISE	SEA BIRDS (ALL)	ALL SPECIES	PILOT coverage
Longline	all	all	NE	all	133	35	35	35	35	250	107	
Longline	all	all	MA	all	11	76	76	76	76	76	76	pilot
Otter Trawl	all	all	NE	small	577	211	211	1464	1432	2157	484	
Otter Trawl	all	all	NE	large	1947	730	730	5591	3001	6776	537	
Otter Trawl	all	all	MA	small	499	1886	196	196	1661	1014	561	
Otter Trawl	all	all	MA	large	186	342	342	342	342	481	137	
Scallop Trawl	open	limited	MA	all	22	95	95	95	95	95	95	pilot
Scallop Trawl	open	general	MA	all	71	51	51	51	51	51	35	pilot
Shrimp Trawl	all	all	NE	all	12	42	42	42	42	42	43	
Shrimp Trawl	all	all	MA	all	2	76	76	76	76	76	55	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	12	12	12	12	12	12	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	large	876	141	971	141	1081	2831	209	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	701	144	1249	144	1322	2644	162	
Sink, Anchor, Drift Gillnet	all	all	MA	small	375	1025	62	62	62	411	62	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	85	107	29	29	29	161	93	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	152	557	849	68	445	852	50	pilot for fish
Scallop Dredge	open	limited	NE	all	457	2718	269	269	269	1054	323	
Scallop Dredge	open	limited	MA	all	675	3470	329	329	329	329	218	
Scallop Dredge	open	general	NE	all	24	92	92	92	92	92	86	pilot
Scallop Dredge	open	general	MA	all	55	96	96	96	96	96	20	
Scallop Dredge	closed	limited	NE	all	805	2431	139	139	139	2444	241	
Scallop Dredge	closed	limited	MA	all	373	108	108	108	108	108	223	
Scallop Dredge	closed	general	NE	all	0	24	24	24	24	24	24	pilot
Scallop Dredge	closed	general	MA	all	2	21	21	21	21	21	21	pilot
Mid-water paired & single Trawl	all	all	NE	all	242	56	56	548	367	567	322	
Mid-water paired & single Trawl	all	all	MA	all	42	35	35	35	35	35	95	
Fish Pots/ Traps	all	all	NE	all	0	20	20	20	20	20	20	pilot
Fish Pots/ Traps	all	all	MA	all	9	40	40	40	40	40	36	pilot
Purse Seine	all	all	NE	all	53	19	19	19	19	19	123	
Purse Seine	all	all	MA	all	2	9	9	9	9	9	9	pilot
Hand Line	all	all	NE	all	18	72	72	72	72	72	131	pilot
Hand Line	all	all	MA	all	11	133	133	133	133	133	133	pilot
Scottish Seine	all	all	NE	all	8	12	12	12	12	12	21	pilot
Clam Quahog Dredge	all	all	NE	all	0	50	50	50	50	50	50	pilot
Clam Quahog Dredge	all	all	MA	all	0	84	84	84	84	84	84	pilot
Crab Pots	all	all	NE	all	0	101	101	101	101	101	101	pilot
Crab Pots	all	all	MA	all	0	28	28	28	28	28	28	pilot
Lobster Pots	all	all	NE	all	0	439	439	439	439	439	439	pilot
Lobster Pots	all	all	MA	all	3	89	89	89	89	89	89	pilot
Total Sea Days					8,429	15,676	7,289	11,180	12,335	23,792	5,554	
Total Sea Days excluding shaded cells						15,676	6,006	10,103	12,335	23,792	5,554	

Table 51. Number of sea days needed to achieve a 30 percent CV on estimates of total discard and the 2004 observed sea days for protected species, by fishing mode and species group; see Appendix B, Table B-4 for all species.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	2004 OB FISH TRIPS	BLUEFISH	HERRING	SALMON	RED CRAB	SCALLOP	MACK-/SQUID-/BUTTERFISH	MONKFISH	NE MULTI-SPP (LARGE-MESH)	NE MULTI-SPP (SMALL-MESH)	SKATE	DOGFISH	FLUKE/-SCUP/-BLK SEA BASS	SURF CLAM/-OCEAN QUAHOG	TILEFISH	PILOT coverage
Longline	all	all	NE	all	12	26	26	26	26	26	26	26	54	47	84	187	26	26	26	
Longline	all	all	MA	all	0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	pilot
Otter Trawl	all	all	NE	small	142	677	615	70	900	859	217	268	288	317	391	371	453	608	565	
Otter Trawl	all	all	NE	large	386	1917	1671	304	1378	1269	483	151	168	343	296	355	1050	2231	897	
Otter Trawl	all	all	MA	small	194	706	664	104	392	877	749	595	399	556	326	513	424	1364	287	
Otter Trawl	all	all	MA	large	75	249	305	177	177	384	294	203	182	342	110	272	158	488	177	
Scallop Trawl	open	limited	MA	all	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	pilot
Scallop Trawl	open	general	MA	all	31	73	25	25	201	58	87	56	43	147	40	222	206	25	25	pilot
Shrimp Trawl	all	all	NE	all	12	42	101	42	42	388	400	25	22	136	272	384	42	42	42	
Shrimp Trawl	all	all	MA	all	2	13	13	13	13	13	13	13	13	13	13	13	13	13	13	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	large	577	1160	634	104	2503	365	1875	1040	246	914	673	375	1736	104	104	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	445	479	937	94	1043	1122	1809	324	356	1497	197	314	1052	94	263	
Sink, Anchor, Drift Gillnet	all	all	MA	small	3	58	58	58	58	58	58	58	58	58	58	58	58	58	58	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	4	101	27	27	27	27	27	27	17	27	95	91	27	27	27	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	27	96	51	51	51	216	51	77	51	51	43	45	89	51	51	pilot for fish
Scallop Dredge	open	limited	NE	all	26	25	25	25	98	68	141	52	109	92	25	111	96	138	25	
Scallop Dredge	open	limited	MA	all	69	36	36	36	98	65	134	53	130	347	35	283	67	288	36	
Scallop Dredge	open	general	NE	all	9	71	71	71	71	150	131	90	64	102	92	92	71	141	71	pilot
Scallop Dredge	open	general	MA	all	22	69	69	69	69	183	184	46	139	82	55	94	180	162	69	
Scallop Dredge	closed	limited	NE	all	86	182	326	15	405	49	147	48	41	139	21	291	123	458	15	
Scallop Dredge	closed	limited	MA	all	35	42	167	12	143	47	71	15	55	92	32	170	95	258	12	
Scallop Dredge	closed	general	NE	all	0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	pilot
Scallop Dredge	closed	general	MA	all	1	15	15	15	15	15	15	15	15	15	15	15	15	15	15	pilot
Mid-water paired & single Trawl	all	all	NE	all	66	166	244	21	21	160	305	199	254	350	298	114	198	21	21	
Mid-water paired & single Trawl	all	all	MA	all	13	20	86	12	12	12	14	118	132	25	12	18	113	12	12	
Fish Pots/ Traps	all	all	NE	all	0	19	19	19	19	19	19	19	19	19	19	19	19	19	19	pilot
Fish Pots/ Traps	all	all	MA	all	6	37	37	37	37	37	37	98	37	37	37	37	37	37	37	pilot
Purse Seine	all	all	NE	all	16	10	85	10	10	10	79	10	82	10	10	87	10	10	10	
Purse Seine	all	all	MA	all	0	9	9	9	9	9	9	9	9	9	9	9	9	9	9	pilot
Hand Line	all	all	NE	all	6	68	68	68	68	68	68	68	130	68	68	68	68	68	68	pilot
Hand Line	all	all	MA	all	0	126	126	126	126	126	126	126	126	126	126	126	126	126	126	pilot
Scottish Seine	all	all	NE	all	5	12	12	12	12	12	12	12	14	12	12	12	30	12	12	pilot
Clam Quahog Dredge	all	all	NE	all	0	69	69	69	69	69	69	69	69	69	69	69	69	69	69	pilot
Clam Quahog Dredge	all	all	MA	all	0	69	69	69	69	69	69	69	69	69	69	69	69	69	69	pilot
Crab Pots	all	all	NE	all	0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	pilot
Crab Pots	all	all	MA	all	0	27	27	27	27	27	27	27	27	27	27	27	27	27	27	pilot
Lobster Pots	all	all	NE	all	0	353	353	353	353	353	353	353	353	353	353	353	353	353	353	pilot
Lobster Pots	all	all	MA	all	0	75	75	75	75	75	75	75	75	75	75	75	75	75	75	pilot
Total Trips						7,160	7,175	2,306	8,679	7,348	8,236	4,495	3,908	6,626	4,117	5,400	7,245	7,559	3,746	
Total Trips excluding shaded cells						5,826	5,580	2,306	3,386	4,200	7,000	3,699	3,731	5,679	3,008	4,216	6,113	139	2,021	

Table 52. Number of trips needed to achieve a 30 percent CV for estimates of total discard and the 2004 observed trips of fish species, by fishing mode and species group; see Appendix B, Table B-5 for all species.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	2004 OB PSPP TRIPS	TURTLES	SEALS	WHALES	DOLPHINS/-PORPOISE	SEA BIRDS (ALL)	ALL SPECIES	PILOT coverage
Longline	all	all	NE	all	119	26	26	26	26	215	107	
Longline	all	all	MA	all	2	12	12	12	12	12	12	pilot
Otter Trawl	all	all	NE	small	200	70	70	505	557	677	157	
Otter Trawl	all	all	NE	large	539	304	304	1577	777	1973	177	
Otter Trawl	all	all	MA	small	205	901	104	104	799	522	222	
Otter Trawl	all	all	MA	large	76	177	177	177	177	251	65	
Scallop Trawl	open	limited	MA	all	3	12	12	12	12	12	12	pilot
Scallop Trawl	open	general	MA	all	39	25	25	25	25	25	19	pilot
Shrimp Trawl	all	all	NE	all	12	42	42	42	42	42	43	
Shrimp Trawl	all	all	MA	all	2	13	13	13	13	13	9	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	12	12	12	12	12	12	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	large	772	104	844	104	966	2510	182	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	569	94	995	94	973	2176	118	
Sink, Anchor, Drift Gillnet	all	all	MA	small	358	977	58	58	58	395	58	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	81	105	27	27	27	144	91	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	142	519	793	51	418	796	39	pilot for fish
Scallop Dredge	open	limited	NE	all	36	206	25	25	25	72	24	
Scallop Dredge	open	limited	MA	all	78	378	36	36	36	36	25	
Scallop Dredge	open	general	NE	all	20	71	71	71	71	71	69	pilot
Scallop Dredge	open	general	MA	all	39	69	69	69	69	69	13	
Scallop Dredge	closed	limited	NE	all	86	243	15	15	15	263	25	
Scallop Dredge	closed	limited	MA	all	35	12	12	12	12	12	21	
Scallop Dredge	closed	general	NE	all	0	12	12	12	12	12	12	pilot
Scallop Dredge	closed	general	MA	all	1	15	15	15	15	15	15	pilot
Mid-water paired & single Trawl	all	all	NE	all	99	21	21	196	92	218	124	
Mid-water paired & single Trawl	all	all	MA	all	14	12	12	12	12	12	33	
Fish Pots/ Traps	all	all	NE	all	0	19	19	19	19	19	19	pilot
Fish Pots/ Traps	all	all	MA	all	8	37	37	37	37	37	34	pilot
Purse Seine	all	all	NE	all	26	10	10	10	10	10	61	
Purse Seine	all	all	MA	all	2	9	9	9	9	9	9	pilot
Hand Line	all	all	NE	all	9	68	68	68	68	68	130	pilot
Hand Line	all	all	MA	all	3	126	126	126	126	126	126	pilot
Scottish Seine	all	all	NE	all	8	12	12	12	12	12	21	pilot
Clam Quahog Dredge	all	all	NE	all	0	69	69	69	69	69	69	pilot
Clam Quahog Dredge	all	all	MA	all	0	69	69	69	69	69	69	pilot
Crab Pots	all	all	NE	all	0	12	12	12	12	12	12	pilot
Crab Pots	all	all	MA	all	0	27	27	27	27	27	27	pilot
Lobster Pots	all	all	NE	all	3	353	353	353	353	353	353	pilot
Lobster Pots	all	all	MA	all	0	75	75	75	75	75	75	pilot
Total Trips						5,318	4,689	4,189	6,139	11,444	2,689	
Total Trips excluding shaded cells						5,318	4,352	3,934	6,139	11,444	2,689	

Table 53. Number of fishing trips needed to achieve a 30 percent CV for estimates of total discard and the 2004 observed trips for protected species, by fishing mode and species group; see Appendix B, Table B-5 for all species.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	2004 OB FISH sea days	2004 OB PSPP sea days	BASELINE: Sea days needed for 20 species groups by fleet	BASELINE: Sea days needed for 15 species groups by fleet	FILTER APPLIED: Sea days needed for 20 species groups by fleet	FILTER APPLIED: Sea days needed for 15 species groups by fleet
Longline	all	all	NE	all	12	133	250	187	250	187
Longline	all	all	MA	all	0	11	76	76	76	76
Otter Trawl	all	all	NE	small	449	577	2769	2769	2769	2769
Otter Trawl	all	all	NE	large	1076	1947	6776	6058	6776	5680
Otter Trawl	all	all	MA	small	471	499	3316	3316	2054	2054
Otter Trawl	all	all	MA	large	183	186	892	892	892	892
Scallop Trawl	open	limited	MA	all	11	22	95	95	95	95
Scallop Trawl	open	general	MA	all	56	71	430	430	430	430
Shrimp Trawl	all	all	NE	all	12	12	400	400	400	400
Shrimp Trawl	all	all	MA	all	2	2	76	76	76	76
Gillnet	all	all	NE	small	1	1	12	12	12	12
Gillnet	all	all	NE	large	657	876	2831	2808	2831	2096
Gillnet	all	all	NE	xlg	533	701	2644	2244	2644	2244
Gillnet	all	all	MA	small	3	375	1025	1025	1025	1025
Gillnet	all	all	MA	large	4	85	161	107	161	107
Gillnet	all	all	MA	xlg	30	152	852	557	852	557
Scallop Dredge	open	limited	NE	all	344	457	2718	2718	2718	2718
Scallop Dredge	open	limited	MA	all	591	675	3470	3470	3470	3470
Scallop Dredge	open	general	NE	all	11	24	180	180	180	180
Scallop Dredge	open	general	MA	all	33	55	270	270	270	270
Scallop Dredge	closed	limited	NE	all	805	805	4242	4242	3810	3810
Scallop Dredge	closed	limited	MA	all	373	373	2662	2662	1778	1778
Scallop Dredge	closed	general	NE	all	0	0	24	24	24	24
Scallop Dredge	closed	general	MA	all	2	2	21	21	21	21
single Trawl	all	all	NE	all	165	242	924	924	924	924
single Trawl	all	all	MA	all	39	42	379	379	379	379
Fish Pots/ Traps	all	all	NE	all	0	0	20	20	20	20
Fish Pots/ Traps	all	all	MA	all	6	9	100	100	40	40
Purse Seine	all	all	NE	all	33	53	176	176	176	176
Purse Seine	all	all	MA	all	0	2	9	9	9	9
Hand Line	all	all	NE	all	6	18	131	131	131	131
Hand Line	all	all	MA	all	0	11	133	133	133	133
Scottish Seine	all	all	NE	all	5	8	30	30	30	30
Dredge	all	all	NE	all	0	0	50	50	50	50
Dredge	all	all	MA	all	0	0	84	84	84	84
Crab Pots	all	all	NE	all	0	0	101	101	101	101
Crab Pots	all	all	MA	all	0	0	28	28	28	28
Lobster Pots	all	all	NE	all	0	0	439	439	439	439
Lobster Pots	all	all	MA	all	0	3	89	89	89	89
Total Sea Days					5,913	8,429	38,882	37,330	36,244	33,602

Table 54. The maximum number of sea days (baseline and filtered) needed to achieve a 30 percent CV on estimates of total discard for any of 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.

Gear Type	Gear code	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	2004 OB FISH TRIPS	2004 OB PSPP TRIPS	BASELINE: Trips needed for 20 species groups by fleet	BASELINE: Trips needed for 15 species groups by fleet	FILTER APPLIED: Trips needed for 20 species groups by fleet	FILTER APPLIED: Trips needed for 15 species groups by fleet
Longline	010	all	all	NE	all	12	119	215	187	215	187
Longline	010	all	all	MA	all	0	2	12	12	12	12
Otter Trawl	050	all	all	NE	small	142	200	900	900	900	900
Otter Trawl	050	all	all	NE	large	386	539	2231	2231	1973	1917
Otter Trawl	050	all	all	MA	small	194	205	1364	1364	901	901
Otter Trawl	050	all	all	MA	large	75	76	488	488	384	384
Scallop Trawl	052	open	limited	MA	all	1	3	12	12	12	12
Scallop Trawl	052	open	general	MA	all	31	39	222	222	222	222
Shrimp Trawl	058	all	all	NE	all	12	12	400	400	400	400
Shrimp Trawl	058	all	all	MA	all	2	2	13	13	13	13
Sink, Anchor, Drift Gillnet	100, 110	all	all	NE	small	1	1	12	12	12	12
Sink, Anchor, Drift Gillnet	100, 110	all	all	NE	large	577	772	2510	2503	2510	1875
Sink, Anchor, Drift Gillnet	100, 110	all	all	NE	xlg	445	569	2176	1809	2176	1809
Sink, Anchor, Drift Gillnet	100, 110	all	all	MA	small	3	358	977	977	977	977
Sink, Anchor, Drift Gillnet	100, 110	all	all	MA	large	4	81	144	105	144	105
Sink, Anchor, Drift Gillnet	100, 110	all	all	MA	xlg	27	142	796	519	796	519
Scallop Dredge	132	open	limited	NE	all	26	36	206	206	206	206
Scallop Dredge	132	open	limited	MA	all	69	78	378	378	378	378
Scallop Dredge	132	open	general	NE	all	9	20	150	150	150	150
Scallop Dredge	132	open	general	MA	all	22	39	184	184	183	183
Scallop Dredge	132	closed	limited	NE	all	86	86	458	458	405	405
Scallop Dredge	132	closed	limited	MA	all	35	35	258	258	170	170
Scallop Dredge	132	closed	general	NE	all	0	0	12	12	12	12
Scallop Dredge	132	closed	general	MA	all	1	1	15	15	15	15
Mid-water paired & single Trawl	170, 370	all	all	NE	all	66	99	350	350	350	350
Mid-water paired & single Trawl	170, 370	all	all	MA	all	13	14	132	132	132	132
Fish Pots/ Traps	181	all	all	NE	all	0	0	19	19	19	19
Fish Pots/ Traps	181	all	all	MA	all	6	8	98	98	37	37
Purse Seine	121,120	all	all	NE	all	16	26	87	87	87	87
Purse Seine	121,120	all	all	MA	all	0	2	9	9	9	9
Hand Line	020	all	all	NE	all	6	9	130	130	130	130
Hand Line	020	all	all	MA	all	0	3	126	126	126	126
Scottish Seine	360	all	all	NE	all	5	8	30	30	30	30
Clam Quahog Dredge	400	all	all	NE	all	0	0	69	69	69	69
Clam Quahog Dredge	400	all	all	MA	all	0	0	69	69	69	69
Crab Pots	300	all	all	NE	all	0	0	12	12	12	12
Crab Pots	300	all	all	MA	all	0	0	27	27	27	27
Lobster Pots	200	all	all	NE	all	0	3	353	353	353	353
Lobster Pots	200	all	all	MA	all	0	0	75	75	75	75
Total Trips						2,272	3,587	15,721	15,001	14,694	13,290

Table 55. The maximum number of trips (baseline and filtered) needed to achieve a 30 percent CV on estimates of total discard for any of 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.

Species	VTR - OB Avg Kept	N	SE	t-value	Pr >|t|		VTR-OB SD Kept	N	SE	t-value	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 Avg Trip Duration	N	SE	t-value	Pr >|t|		VTR-OB SD Trip Duration	N	SE	t-value	Pr >|t|
-0.2133396	89.000	0.15309	-1.390	0.167		0.2989122	79.000	0.094976	3.150	**0.002**

Table 56. 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	Trip Duration	df	Chi Sqr Test Statistic	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	lg	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	lg	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	lg	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	lg	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	lg	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	lg	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	lg	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	lg	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	lg	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	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	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	lg	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	Trip Duration	df	Chi Sqr Test Statistic	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 57. 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 0.05.

Chapter 6
Preferred and Other Alternatives Under Consideration

This chapter presents the alternatives for the SBRM for Northeast Region FMP fisheries, including those identified as the preferred alternatives, considered during the development of this amendment. Following the public review and hearing phase of the process, the Councils and NOAA Fisheries Service will reevaluate the preferred alternatives, and may make changes based on comments received on the draft amendment. Once the Councils and NOAA Fisheries Service decide upon a proposed action (the final preferred alternatives), this chapter will be revised to reflect any changes.

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.[30]

For the purposes of this amendment, the SBRM to be established for the FMPs of the Northeast 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* and *Oceana* v. *Evans II*. Therefore, based on the NOAA Fisheries Service definition and recent 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. The SBRM Amendment includes an additional element regarding a process by which bycatch data collected under the SBRM will be evaluated.

The presentation of alternatives in this chapter is structured around the four components identified above. For each component, or item, two to three 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

[30] 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.

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 four 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 NOAA Fisheries Service 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.[31] 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 NOAA Fisheries Service fail to develop, submit, approve, and implement an SBRM Amendment that documents and establishes those components of a bycatch reporting program required under the law. However, because the Magnuson-Stevens Act requires that an SBRM be established for each FMP, and because the Court, in rulings regarding *Oceana* v. *Evans I* and *Oceana* v. *Evans II*, remanded to the Secretary of Commerce both Amendment 13 to the Northeast Multispecies FMP and Amendment 10 to the Sea Scallop FMP pending development 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.

Bycatch data are currently being collected by a variety of mechanisms on a variety of Northeast 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 Northeast Region. Furthermore, the status 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.

[31] 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.

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, and analyzed. 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 Northeast 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 Northeast Region SBRM are called the "status quo" alternatives. Alternatives that would modify, supplement, or replace the current program are named for their most distinguishing characteristic.

6.1. Item 1: Bycatch Reporting and Monitoring Mechanisms

6.1.1. Alternative 1.1 – Status Quo (*Preferred Alternative*)

Under this preferred 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;
- Marine Recreational Fishery Statistics Survey (MRFSS);[32]
- Vessel monitoring systems (VMS); and
- Fishing vessel trip reports (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:

- Fishery independent surveys (state and Federal);

[32] As noted in Chapter 4, the MRFSS program is currently under-going a system-wide review by NOAA Fisheries Service. This review is a direct result of the assessment conducted by the NRC, and is intended to address the issues with the survey identified by the NRC. This review is being conducted on a national scale and has potentially far-reaching implications for how recreational fishery data are collected and analyzed. For the purposes of this amendment, it is assumed that MRFSS or its replacement will continue to serve as the primary tool to collect information on discards in the recreational fishery. Therefore, all references to MRFSS in the discussion of alternatives should be considered as placeholders representing the recreational fishery survey program that results from this NOAA Fisheries Service review. The resulting program will serve as the primary source of information on discards in recreational fisheries.

- Dealer purchase reports;
- Fishing vessel trip report; 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 (such as the incidental unobserved take of sea turtles by sea scallop dredges with chain mats) 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, this alternative would not preclude adoption and implementation of one or more of these technologies in the future.

As summarized in Table 58, the preferred 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 Northeast Region fisheries.

Tier 1: Primary Sources of Fishery Discard Information	**Tier 2: Primary Sources of Fishery-Related Information**
• At-sea fishery observers • Marine Recreational Fishery Statistics Survey (or replacement) • Vessel monitoring system reports • Fishing vessel trip reports (limited)	• Fishery-independent surveys • Seafood dealer purchase reports • Port Agent sampling • Fishing vessel trip reports
Tier 3: Supplemental Sources of Discard and Fishery-Related Information	**Tier 4: Potential Future Sources of Discard and Fishery-Related Information**
• Industry-based surveys • Study fleets • Alternate platforms	• Electronic monitoring • Image capture and processing • Specialized monitoring programs

Table 58. Preferred alternative fishery information collection and monitoring in the Northeast Region SBRM.

6.1.2. Alternative 1.2 – Implement Electronic Monitoring to Collect Bycatch Information

As described in 0, there are a variety of mechanisms by which information on discards can be collected. Many of these mechanisms are already employed in the Northeast 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 Northeast 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 clearly take an extensive development effort, starting with the decision of what data electronic monitoring could provide and where electronic monitoring collection data could be useful. Within the Northeast

Region, an electronic monitoring pilot study has been conducted on hook and line vessels. Proof-of-concept studies are scheduled for small gillnet vessels and in pelagic herring trawl fisheries. Other fisheries may also be suitable for electronic monitoring development and deployments depending on the type(s) of data to be collected. Table 59 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.

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 59. Evaluation of fishery modes complexity for Northeast 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.

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, length, 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 an electronic monitoring pilot project.

6.2. Item 2: Analytical Techniques and Allocation of Observers

6.2.1. Alternative 2.1 – Status Quo

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 remain those currently in use. These analytical techniques and procedures are fully described in Chapter 5 and address such issues as sampling units, response variables, definitions of appropriate strata, data sources, imputation, and tests for sources of bias.

In addition to the analytical techniques described in Chapter 5, this alternative addresses the mechanisms by which observer coverage is determined. Under the status quo approach, observers would continue to be allocated using, among other means, the optimization tool described in Chapter 5 and Appendix A (see Figure 36). The optimization tool is currently designed for the large-mesh otter trawl, gillnet, and longline fisheries, but could be expanded the encompass all fishing modes subject to the SBRM. Effective development and implementation of the expanded optimization tool would require extensive analytical work that would likely take 1-2 years from the date the amendment is approved. Available observer sea days would first be allocated to programs with prescribed observer coverage levels (e.g., Northeast multispecies fishery SAPs and B-Regular DAS program). Remaining available observer sea days would then be allocated to the remaining fishery modes based on the optimization tool and other factors, such as special requests of a Council (for example, the requested hagfish fishery information collection program) or an unforeseen circumstance or problem that arises in a fishery (such as increased monitoring of protected resources interactions).

6.2.2. Alternative 2.2 – Status quo with Importance Filter (*Preferred Alternative*)

This alternative would function the same as the status quo alternative for determining the appropriate allocation of observer effort, with the addition of an "importance filter" to further refine the appropriate target allocation of observer effort within each fishing mode.[33] Under the status quo alternative, the target observer coverage allocation for each fishing mode would be the highest projected number of observer sea days needed to achieve the target CV for each species or species group. However, one of the limitations of the status quo method is that it does not 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 intended to serve as a tool to illuminate that distinction, and to aid in establishing

[33] 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.

target 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 target CV. 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 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. The importance filter is also designed to account for cases where the projected target sea days exceeds the number of sea days actually observed if the realized CV based on those sea days achieved the target. For example, based on the initial calculations of observer coverage levels needed to achieve the target CV, 3,810 observer sea days would be required to monitor red crab bycatch in the New England closed area limited access scallop dredge fishery (see page 31 in Appendix C). However, in 2004 a *total* of 5 lb of red crab were observed to be discarded in this fishery (a fishery in which 29 percent of the trips were observed) and 98 percent of observed trips had zero discards of red crab. Specifically, out of 86 observed trips within this fishing mode, 2 had discards of red crab, and the sum of the discards on those 2 trips was 5 lb. This 5 lb represents less than 0.0001 percent of the annual target quota for the red crab fishery, and 1 percent of the per trip incidental catch allowance (500 lb per trip for any vessel that holds an open access red crab incidental catch permit). Without the application of an importance filter, the target observer sea day coverage level in this fishing mode would be 3,810 days, which is more than the number of days actually fished in this fishery in 2004. As such, allocating this level of coverage, based on the observed discards of red crab, would be an inefficient use of observer coverage resources.

The 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 is one for which the implications of the discards in the fishery are not expected to be negligible. 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 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.

An example of how the 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 5 lb of discarded red crab in the scallop dredge example above, this amount of discarded herring may appear to be substantial. However, the discarded herring only represents 1.24 percent of the total observed discards within the observed fishing mode, and is 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 would be a way to identify that the 2,021 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 60):

(1) The first-level filter would be the gray-cell filter described in Chapter 5, 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 target), but the projected observer sea days exceeds the number of days actually observed in the year(s) in which the target 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 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.[34]

So, for example, in the New England small-mesh otter trawl fishing mode (see page 23 in Appendix C), after eliminating the gray-celled surfclam and ocean quahog, the importance filter would be used to eliminate red crab (the 1,143 lb of observed discards represent only 0.10 percent of the total observed discards in this fishing mode), sea scallops (with a total of 180 lb of observed discards, less than 0.02 percent of all discards in this fishing mode), and then to eliminate herring (while the 1.25 percent of all discards in the fishing mode may exceed the threshold for this filter, with total discards at less than 0.2 percent of total landings of herring, it would likely fall below the threshold established for the third-level filter). Eliminating bluefish and tilefish for similar reasons

[34] 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 are markedly less than the total allowable catch and, therefore, may not be an effective measure of the implications of the bycatch amount in the subject fishing mode.

would reduce the target observer sea days for this fishing mode from 2,769 to no more than 1,431. Given that the cost of each observer sea day is roughly $1,150, the reduction in the target represents over $1.5 million.

The two most important aspects of the design and application of the importance filter 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. At this time, threshold levels are not proposed for the suggested filters. Finalizing the observer coverage analyses is first required in order to ensure that any proposed threshold levels are appropriate given the results of the analyses. These thresholds will be presented in the final version of the SBRM Amendment after review by all appropriate technical groups and the two Councils.

	Total Sea Days Required for All 15 Species Groups (including sea turtles)		
	Option 1 (e.g., 0.5%)	**Option 2** (e.g., 1.0%)	**Option 3** (e.g., 3.0%)
Baseline	37,332	37,332	37,332
Step 1: Gray-cell filter	33,604	33,604	33,604
Step 2: CV-target met filter	33,518	33,518	33,518
Step 3: Discard % of discards filter	25,979	24,318	20,483
Step 4: Discard % of catch filter	23,587	22,775	19,006
Step 5: Discard % of TAC/B filter (*potential future upgrade*)	N/A	N/A	N/A

Table 60. Summary of the number of observer sea days needed to achieve a CV of 30 percent, based on the sequential application of the importance filters at a variety of threshold levels.

It is important to understand that without the importance filter, 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 New England fisheries (see “baseline” row in Table 60). 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 20,193 days. With the gray-cell filter, but without the full importance filter, the number decreases to 11,488 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 20,193 days would be $23.2 million and the cost to observe 11,488 days would be $13.2 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 seem appropriate to expend more than three 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 is 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. Alternative 2.3 – 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 counter-intuitive: 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 non-protected 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 that comprise the status quo.

6.3. Item 3: SBRM Standard

6.3.1. Alternative 3.1 – Status Quo

Under this alternative, the SBRM 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.

6.3.2. Alternative 3.2 – Establish a CV SBRM Standard (*Preferred Alternative*)

The preferred alternative for the Northeast Region 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 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.

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 preferred alternative would establish, as a performance measure of the SBRM, a standard that the Northeast Region 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 44 and Table 45). 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 the preferred 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 39 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 Northeast 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 30 individual species or species groups.

In total, the proposed SBRM would separately track and report the precision associated with the discard estimates of 36 individual fishery resource species or species groups and 23 individual protected species or species groups across 39 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 16 major fisheries (16 separate estimates), under this proposed SBRM, the Councils and NOAA Fisheries Service will strive to achieve a precision of no more than 30 percent in each of up to 312 unique fishing gear mode and species combinations (see Table 44 and Table 45).

6.4. Item 4: SBRM Review/Reporting Process

6.4.1. Alternative 4.1 – Status Quo

Under this alternative, the SBRM 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 NOAA Fisheries Service 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 preferred alternative would establish a periodic review and reporting process through which the Councils and NOAA Fisheries Service 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 NOAA Fisheries Service would review information regarding the effectiveness of the SBRM relative to the CV standard.

The cornerstone of the review process would be a report, prepared periodically (see options below), that 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 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 described and evaluated in this 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. For example, these reports 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.

This preferred alternative would also specify the periodicity of the SBRM review process. There are three options relative to the periodicity with which the review process is conducted:

Option 1 – Annually. Under this option, the Councils would be presented with an annual SBRM Report that would address all fisheries for which the SBRM applies, including any new fisheries added to Council management since the last SBRM Report.

Option 2 – Every 5 years. Under this option, the Councils would be presented with an SBRM 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 Report. The structure of this review would be similar to the 5-year review of Council EFH designations, with NOAA Fisheries Service providing the information needed by the Councils and the Councils each incorporating that information into their management process either in an omnibus SBRM 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 3 – SAFE Report schedule. Instead of a single SBRM 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) 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.

The information provided to the Councils in the SBRM 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. 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 preferred alternative, the SBRM Report would identify pertinent issues to the Councils, and the Councils would choose whether and how to most effectively address the issues raised.

6.5. 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 Amendment (section 1.4) for one or more reasons. The rationale for rejecting these alternatives is discussed in this section.

6.5.1. 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 2004 provided insight into this issue. In 2004, observers reported discards of 211 unique species.[35] Of these, 45 are managed under a Council FMP subject to this amendment. Another 14 species are subject to an FMP of the ASMFC. The remaining 152 species are either unmanaged or managed only at the level of the individual state.

An analysis of these data indicates that the 45 Council FMP species comprised 84.4 percent, by weight, of the observed discards in 2004. The addition of the ASMFC species, to total 59 species, equaled 86 percent of the observed discards (1.6 percent of total). Of the remaining 152 species that accounted for 14 percent of the observed discards, the top 16 non-managed species accounted for 13 percent of total discards, leaving 136 species that together comprised only 1 percent of the observed discards, by weight. Looking at the data another way, of the 211 recorded species, 57 species (roughly one-quarter of the reported species) accounted for 99 percent of the discards by weight. Of these 57 species, 34 are managed under a Council FMP and 5 are managed under an ASMFC FMP. Table 61 shows the top 16 non-managed discard species in the 2004 observer database.

[35] 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.

Species	Percent of total observed discards
Starfish	2.8 %
Sand dollar	2.1 %
Spotted hake	2.0 %
Sponge	1.4 %
Northern sea robin	1.0 %
Jonah crab	1.0 %
Fourspot flounder	0.5 %
Sea raven	0.5 %
Longhorn sculpin	0.4 %
Rock crab	0.4 %
Striped sea robin	0.2 %
“True” crab	0.2 %
Smooth dogfish	0.2 %
Conch	0.1 %
Hermit crab	0.1 %
“Fish”	0.1 %

Table 61. Top non-FMP species, by weight, of observed discards in 2004, and the percent of each relative to the total observed discards of all species.

Together, the species identified in Table 61 and the species managed under an FMP account for 99 percent of all discards in 2004. This indicates that the majority of discards (99 percent of observed discards) are comprised of relatively few species (27 percent of observed discard species).

More important than the relative proportion of discards of various species was that this analysis demonstrated that at-sea observers are currently recording information on all species encountered by the fishing vessel. Observers are trained and expected to record information regarding 611 species (this includes differentiating some species by market code), and observers do so for both discards and landed catch (NMFS 2005a). 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 NOAA Fisheries Service, 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 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.

6.5.2. 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 Northeast 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 Northeast 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 Northeast 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 Northeast Regions 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 NOAA Fisheries Service 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 Northeast 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 Northeast 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 Northeast 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.

6.6. 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.

6.6.1. 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 Northeast 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 Northeast Region fisheries.

Currently, NOAA Fisheries Service 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 Northeast 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 Northeast 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 NOAA Fisheries Service 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 Northeast 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 start up costs associated with a new program.

6.6.2. Item 2: Analytical Techniques and Allocation of Observers

For this item, three alternatives are considered: The status quo; the status quo with the addition of an importance filter; and establishing a minimum percentage observer coverage level. The benefits, concerns, and limitations associated with the status quo methods are well described in Chapter 5 and Appendix A and so will not be repeated here. The sole difference between the second alternative and the status quo is the addition of the "importance filter" described in section 6.2.2. As noted above, the importance filter functions to dampen the target observer sea days needed to achieve the 30 percent target CV by eliminating cases where the effect of the discards is likely to be minimal. Thus, the second alternative carries forward most of the same benefits, concerns, and limitations of the status quo, with the additional benefit of being more selective as to the gear mode-species combinations that drive the target level of observer sea days.

The primary benefit of the importance filter alternative 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 gear modes and species where (1) it is infeasible or exceedingly rare that the species would be encountered in the gear, (2) the target CV has been achieved for fewer days than projected, 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, the result would be to accept that the target CV 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 target observer sea day coverage levels 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 third alternative considered for this item, establishing a minimum percentage observer coverage level of 20 percent for common species and 50 percent 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 or set of funding or logistical constraints. The expectations for precision vary by the use of the data and realizations of precisions 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 addressed by increases in sampling size. Analyses presented in Chapter 5 and 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 fail to recognize the great cost of achieving high levels of coverage.

6.6.3. Item 3: Establish an SBRM CV Standard

For this item, two alternatives are considered: The status quo and establishing a SBRM CV standard of 30 percent. While the status quo process for optimizing the observer sea day allocation across fisheries for several fishing gear types (otter trawl, gillnet, and longline) uses 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.

6.6.4. Item 4: SBRM Review/Reporting Process

For this item, two alternatives were considered: The status quo and establishing an SBRM review process. Under the status quo scenario, there is no requirement to prepare formal reports that evaluate the effectiveness of the SBRM at achieving its goals and objectives. This information would be available upon request by either Council or NOAA Fisheries Service, 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 ad-hoc manner by a Council.

With the second alternative, the frequency of the preparation of SBRM review reports would be specified, allowing for adequate planning and resource allocation, and minimum expected contents of the 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 Magnuson-Stevens 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 Northeast Region 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, three options are presented for the periodicity of such reports: Annually; every 5 years; and as part of the required SAFE reporting schedule. Under the first two options, a single report would present the required information for all species and fishing modes to allow the Councils and NOAA Fisheries Service to evaluate the 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, which may prevent other important activities, such as stock assessments, from being completed. In particular, the option for an annual report does not reflect an effective use of available resources. In addition, there is concern that under the either of the first two options, the SBRM 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, both of the first two options add an additional reporting requirement, which may be perceived as redundant with other reports prepared for Northeast Region fisheries (including stock assessment reports, SAFE reports, annual reports, etc.)

The third option addresses all of these concerns by linking the presentation of the SBRM information to the development of SAFE reports already prepared for the relevant fisheries. This breaks up the reporting requirement so that the analytical burden 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 (typically, the preparation and presentation of a SAFE report to a Council includes recommendations for changes to management measures to address any noted issues related to stock status, rebuilding, or changes in the affected fisheries).

6.7. 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 one year 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 on and monitor fisheries and fishing activities cannot be static. Any SBRM established for the fisheries of the Northeast 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 to fulfill all *potential* information and monitoring needs into the future.

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., species-specific hard TACs in the groundfish fishery or ITQs in the sea scallop 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 NOAA Fisheries Service cannot predict with any expected accuracy either how unforeseen future environmental changes may affect all 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 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), and dictates a periodic review, evaluation, and reporting process. Table 62 identifies, for each element of the SBRM, the alternatives under consideration and highlights the preferred alternatives of the Councils.

<table>
<tr><th>SBRM Element</th><th colspan="4">Alternatives Under Consideration</th></tr>
<tr><td>Bycatch Reporting and Monitoring Mechanisms</td><td colspan="2">Status quo</td><td colspan="2">Implement electronic video monitoring</td></tr>
<tr><td>Analytical Techniques and Allocation of Observers</td><td>Status quo</td><td colspan="2">Status quo with importance filter</td><td>Minimum percent observer coverage</td></tr>
<tr><td>SBRM Standard</td><td colspan="2">Status quo</td><td colspan="2">Establish a CV standard</td></tr>
<tr><td>SBRM Review/Reporting Process</td><td colspan="2">Status quo</td><td colspan="2">Specify an SBRM review process</td></tr>
</table>

Table 62. Summary of alternatives under consideration for the Omnibus SBRM 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 represents all bycatch reporting and monitoring mechanisms currently employed in the Northeast 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 status quo, with the addition of the importance filter. The status quo procedures have been utilized successfully in the Northeast Region for several years and are considered to provide an efficient and effective means to allocate observer effort. The addition of the importance filter incorporates the recommendation of the technical review by members of the two Council SSCs. Although the Councils considered a different approach to allocate observer coverage based on minimum percent levels, this approach is not considered to be sufficiently robust to effectively account for the many differences among the 39 Northeast Region fishing modes, nor does it directly employ the type of feedback mechanism that the status quo approach does. There is 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.

- 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 equal 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 continues to meet the needs of the fishery scientists and managers.

Chapter 7
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 Northeast 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 0). 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 administrative 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 37 for a map of the Northeast Region with the three major subsystems identified.

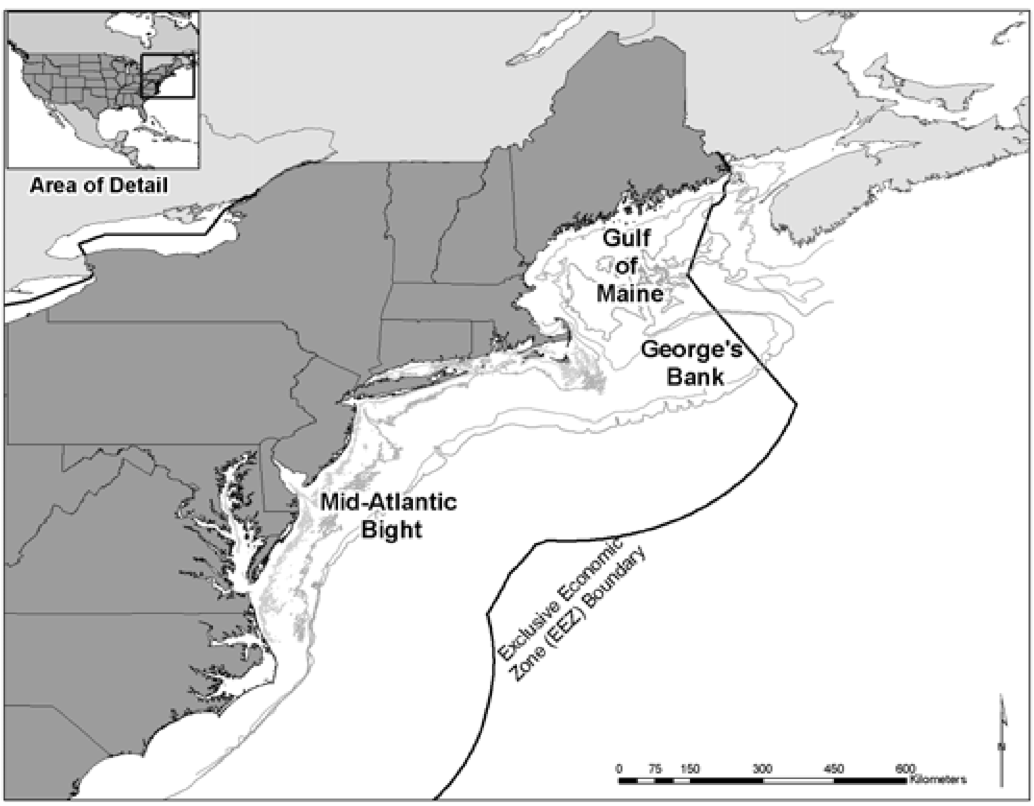

Figure 37. Map of the Gulf of Maine, Georges Bank, and Mid-Atlantic Bight.

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.[36] The

[36] 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.

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.

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 63.[37] Protected resources include whales and other marine mammals afforded protection under the Marine Mammal Protection Act, as well as sea turtles and other species afforded protection under the Endangered Species Act. 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 or 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 Northeast 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 63). These fishery resources include many species of both demersal and pelagic finfish, several species of crustaceans, mollusks,

[37] Some fishery resources, such as hagfish, Atlantic wolffish, 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.

and other invertebrates. These species occupy broad ranges within the Northeast Region (see Table 63) 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 2004, over 200 species were recorded in FVTRs as being landed. Of the 41 species that comprised the top 99 percent, by weight, of the reported landings, all but 7 are the subject of an FMP by the Mid-Atlantic Council, the New England Council, or the ASMFC. Of the seven non-FMP species in this group, three are managed by at least one state (Northern kingfish, whelks, and blue crabs), one is likely to be subject to a forthcoming Council FMP (Atlantic hagfish), and two may be considered for future Council FMPs (smooth dogfish and Jonah crabs). Only rock crabs appear in the top 99 percent of landed species and are not subject to current or potential future management.

The 39 species managed under the FMPs subject to this amendment comprised 92 percent, by weight, of the species reported as landed in the 2004 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 6.1 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, 98.2 percent, by weight, of all reported landings in 2004 were comprised by species subject to either Federal or ASMFC FMPs.[38]

7.1.2.2. Protected Resources

There are many types of protected species that live and migrate through the Northeast Continental Shelf Large Marine Ecosystem, including endangered finfish such as Atlantic salmon, 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 biological resources 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 more complete list of protected resources that occur in the Northeast Region, see Table 63. 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 (NMFS and USFWS 1995; Hirth 1997; USFWS 1997; Marine Turtle Expert Working Group (TEWG) 1998 & 2000), recovery plans for Endangered Species Act-listed sea turtles and marine mammals (NMFS 1991; NMFS and USFWS 1991a; NMFS and USFWS 1991b; NMFS and USFWS 1992; NMFS 1998; USFWS and NMFS 1992; NMFS 2005b), the marine mammal stock assessment reports (e.g., Waring et al. 2006), 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

[38] 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 NOAA Fisheries Service Highly Migratory Species Division web page at www.nmfs.noaa.gov/sfa/hms/.

on the Gulf of Maine Distinct Population Segment of Atlantic salmon can be found in the recovery plan (NMFS and USFWS 2005) as well as the status review for Atlantic salmon (NMFS and USFWS 1999).

The wild populations of Atlantic salmon found in rivers and streams from the lower Kennebec River north to the U.S.-Canada border are listed as endangered under the Endangered Species Act. Atlantic salmon of U.S. origin 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). 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 (NMFS and USFWS 1999).

Loggerhead, leatherback, Kemp's ridley, and green sea turtles occur seasonally in southern New England and Mid-Atlantic 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 species are typically observed as far north as Cape Cod whereas the more cold-tolerant leatherbacks are observed in more northern Gulf of Maine waters in the summer and fall (Shoop and Kenney 1992; STSSN database).

The western North Atlantic baleen whale species (Northern 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; Kenney 2002). 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. 2006). 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. (2006) 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 east-northeast 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, 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, spotted dolphins, striped dolphins). 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° N (Katona et al. 1993). Gray seals are the second most common seal species in EEZ waters, occurring primarily in New England (Katona et al. 1993; Waring et al. 2006). 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. 2006). 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. 2006).

There are no seabird species in the Northeast 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.

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 63 lists examples of non-fishery resources known to be subject to interactions with fishing gear or operations. These 26 species and species groups represent over 90 percent, by weight, of the observed fishery interactions with non-fishery resources during 2004. The non-fishery 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 Northeast 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 Northeast 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).

	Species	Gulf of Maine	Georges Bank	Middle Atlantic Bight
Fishery Resources	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
	Cusk	X	X	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
Protected Resources	Northern right whale	X	X	X
	Humpback whale	X	X	X
	Fin whale	X	X	X
	Blue whale[39]			
	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 salmon	X		
Other Non-fishery Resources	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 63. List of example biological resources and the geographic regions where the resources are most commonly found.

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

[39] Blue whales are considered only an occasional "visitor" to this region.

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 mackerel, Atlantic herring, Atlantic bluefish, and skates remain entirely open access.[40,41] In the Northeast 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 2004, the dealer purchase report database includes 524 ports of record among the 12 states in the Northeast Region. Of these, the top 91 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 14 ports. Nationally, 11 Northeast 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 64).

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). 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. Cape May, NJ, is another leading sea scallop port, and is also a primary port for squid (*Loligo* and *Illex*) and Atlantic mackerel. Gloucester, MA, and Portland, ME, are similarly important ports for American lobster, groundfish, monkfish, and Atlantic herring. Point Judith, RI, is a primary port for American lobster, squid (*Loligo* 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 Northeast Region FMP species.

[40] Amendment 1 to the Atlantic Herring FMP proposes a limited access permit system for this fishery. Upon implementation of this amendment, only the mackerel, bluefish, and skate fisheries would remain entirely open access.

[41] 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.

Port	Quantity (million pounds) 2003	2004	Port	Value (million dollars) 2003	2004
Reedville, VA	375.3	400.5	New Bedford, MA	176.2	206.5
New Bedford, MA	155.5	175.1	Hampton Roads Area, VA	78.0	100.6
Gloucester, MA	88.8	113.3	Cape May-Wildwood, NJ	42.7	68.1
Cape May-Wildwood, NJ	74.1	97.5	Gloucester, MA	37.8	42.7
Portland, ME	68.5	58.0	Point Judith, RI	31.2	31.5
Point Judith, RI	44.7	39.6	Reedville, VA	24.2	26.1
Hampton Roads Area, VA	30.1	34.5	Portland, ME	28.9	24.2
Point Pleasant, NJ	37.5	33.4	Long Beach-Barnegat, NJ	16.4	20.6
Atlantic City, NJ	38.1	33.2	Wanchese-Stumpy Point, NC	21.0	20.6
Wanchese-Stumpy Point, NC	33.0	31.4	Point Pleasant, NJ	22.8	19.2
Rockland, ME	31.7	30.9	Atlantic City, NJ	20.8	17.7

Table 64. Commercial fishery landings and value at major Northeast Region ports, 2003-2004 (from Pritchard 2005).

Figure 38 and Figure 39 display 2004 commercial fishing landings for major U.S. ports, both by weight and by value. These figures display the relative importance of Northeast 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 account 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 Mid-Atlantic 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 Mid-Atlantic ports and fishing communities.

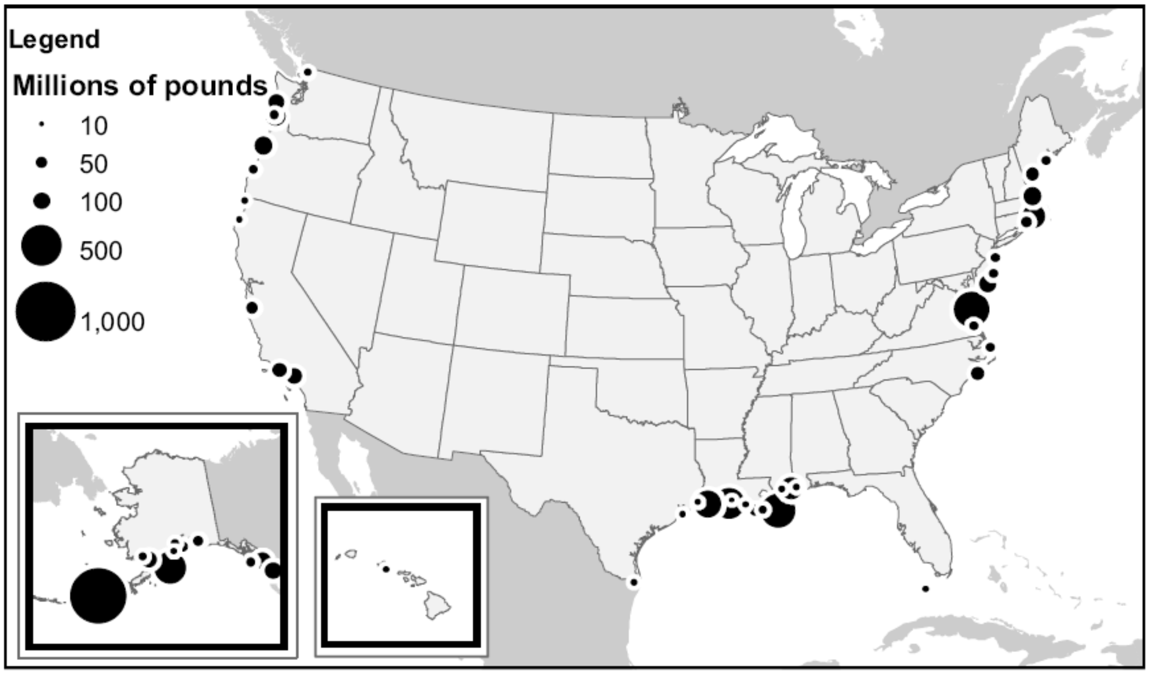

Figure 38. 2004 commercial fishery landings, by weight, at major U.S. ports (from Pritchard 2005).

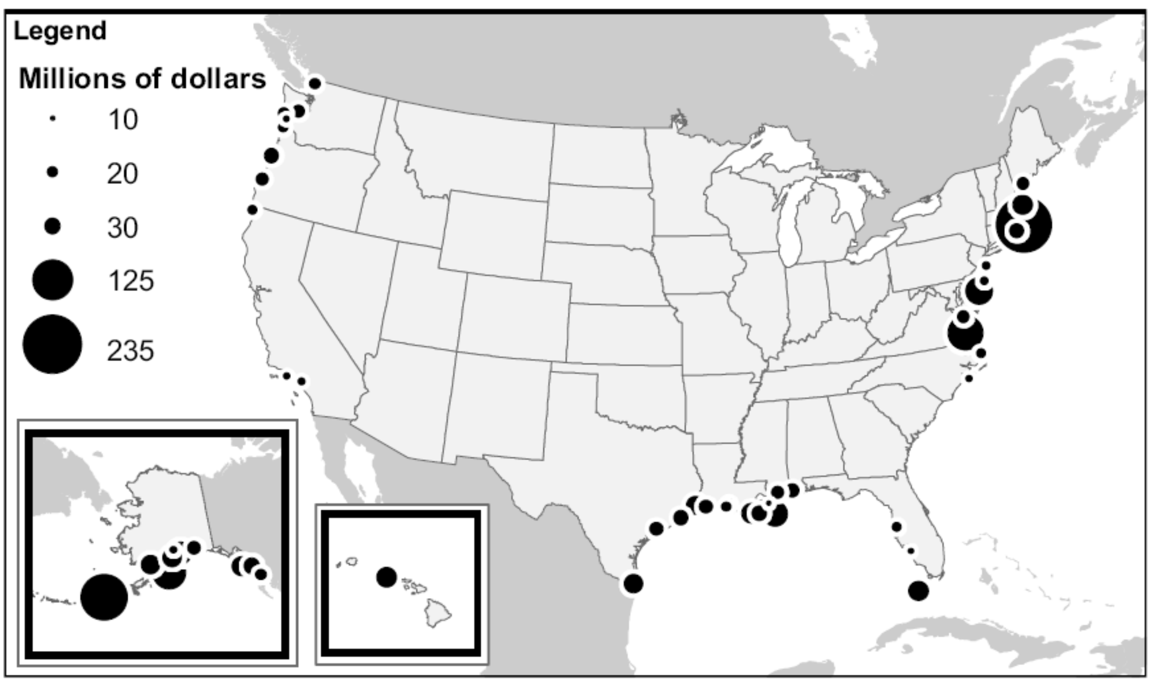

Figure 39. 2004 commercial fishery landings, by value, at major U.S. ports (from Pritchard 2005).

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 Northeast Region SBRM.

As noted above in the introduction to the affected environment (section 7.1), this amendment is wholly administrative in nature—focused on the procedures and mechanisms by which data and information on the types and rates of bycatch occurring in Northeast 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, particularly for the preferred alternatives. 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 socio-economic 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, 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 Northeast 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 administrative mechanisms by which data and information regarding fishery discards are collected (e.g., FVTRs, at-sea observers, seafood dealer purchase reports, MRFSS, etc.), neither of the alternatives would affect the level of fishing effort, fishing operations, the species targeted, or areas or times fished in the Northeast Region. The preferred alternative proposes maintaining the status quo bycatch collection mechanisms, which would impose no additional requirements or changes to current fishing practices. 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 no direct or indirect impacts on biological resources (including fishery resources, protected resources, and other non-fishery resources) associated with either alternative. As there are no biological impacts associated with either of these alternatives, there are no differences between them.

7.2.1.2. Effects on the Physical Environment (Habitat)

Because neither the preferred 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 Northeast 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)

Because the preferred alternative would continue the status quo program for bycatch reporting and monitoring, 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.

7.2.1.3.2. 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 Northeast 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 NOAA Fisheries Service purchases the equipment for the industry participants and provides it for their use (government pays). Based on the various VMS programs implemented in the Northeast 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).[42, 43] 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

[42] 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.

[43] 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.

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 65).

	Year 1 (per vessel)	Year 2+ (per vessel)
Equipment purchase	$7,194	N/A
Installation costs (average)	$2,438	N/A
Annual program registration fee	$608	$608
Annual maintenance	N/A	$975
Total	**$10,240**	**$1,583**

Table 65. 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 65 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 66 below identifies the primary vessel permit categories established for each FMP, with the number of permit holders in 2005. 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 66 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 66 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 NOAA Fisheries Service 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).

		Fleet-wide Cost	
Type of Permit	**Number of Permits**	**Year 1**	**Year 2+**
Atlantic Bluefish Open Access	3,766	$38,563,840	$5,961,578
Red Crab Limited Access	5	$51,200	$7,915
Red Crab Open Access	1,592	$16,302,080	$2,520,136
Atlantic Herring Limited Access	N/A[44]	N/A	N/A
Atlantic Herring Open Access	2,754	$28,200,960	$4,359,582
Sea Scallop Limited Access	347	$3,553,280	$549,301
Sea Scallop Open Access	258	$2,641,920	$408,414
Black Sea Bass Limited Access	903	$9,246,720	$1,429,449
Dogfish Open Access	3,501	$35,850,240	$5,542,083
Monkfish Limited Access	1,495	$15,308,800	$2,366,585
Monkfish Open Access	2,355	$24,115,200	$3,727,965
NE Multispecies Limited Access	1,550	$15,872,000	$2,453,650
NE Multispecies Open Access	2,782	$28,487,680	$4,403,906
Scup Limited Access	851	$8,714,240	$1,347,133
Skate Open Access	2,741	$28,067,840	$4,339,003
Squid/Mackerel/Butterfish Limited Access	476	$4,874,240	$753,508
Squid/Mackerel/Butterfish Open Access	4,941	$50,595,840	$7,821,603
Summer Flounder Limited Access	988	$10,117,120	$1,564,004
Surfclam/Ocean Quahog Limited Access	61[45]	$624,640	$96,563
Surfclam/Ocean Quahog Open Access	3,849[46]	$39,413,760	$6,092,967
Tilefish Limited Access	28	$286,720	$44,324
Tilefish Open Access	2,289	$23,439,360	$3,623,487

Table 66. Number of permits by FMP permit category for 2005 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 Northeast Region would most likely be orders of magnitude greater.

[44] Although limited access has been proposed for the Atlantic herring fishery as part of Amendment 1, this has not yet been implemented so the number of permit holders is not currently available.
[45] Maine Mahogany Quahog Permits.
[46] Individual Transferable Quota (ITQ) required.

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 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.

7.2.2. Environmental Consequences of Item 2: Analytical Techniques and Allocation of Observers

This item includes three 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 Northeast Region fishing modes. In addition to the status quo, an alternative is considered that would supplement the status quo with an importance filtering process to refine the initial target observer coverage levels, and another alternative is considered 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. The preferred alternative would continue the status quo allocation by fishing mode strata to achieve a target CV with the addition of the importance filter. 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 Northeast 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 is 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 Northeast 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 preferred 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 Northeast Region, the fisheries observer program operates entirely through a contract service funded by NOAA Fisheries Service, with the single exception of the sea scallop industry-funded program currently operating under emergency regulations (71 FR 34842, June 16, 2006). 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 established through the emergency rule, no other industry-funded observer programs are authorized in the Northeast Region. Even the sea scallop program is temporary, as the emergency rule is scheduled to expire on December 13, 2006, unless continued for another 180 days. According to the provisions of the Magnuson-Stevens Act, an emergency rule such as the sea scallop industry-funded observer program may be implemented for a total of two 180-day periods, after which the temporary emergency regulations expire. Once the second 180-day emergency rule expires (should it be implemented), the sea scallop industry-funded observer program may only be continued through Council action to amend the Sea Scallop FMP. Such an amendment could include consideration of a variety of alternatives and issues related to the industry-funded observer program, such as increasing the observer set-aside to cover any proposed increases in observer coverage levels.

As the three 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 three 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 status quo alternative would result in no SBRM standard, while the preferred alternative would establish a CV of 30 percent as the performance standard for the Northeast Region 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

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 Northeast Region SBRM, there are no direct or indirect effects on any biological resources (fishery resources, protected resources, or other non-fishery resources) anticipated for either alternative.

7.2.3.2. Effects on the Physical Environment (Habitat)

As above, 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 Northeast Region SBRM, there are no direct or indirect effects on the physical environment (including EFH) anticipated for either alternative.

7.2.3.3. 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 performance measure of a 30 percent CV standard for the Northeast Region 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/Change Process

This item includes two alternatives addressing whether the SBRM should include a reporting/evaluation process to present information on bycatch rates in the Northeast 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 preferred alternative would establish a periodic reporting and evaluation process as a formal component of the Northeast Region SBRM. The requirement would specify the types of information to be provided in the report, and time intervals for which the reports must be prepared (either annually, every 5 years, or as part of the required SAFE report 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 Northeast Region SBRM, there are no direct or indirect effects on any biological resources (fishery resources, protected resources, or other non-fishery resources) anticipated for either alternative.

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 Northeast Region SBRM, there are no direct or indirect effects on the physical environment (including EFH) anticipated for either alternative.

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 Northeast Region SBRM, there are no direct or indirect socio-economic effects on fishing vessels, fleets, or ports anticipated for either alternative.

7.3. Summary of Cumulative Effects Associated with the Preferred Alternative

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 non-federal) 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 action; and
- the overall impact that can be expected if the individual impacts are allowed to accumulate.

However, 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 Northeast 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 Northeast 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 this action is unique in the Northeast Region as the first action to propose the establishment of a comprehensive SBRM for the region.

In many ways, this action simply formalizes the status quo mechanisms used in the Northeast 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 Northeast 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 three 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, and the requirement to conduct periodic evaluations and prepare a periodic SBRM report—are purely administrative features intended to improve the effectiveness and the transparency of the Northeast Region SBRM. None of these additional components are associated with impacts to any fishing areas or living marine resources within the Northeast Region that could be distinguished from the no action baseline.

Therefore, given the limited and administrative nature of this action and the preferred alternatives, this action is not related to any other actions with individually insignificant but cumulatively significant impacts.

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Chapter 8
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 administrative mechanisms by which data and information on bycatch in Northeast 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 preferred alternatives on protected species are considered in Chapter 7, section 7.2, and, based on the administrative 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

Pursuant to the requirements of E.O. 12866, a Regulatory Impact Review will be completed as part of the final document prepared for submission. See section 8.9 for a discussion of the preliminary regulatory economic evaluation.

8.5. 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 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 Council 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 Council, and NOAA Fisheries Service.

This document is available in several formats, including printed publication and online through the Councils' and NOAA Fisheries Service'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 NOAA Fisheries Service adheres to the standards set out in Appendix III, "Security of Automated Information Resources," of OMB Circular A-130; the Computer Security Act; and the Government Information Security Act. All confidential information (e.g., dealer purchase reports) is safeguarded pursuant to the Privacy Act; Titles 13, 15, and 22 of the U.S. Code (confidentiality of census, business, and financial information); the Confidentiality of Statistics provisions of the Magnuson-Stevens Act; and NOAA Administrative Order 216-100, Protection of Confidential Fisheries Statistics.

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 Northeast Fisheries Science Center. 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 NOAA Fisheries Service observer program and incorporated into the sea sampling or observer database systems. These reports are developed using an approved, scientifically valid sampling process. In addition to these sources, additional information is presented that has been accepted and published in peer-reviewed journals or by scientific organizations. Original analyses in this document were prepared using data from accepted sources, and the analyses have been reviewed by members of the 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 2004 or 2005, depending on the database. Complete FVTR and fishery observer program data for 2005 were not available at the time during which these analyses were conducted. The data used in the analyses provide the best available information on catch and landings by participants in Northeast 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 Northeast 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 Northeast Fisheries Science Center, the Northeast Regional Office, and NOAA Fisheries Service Headquarters. The Center's technical review is conducted by senior level scientists with specialties in population dynamics, stock assessment methods, demersal resources, population biology, and the social sciences. The Council review process involves public meetings at which affected stakeholders have opportunity to provide comments on the document. Review by staff at the Regional Office is conducted by those with expertise in fisheries management and policy, habitat conservation, protected species, and compliance with the applicable law. Final approval of the action proposed in this document and clearance of any rules prepared to implement resulting regulations would be conducted by staff at NOAA Fisheries Service Headquarters, the Department of Commerce, and the U.S. Office of Management and Budget.

This is a public hearing draft of the amendment, so there will be additional opportunity to improve the document based on relevant comments received during the public hearing process. There is also the potential for changes to the preferred alternatives ultimately proposed by the Councils, based on input received during the public hearing process.

8.7. Magnuson-Stevens Act

The preferred alternatives identified in this draft 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 Northeast 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 Northeast 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.

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 administrative 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)

An assessment of the expected impacts of the preferred alternatives, and other alternatives considered as part of this amendment is presented in Chapter 7, section 7.2. This draft environmental assessment was prepared according to the provisions of NOAA Administrative Order 216-6. The final amendment will address the Finding of No Significant Impact.

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 final SBRM Amendment prepared for submission will address the requirements of the RFA to prepare an initial regulatory flexibility analysis (IRFA) or to certify that the proposed rule would not have a significant economic impact on a substantial number of small entities. For the purpose of conducting a preliminary regulatory economic evaluation (PREE), Chapter 7, section 7.2, addresses the expected economic impacts associated with the preferred alternatives, as well as the other alternatives considered as part of this amendment.

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Chapter 9
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 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 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.

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 39 fishing modes defined in the Northeast Region for the purpose of the SBRM 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 Northeast Region, except those who hold a Federal permit only for lobster.

Marine Recreational Fisheries Statistical Survey (MRFFS). An annual national survey conducted by NOAA Fisheries Service, in cooperation with the coastal states, to estimate the number, catch, and effort of recreational fishermen. MRFSS is currently undergoing a major program-wide review by NOAA Fisheries Service in response to a report by the National Research Council, and is likely to be updated, or even replaced, in the near future. The SBRM Amendment uses the term MRFSS as a placeholder representing the recreational fishery survey program that results from the agency review of and consequent changes to the program.

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." NOAA Fisheries Service 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 in-season quotas (including bycatch quotas), or a variety of other reasons. The Northeast Region 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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Chapter 10
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APPENDICES

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Appendix A
NEFSC Bycatch Estimation Methodology: Allocation, Precision, and Accuracy

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Northeast Fisheries Science Center Reference Document 05-09

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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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 D/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 D/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 non-response 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 ($p=0.59$, $df=84$).   A paired t-test of the stratum specific standard deviations of pounds kept suggested no significant difference from zero ($p=0.08$). 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 ($P<0.05$) in 20 of 65 comparisons. Of these 20 cases, 10 involved ports in Southern New England and the Mid-Atlantic 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 (d/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 (d/k) for species groups as the primary response variable.
7. Estimation of approximate variances for d/k for groups of species, rather than individual species
8. Allocation of sampling effort based on reduction in total variance of the d/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 stratum-specific 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 peer-reviews 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 (mt)	Dealer Landings (mt)	Difference (mt)	Pecent 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 (d/k) is used. Fisheries using other gear types where regulations may prohibit groundfish possession are excluded from the current optimization process because a d/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 d/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 d/k ratio, total observed kept pounds, standard error of the d/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:

$T_{vtr} =$ total VTR trips of $Level_i$
$T_{obs} =$ total NEFOP trips for $Level_i$
$T_{imp,h} = (T_{obs} / T_{vtr}) * Trips_{vtr,h}$;
$Kept_{imp} = (T_{imp,h} / T_{obs}) *$ NEFOP kept pounds sum in $Level_i$
$SE_{imp} = (T_{obs} / T_{imp,h})^{1/2} *$ NEFOP standard error in $Level_i$
$Days_{imp} = (T_{imp,h} / T_{obs}) *$ total number of NEFOP days in $Level_i$
$T_{imp,h}$ is rounded to a whole number, if $T_{imp,h} < 1$, then $T_{imp,h} = 1$;

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 d/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 I_{hij} be an indicator variable denoting the presence or absence of species group j within trip i in stratum h. Then I_{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

	I_{h_1}	I_{h_2}	I_{h_3}
	j=1	j=2	j=3
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
n_h=7	n_{h1}	n_{h2}	n_{h3}

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., n_{hj}) divided by the total number of unique trips within the stratum (n_h). Note that

$$n_h \neq \sum_{j=1}^{3} n_{hj}$$

owing to the overlap in coverage for some trips. The probability that a random trip provides information on species group j is defined as

$$\hat{p}_{hj} = \frac{n_{hj}}{n_h} \qquad (1)$$

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

$$\hat{P}_{hj} = \frac{N_{hj}}{N_h} \qquad (2)$$

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 n'_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

$$n'_{hj} = \hat{p}_{hj} n'_h \qquad (3)$$

if Eq. 1 is used , or

$$n'_{hj} = \hat{P}_{hj} n'_h \qquad (4)$$

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'_{hj}.

Example 2

Trip ID	I_{h_1} j=1 NEGF	I_{h_2} j=2 Monk	I_{h_3} j=3 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
n_h=10	n_{h1}	n_{h2}	n_{h3}
p_{hj}	7/10	4/10	5/10

If the n_h were increased to n'_h=30 then the revised estimates of n'_{hj} would be

$$\hat{n}'_{h1} = \left(\frac{7}{10}\right)30 = 21$$

$$\hat{n}'_{h2} = \left(\frac{4}{10}\right)30 = 12$$

$$\hat{n}'_{h1} = \left(\frac{5}{10}\right)30 = 15$$

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 n_{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 d/k ratio analyses (e.g. there are trips in d/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_{hi} 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 Σt_{hi} The average trip duration is estimated as

$$\bar{t}_h = \frac{\sum_{i=1}^{n_h} t_{hi}}{n_h} \qquad (5)$$

The actual number of future observer days that will be required under some new sampling intensity (n'_h) is proportional to n'_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

$$T_h = \bar{t}_h n_h = \sum_{i=1}^{n_h} t_{hi} \qquad (6)$$

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

$$T_h' = \bar{t}_h n_h' \qquad (7)$$

The grand total number of days at sea that would be allocated given some new set $\{n'_h\}$ would be

$$T' = \sum_{h=1}^{H} \bar{t}_h n_h' \qquad (8)$$

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:

$$\hat{R}_{jh} = \frac{\sum_{i=1}^{n_h} d_{ijh}}{\sum_{i=1}^{n_h} k_{ijh}} \qquad (9)$$

where d_{ijh} is the discards for species group j within trip i in stratum h and k_{ijh} is the kept portion of the catch. R_{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:

$$\hat{R}_j = \sum_{h=1}^{H} \left(\frac{N_h}{\sum_{h=1}^{H} N_h} \right) \hat{R}_{jh} I_h \qquad (10)$$

The variable I_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 R_{jh} is obtained from a first order Taylor series expansion about the mean:

$$V\left(\hat{R}_{jh}\right) = \frac{1}{(n_{jh}-1)n_{jh}\bar{k}_{jh}^2}\left[\left(\sum_{i=1}^{n_{jh}} d_{ijh}\right)^2 + \hat{R}_{jh}^2\left(\sum_{i=1}^{n_{jh}} k_{ijh}\right)^2 - 2\hat{R}_{jh}\left(\sum_{i=1}^{n_{jh}} d_{ijh}\right)\left(\sum_{i=1}^{n_{jh}} k_{ijh}\right)\right] \tag{11}$$

where d_{ijh} is the total discard weight of species group j in trip i within stratum h, k_{ijh} is the total kept weight of species group j in trip i within stratum h, nj_h is the sample size (number of trips) that caught species group j in stratum h, and k_{jh} 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 d/k ratio.

The variance of the d/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

$$V\left(\hat{R}_j\right) = \sum_{h=1}^{H}\left(\frac{N_h - n_{jh}}{N_h}\right)\left(\frac{N_h}{\sum_{h=1}^{H} N_h}\right)^2 V\left(\hat{R}_{jh}\right)I_h \tag{12}$$

The overall coefficient of variation for the discard/kept ratio is defined as

$$CV_j = \frac{\sqrt{V(\hat{R}_j)}}{\hat{R}_j} \tag{13}$$

It is now possible to define an overall estimate of the relative precision of the d/k ratio across all species groups as

$$CV = \sum_{j=1}^{3} \lambda_j CV_j \qquad (14)$$

where λ_j is an arbitrary weighting factor for species group j. In this formulation, the λ_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 (n_h) 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 n^*_h is defined as the optimal number of trips taken in stratum h, then the variance of the overall ratio is estimated as

$$V\left(\hat{R}_j^*\right) = \sum_{h=1}^{H} \left(\frac{N_h - n_{jh}}{N_h} \right) \left(\frac{N_h}{\sum_{h=1}^{H} N_h} \right)^2 \left(\frac{n_{jh}}{n_{jh}^*} \right) V\left(\hat{R}_{jh}\right) I_h \qquad (15)$$

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 (T_C) and constraints on the number of trips per stratum.

$$\begin{aligned} &\min \sum_{j=1}^{3} \lambda_j CV_j \\ &\textit{subject to} \\ &2 \le n_{jh}^* \le N_h \qquad , \forall_h \\ &T_C^* \ge \sum_{h=1}^{H} \bar{t}_h n_h^* \end{aligned} \qquad (16)$$

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 (CV_{CRIT}). This version of the model can be written as:

$$
\begin{aligned}
&\min \sum_{h=1}^{H} \bar{t}_h n_h^* \\
&\textit{subject to} \\
&2 \le n_{jh}^* \le N_h \qquad , \forall_h \\
&CV_{CRIT} \ge \sum_{j=1}^{3} \lambda_j CV_j
\end{aligned}
\tag{17}
$$

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 N_h to N'_h where N_h is the total number of trips in stratum h and N'_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 Mid-Atlantic 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(I(L_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

M-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 d/k ratio thresholds

	Threshold (d/k ratio)	Description of Filters that Operate on Individual Cells (Species within Strata)	Number of Cells Included	Number of Cells Excluded
Max d/k_NEGF	1	Maximum d/k ratio used for NEGF. Values>Threshold excluded	25	11
Max d/k_FSB	2	Maximum d/k ratio used for FSB. Values>Threshold excluded	32	4
Max d/k_Monk	2	Maximum d/k ratio used for Monkfish. Values>Threshold 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 d/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 d/k ratios and the variance estimates for 'all data' and for 'data without imputed values'. Generally, the d/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 lbs in which hake comprised less than 50% of the total (designated "Big" trips by Sampson). For trips less than 10,000 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 1st and 3rd 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 self-reported 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 ($p=0.59$, $df=84$). As well, a paired t-test of the stratum specific standard deviations of pounds kept showed no significant difference from zero ($p=0.08$). A strong correlation was detected in trip duration between observed and unobserved trips (Figure 7), with observed trips averaging about a half-day longer ($p = 0.01$) (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 $\mathbf{h}$ ($\mathbf{V_{jh}}$) and the number of observed trips in stratum $\mathbf{n_h}$ **.** Thus, $\mathbf{E_{jh} = V_{jh} * n_h}$. These expectations can then be compared to the actual frequencies ($\mathbf{O_{jh}}$) 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 ($P<0.05$) in 20 of the 65 comparisons. Of these 20 cases, 11 were from ports in Southern New England and Mid-Atlantic 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 post-stratification 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 d/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 d/k ratio is smaller than the precision of the individual components. Thus, the CV of the d/k ratio for a particular gear type or for a d/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 d/k ratio from 20% to 10%.

The coefficient of variation (CV) of the d/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 d/k ratio for this fishery.

A decrease in precision of the d/k ratio is also expected for any single species analysis. For example, the CV of the d/k ratio for haddock alone will probably be much greater than the CV of the d/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 d/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 d/k ratios, which are appropriate for most fisheries; however, for other fisheries, d/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.

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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 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 d/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=ogfxnewcv	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 d/k are observed (=1) or imputed (=0)	FSB	OBS	flag
ofsbnewcv	Desired CV closest to 0.30--intermediate value	FSB	OBS	number
ofsbnewntrips	Number of Observed trips necessary to achieve CV=ofsbxnewcv	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
ofsbcv	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 d/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 d/k ratio in stratum h for NEGF. 1=> exceeds threshold,else 0	NEGF	OBS	switch
I(d/k_fsb)	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 d/k in stratum h for Monk. 1=> exceeds threshold, else 0	Monk	OBS	switch
Total VTR 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.

				QUARTER							
				1		2		3		4	
Region	**Gear**	**Mesh**	**Trip length**	VTR	NEFOP	VTR	NEFOP	VTR	NEFOP	VTR	NEFOP
DE/MD	Otter Trawl	Large	day			95	0	188	0	52	0
			multi-day	17	0	31	0	8	1	21	0
		Medium	day							1	0
			multi-day	8	2	5	0			5	0
		Small	day	3	0	14	0	3	0	24	0
			multi-day			1	0				
	Gillnet	Medium		1	0	1	0				
		Small		4	0	1	0	1	0		
		XLarge		12	0	19	0	2	0	8	0
ME_NH	Longline	None		20	0	68	0	6	0	5	0
	Otter Trawl	Large	day	187	0	102	2	512	6	568	1
			multi-day	315	9	279	5	479	9	439	15
		Medium	day							1	0
			multi-day			1	0				
		Small	day					1	1	1	0
			multi-day							1	0
		XLarge	day			3	0	1	0	10	0
			multi-day	1	0						
	Gillnet	Large		75	0	242	0	823	10	375	3
		Medium								1	0
		None				1	0	10	0	1	0
		Small						3	0		
		XLarge		19	0	77	0	573	14	247	0
N_MA	Longline	None		407	6	28	1	186	0	243	0
	Otter Trawl	Large	day	789	20	739	21	2015	54	1232	34
			multi-day	501	7	382	13	551	10	613	9
		Medium	day			11	1	1	0		
			multi-day			2	4	3	0	2	1
		Small	day	13	0	119	2	3	1	15	2
			multi-day	12	2	57	2	3	3	15	2
		XLarge	day			1	0				
			multi-day					2	0	1	0
	Gillnet	Large		1061	81	367	83	1481	94	1024	64
		Medium		1	0					2	0
		None		2	0	1	0	22	0	1	0
		Small		4	0	1	0	3	0	8	0
		XLarge		191	11	174	37	694	33	540	35
NC/VA	Otter Trawl	Large	day	2	0	5	0			3	0
			multi-day	542	17	117	0			226	3
		Medium	day	4	0	3	0				
			multi-day	35	7	20	0			15	2
		Small	multi-day	12	4	4	0	2	0	13	0
		XLarge	multi-day	4	0	4	0				
	Gillnet	Large		9	0	46	0	11	0	43	0
		Medium		19	0	5	0			10	0
		Small		2	0	8	0	4	1	15	0
		XLarge		38	0	161	0			35	0
NJ/NY	Longline	None		45	0	5	0				
	Otter Trawl	Large	day	426	4	1878	6	936	0	847	0
			multi-day	342	4	421	3	580	0	199	1
		Medium	day	13	1	267	21	464	5	458	4
			multi-day	170	22	42	5	4	1	64	3
		Small	day	29	0	629	5	894	0	465	0
			multi-day	209	8	99	3	105	1	150	5
		XLarge	day			4	0	31	0	20	0
			multi-day	7	0	2	0	1	0	2	0
	Gillnet	Large				72	0	70	0	29	0
		Medium				49	0	81	0	31	0
		None				2	0			4	0
		Small		2	0	8	0	49	0	51	0
		XLarge		418	0	699	1	166	0	995	0
SNE	Otter Trawl	Large	day	273	2	996	20	1399	2	731	2
			multi-day	571	37	515	8	621	21	525	25
		Medium	day			72	3	41	1	158	2
			multi-day	25	1	19	1	4	2	23	0
		Small	day	11	0	104	6	304	2	333	10
			multi-day	503	12	269	8	188	5	373	7
		XLarge	day			2	0			7	0
			multi-day	3	0	1	0	4	0	11	0
	Gillnet	Large		21	1	124	9	170	3	66	2
		Medium						1	0		
		None		1	0	1	0			1	0
		Small				4	0				
		XLarge		314	13	684	38	202	10	582	28

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 length**	NEGF	FSB	MONK	NEGF	FSB	MONK	NEGF	FSB	MONK	NEGF	FSB	MONK
DE/MD	Otter Trawl	Large	day				0	1	1	0	1	1	0	1	1
			multi-day	0	1	1	0	1	1	0	1	1	0	1	1
		Medium	day										0	1	0
			multi-day	0	0	1	0	1	1				0	1	0
		Small	day	0	1	1	0	1	1	0	1	0	0	1	1
			multi-day				0	1	0						
	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	day	1	0	1	0	1	0	0	1	0	1	1	1
			multi-day	0	0	0	0	0	0	0	1	0	0	1	0
		Medium	day										0	1	0
			multi-day				1	0	1						
		Small	day							1	0	0	1	0	1
			multi-day										1	0	1
		XLarge	day				1	0	1	1	0	1	0	0	1
			multi-day	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	None		0	0	0	1	0	0	1	0	0	1	0	0
	Otter Trawl	Large	day	0	1	0	0	0	0	0	1	0	0	1	0
			multi-day	0	1	0	0	0	0	0	0	0	0	1	0
		Medium	day				1	1	1	1	0	1			
			multi-day				0	0	0	1	0	1	1	0	1
		Small	day	1	0	1	0	0	0	0	1	0	0	0	0
			multi-day	0	1	0	0	1	0	0	0	0	0	0	0
		XLarge	day				0	1	0						
			multi-day							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	day	0	1	0	0	1	1				1	1	1
			multi-day	0	0	0	0	1	1				1	0	0
		Medium	day	0	1	0	0	1	0						
			multi-day	0	0	0	0	1	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	None		1	0	0	1	0	0						
	Otter Trawl	Large	day	0	0	0	0	0	0	1	1	1	1	1	1
			multi-day	0	0	0	1	0	0	1	1	1	0	1	1
		Medium	day	1	1	0	0	0	0	0	0	0	0	0	0
			multi-day	0	0	0	0	0	0	1	0	0	0	0	0
		Small	day	1	1	1	0	0	0	1	1	1	1	1	1
			multi-day	0	0	0	0	0	0	1	0	0	1	0	0
		XLarge	day				1	1	1	0	1	1	0	1	1
			multi-day	0	1	1	0	0	1	0	1	0	0	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	1
SNE	Otter Trawl	Large	day	0	0	0	0	0	0	1	0	1	0	0	0
			multi-day	0	0	0	0	0	0	0	0	0	0	0	0
		Medium	day				0	0	1	0	1	1	0	0	0
			multi-day	0	1	1	1	1	1	0	1	0	1	1	1
		Small	day	1	1	1	0	0	0	0	0	1	0	0	0
			multi-day	0	0	0	0	0	0	0	1	0	0	0	0
		XLarge	day				0	1	1				0	1	1
			multi-day	1	1	1	0	1	1	1	0	1	0	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 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

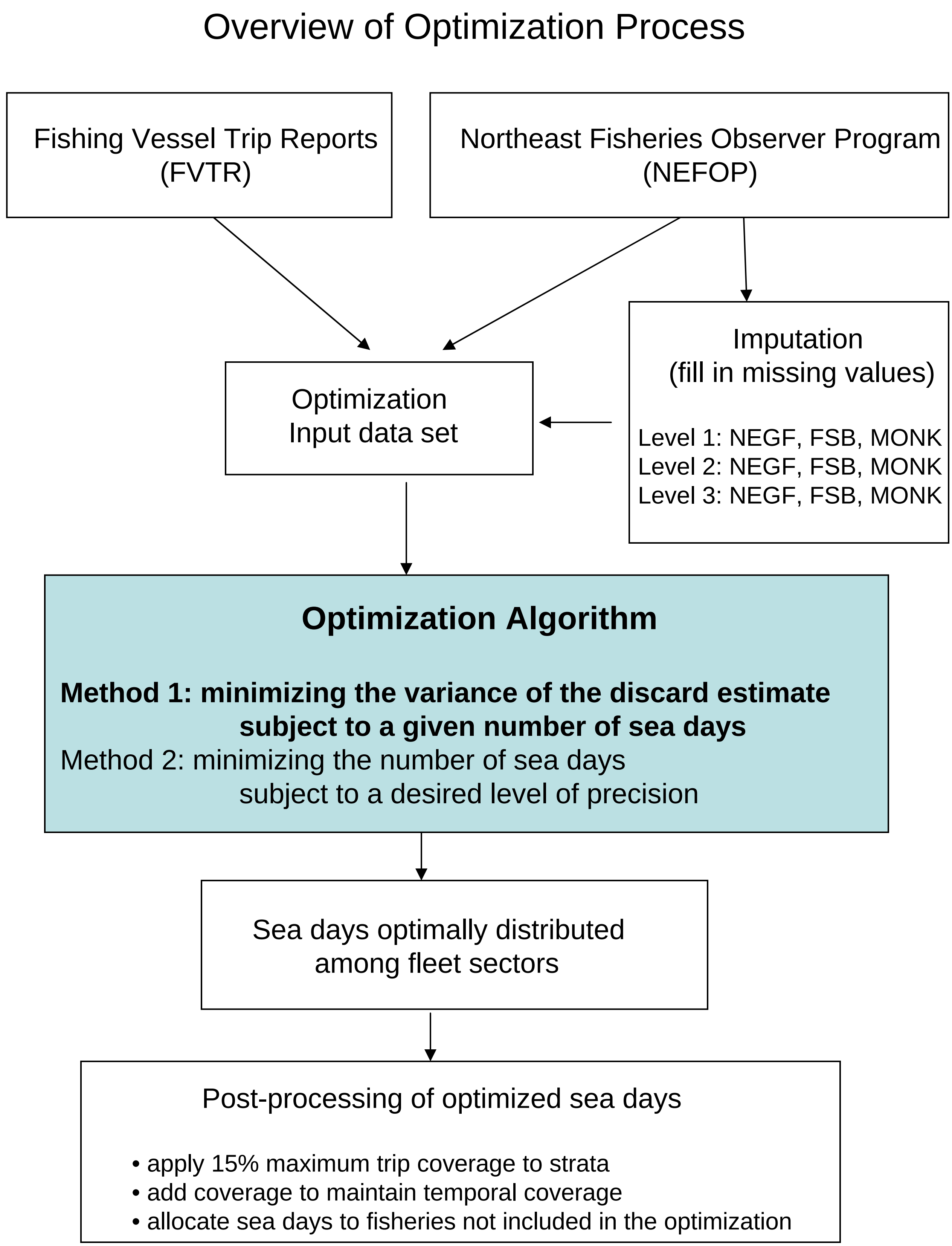


Figure 1. An overview of the optimization process used to allocate sea days to fisheries in the Northeast region.

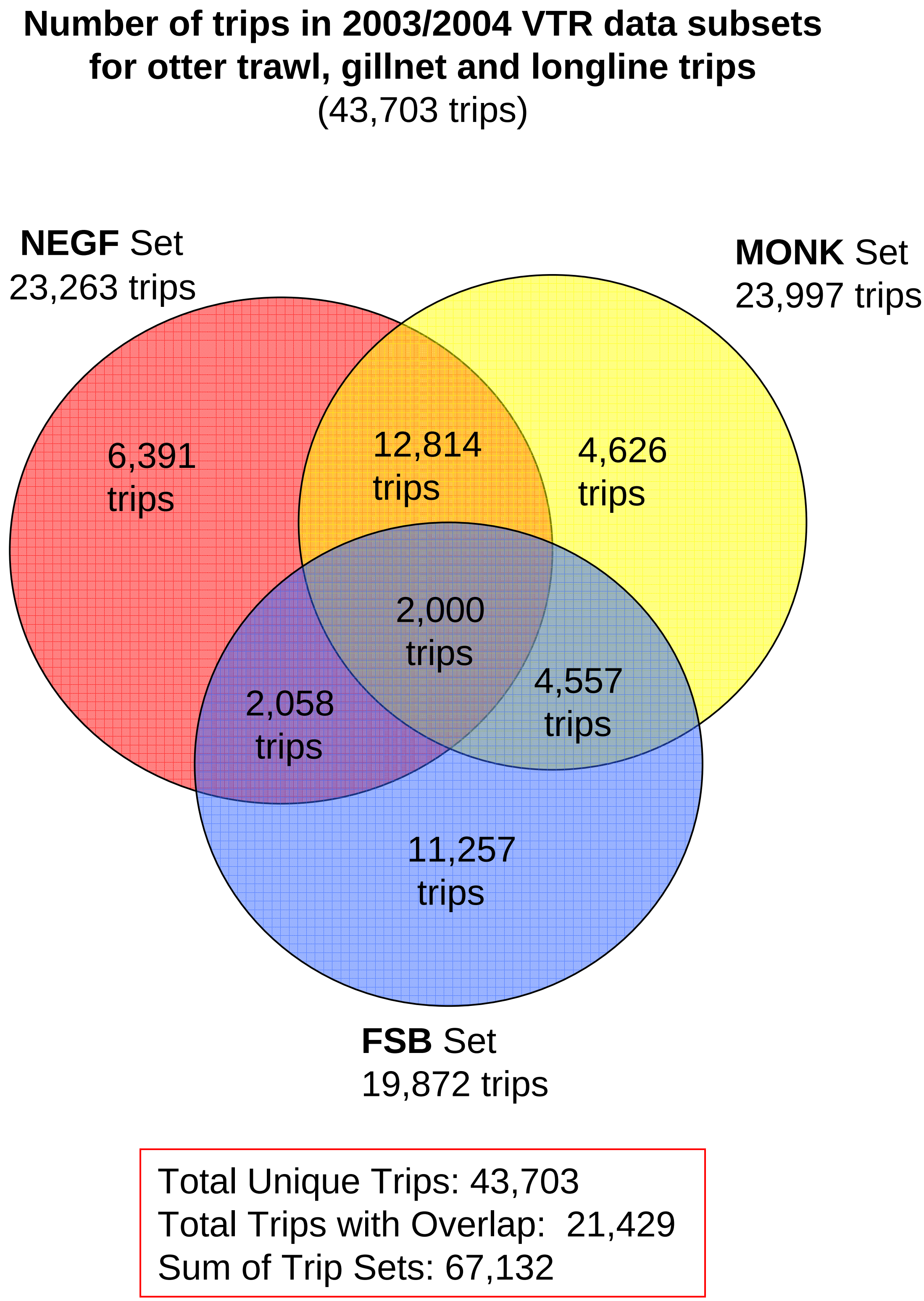
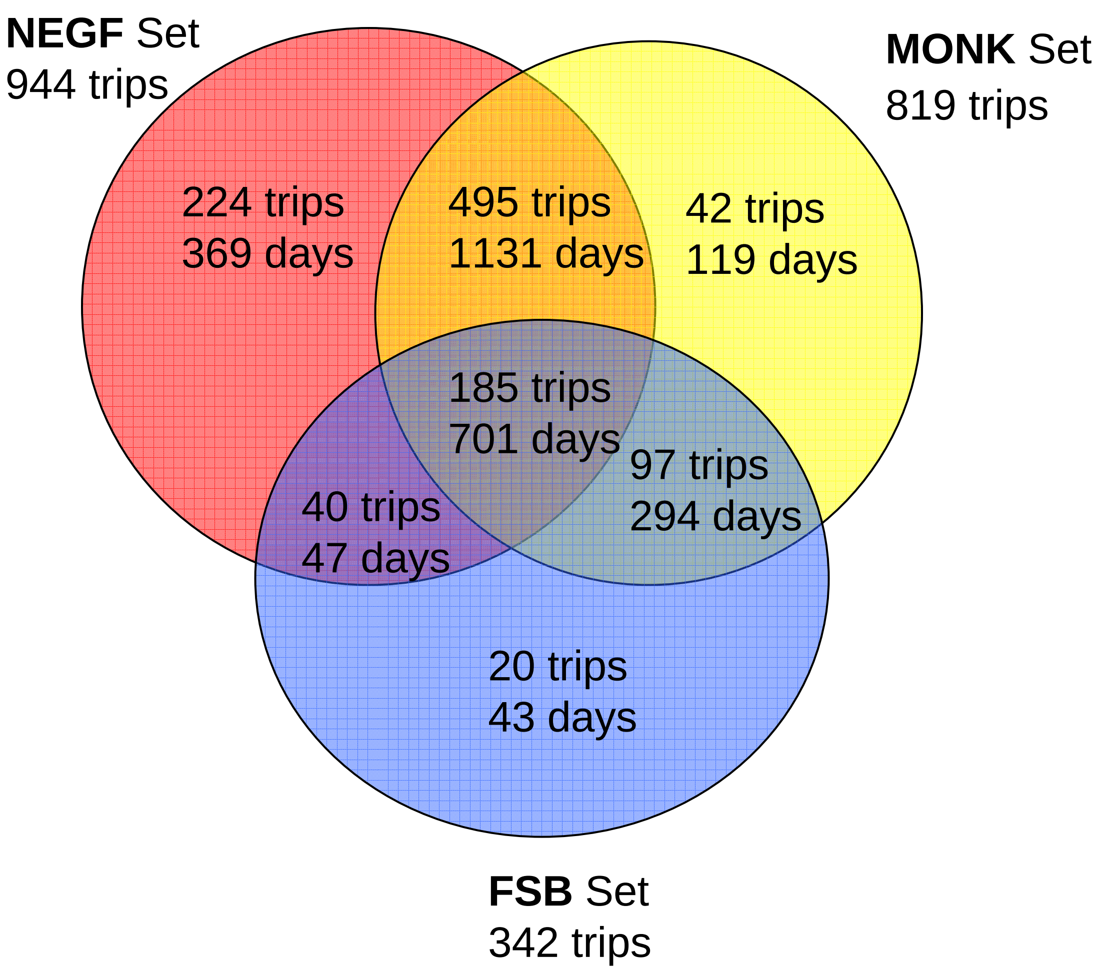


Figure 2. Number of trips in the 2003/2004 Vessel Trip Report (VTR), by data subsets (New England groundfish -NEGF; Monkfish - MONK; and summer flounder, scup and black sea bass - FSB) for otter trawl, gillnet and longline trips.

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)

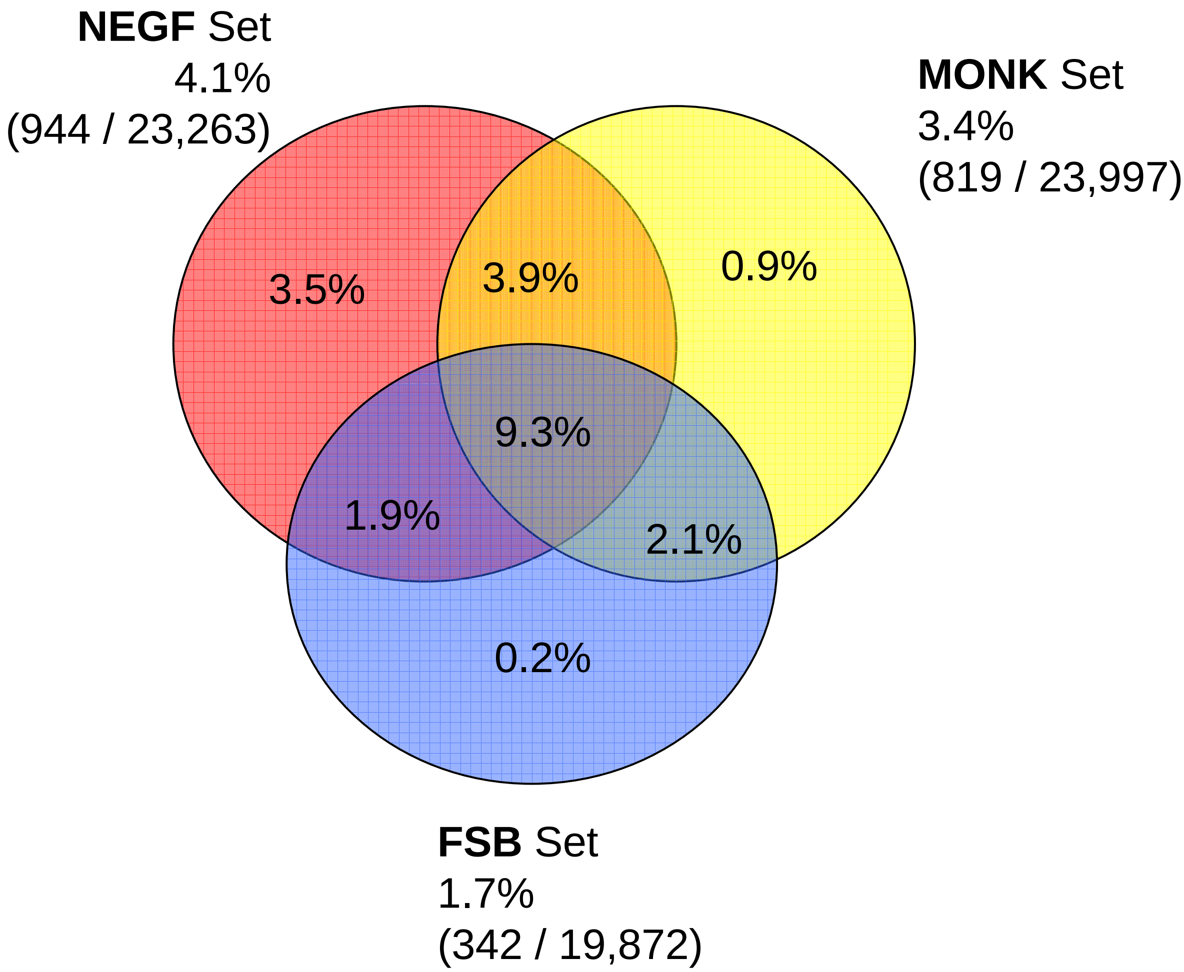


Total Unique Trips: 1,103
Total Trips with Overlap: 817
Sum of Trip Sets: 2,105

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

(43,703 unique trips)



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.

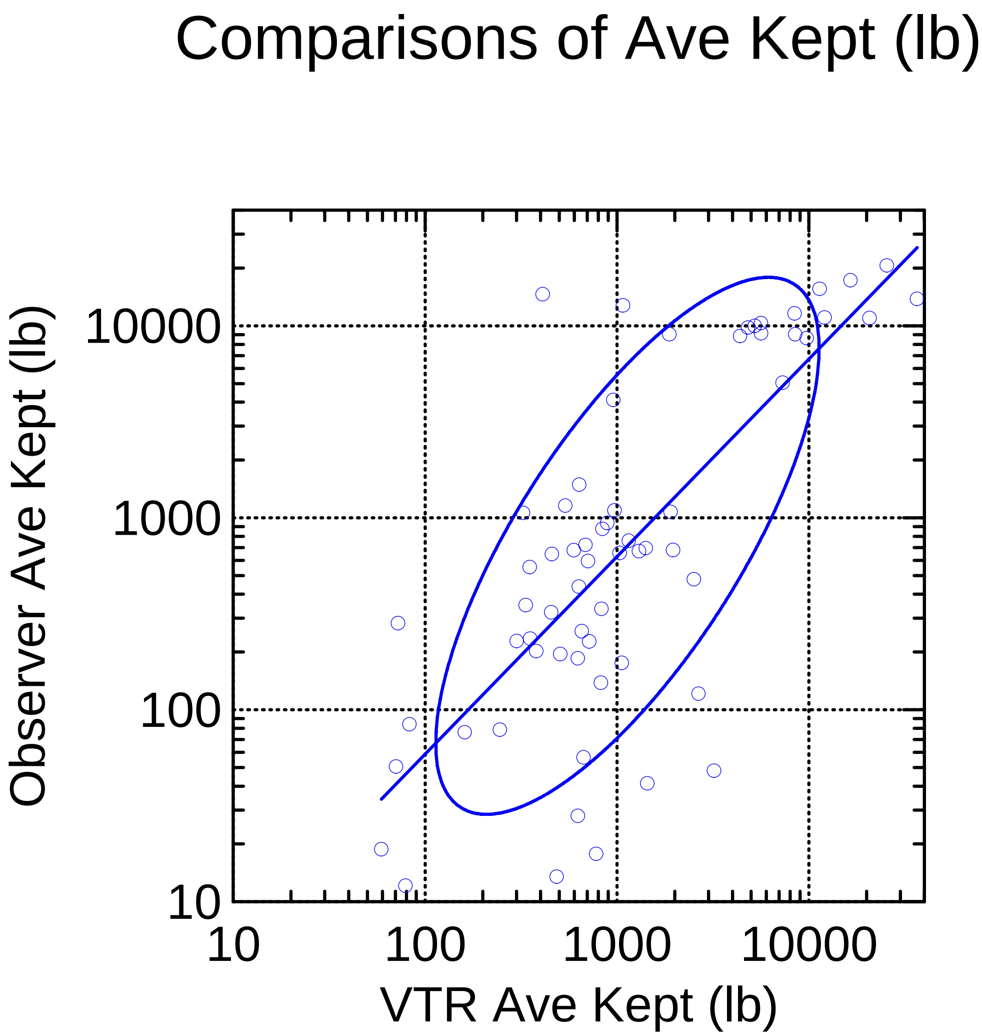
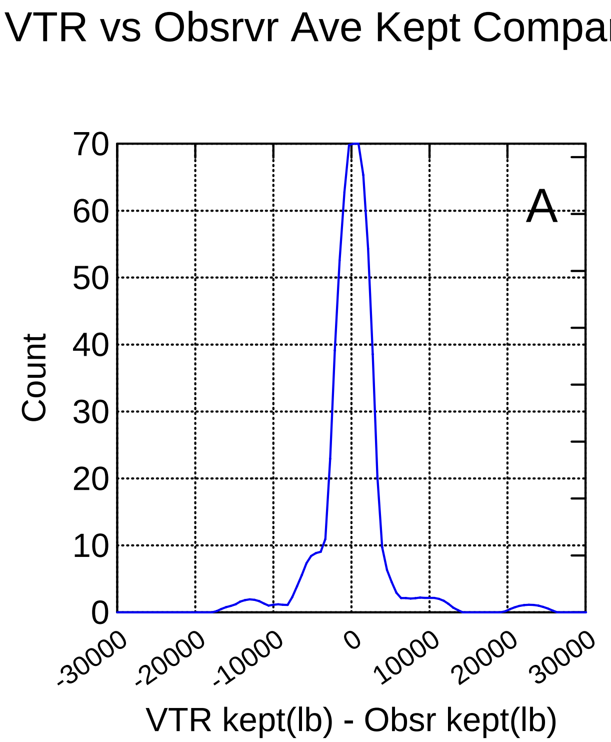


Figure 5. Comparison of average kept pounds of groundfish (natural log scale) in the Northeast Fisheries Observer Program and Vessel Trip Report data sets for 2003/2004. Each point represents the mean of an individual stratum.



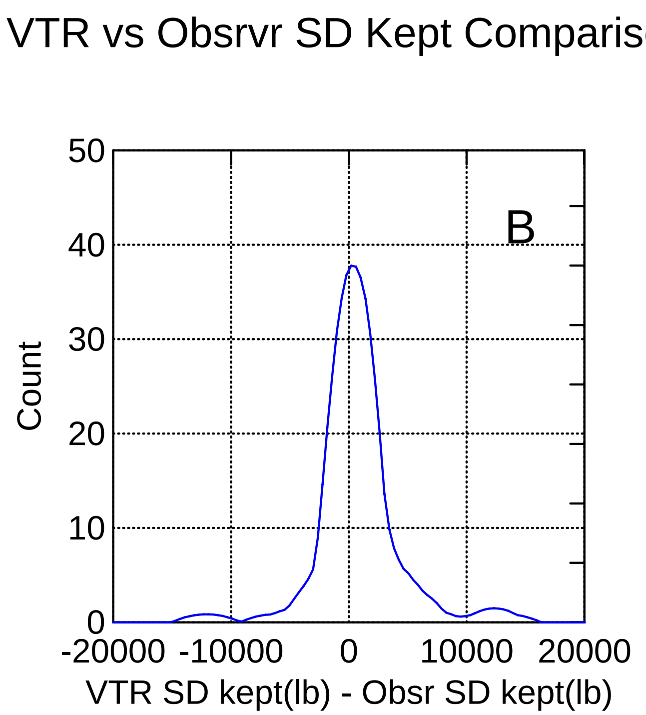


Figure 6. The distribution of differences between the average kept pounds (A) and the standard deviation (SD) of average kept pounds (B) of groundfish in the Northeast Fisheries Observer Program (Obsrvr) and the Vessel Trip Report (VTR) data for 2003/2004. Histograms are non-parametric smooths of the stratum specific differences.

Comparisons of Ave Trip Duration

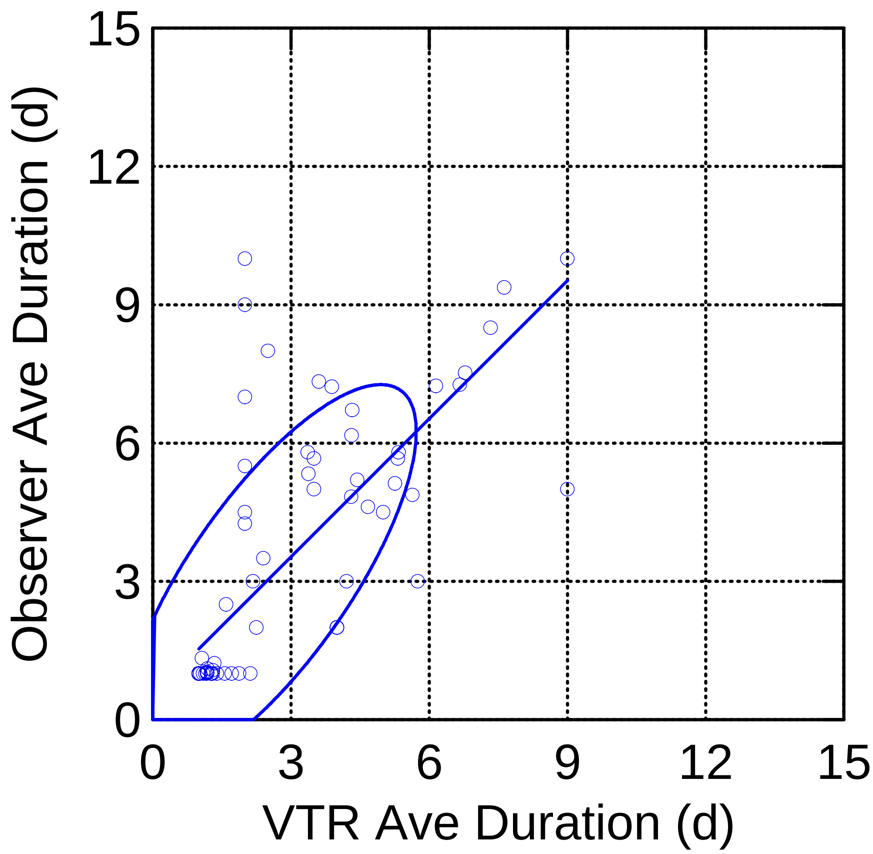
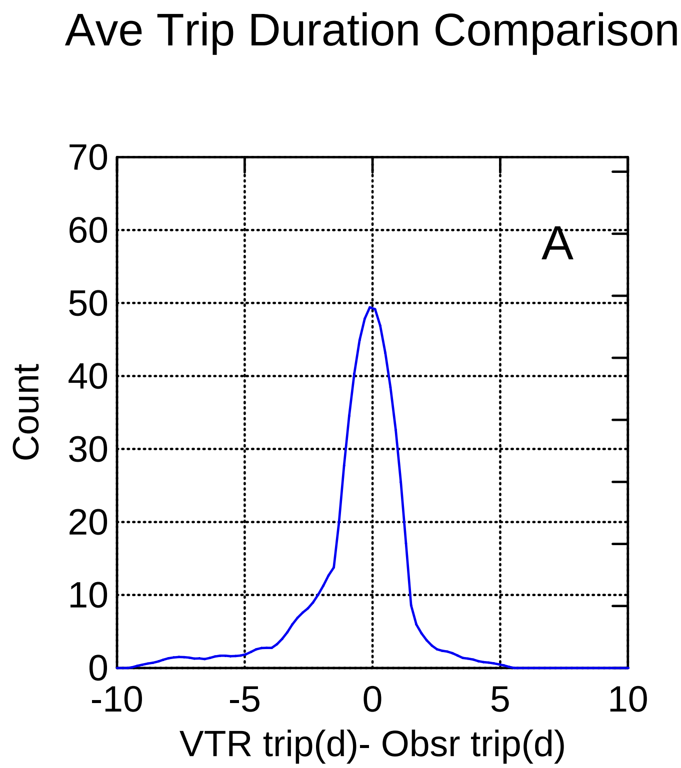


Figure 7. Comparison of average trip duration (in days) for trips that caught groundfish in the Northeast Fisheries Observer Program and Vessel Trip Report (VTR) data sets for 2003/2004. Each point represents the mean of an individual stratum.



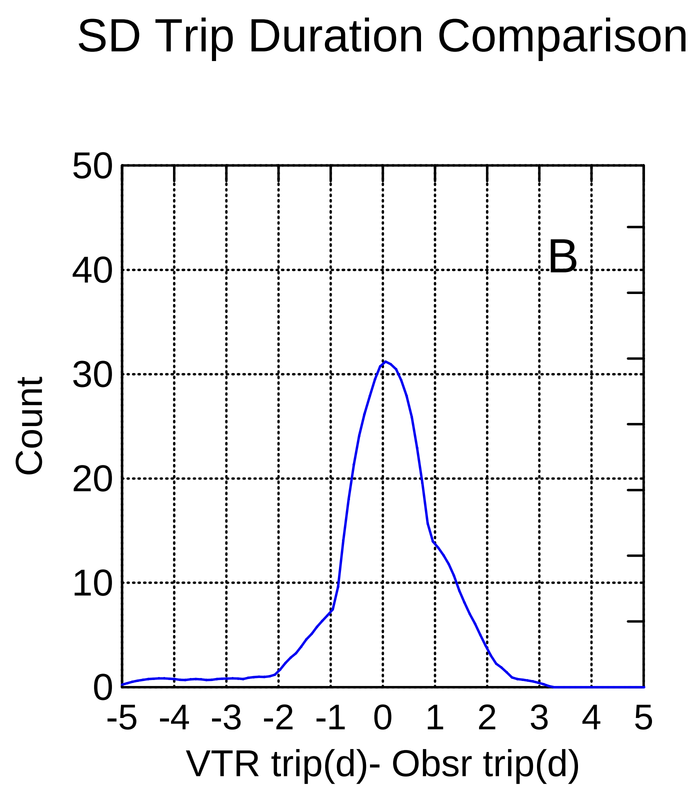


Figure 8. The distribution of differences in average trip duration (in days) (A) and the standard deviation of average trip duration (B) of trips that caught groundfish in the Northeast Fisheries Observer Program (Obsrvr) and the Vessel Trip Report (VTR) data for 2003/2004. Histograms are non-parametric smooths of the stratum specific differences.

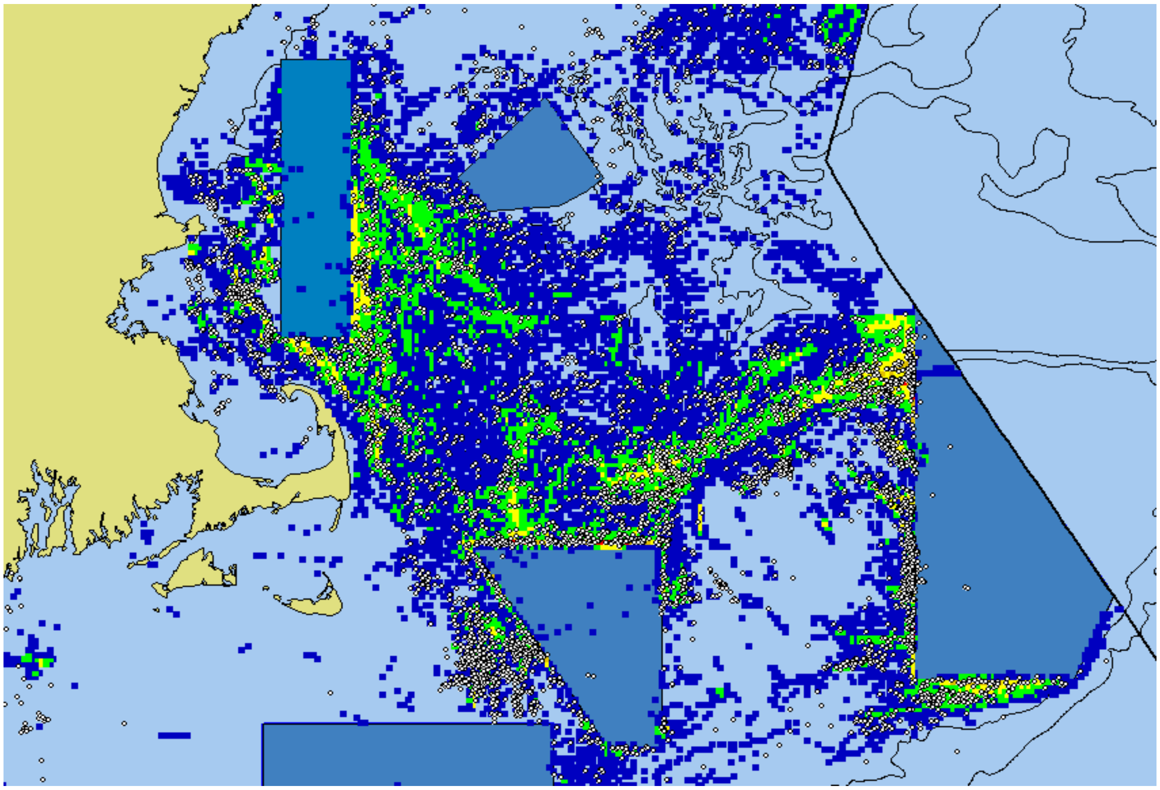


Figure 9. Locations of otter trawl fishing effort (color squares) in 2003 from vessels using VMS (vessel monitoring systems). Locations are plotted only for vessels speeds <= 3.5 knots and data are aggregated to 1' square. Blue squares represent 1-8 hours, green 9 – 25 hours; yellow 26-63 hours; orange 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).

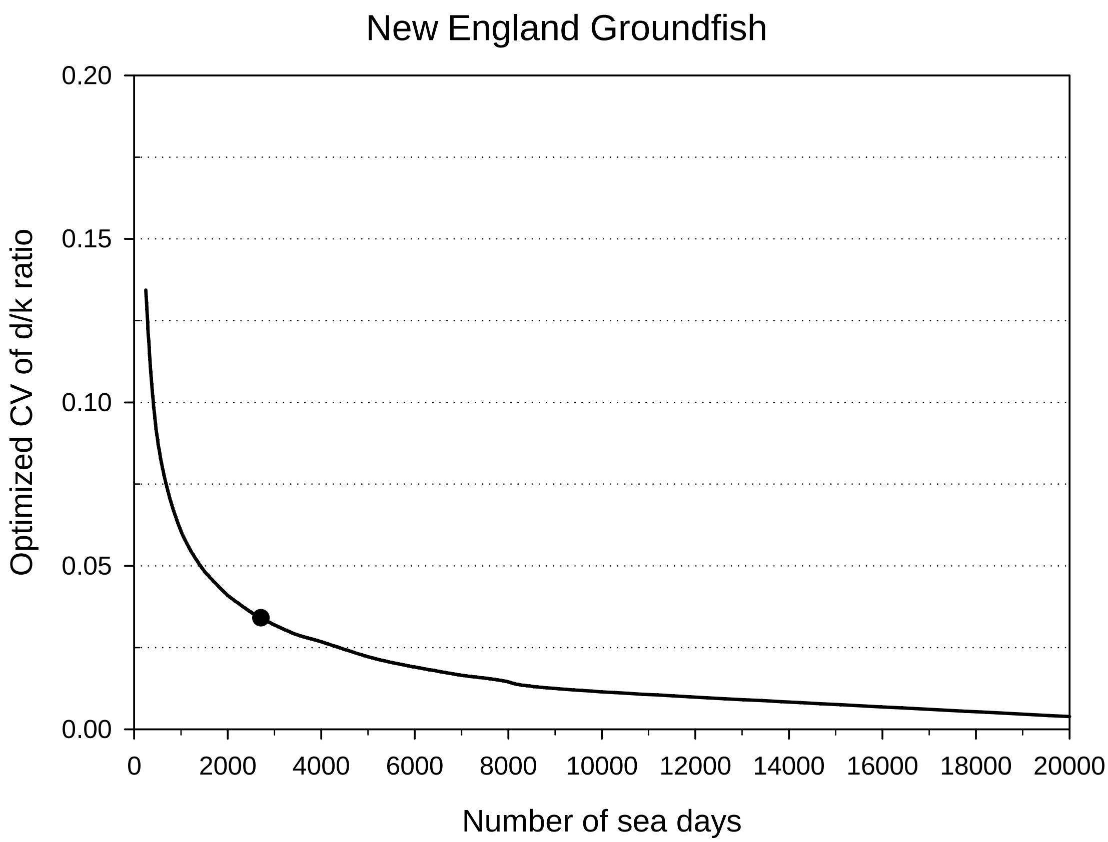


Figure 10. The optimized coefficient of variation (CV) of the discard to kept ratio (d/k) for New England groundfish over a range of sea days; 2,708 sea days (solid circle) are allocated to cover New England groundfish fisheries in 2005.

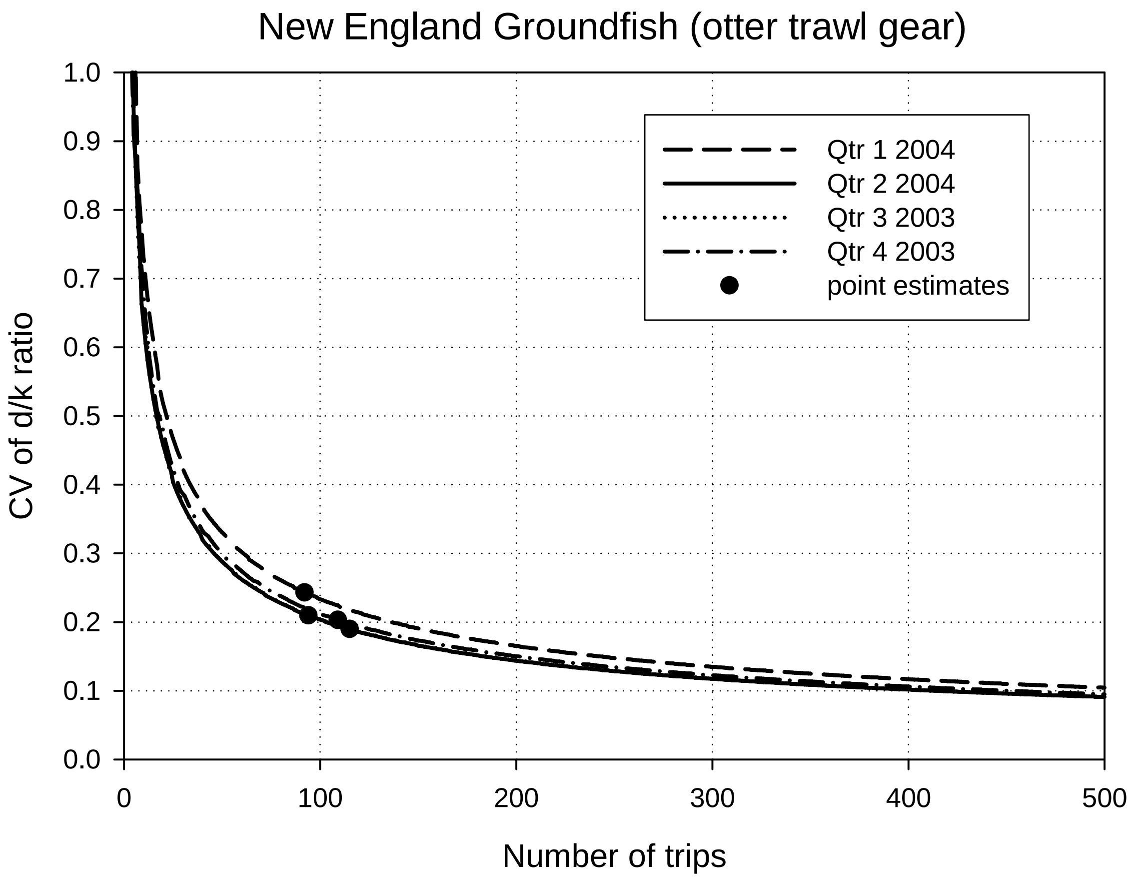


Figure 11. The 2003/2004 point estimates of the coefficient of variation (CV) of the discard to kept (d/k) ratio for New England groundfish caught with otter trawl gear, and the expected coefficient of variation of the discard to kept ratio over a range of sample sizes (number of trips).

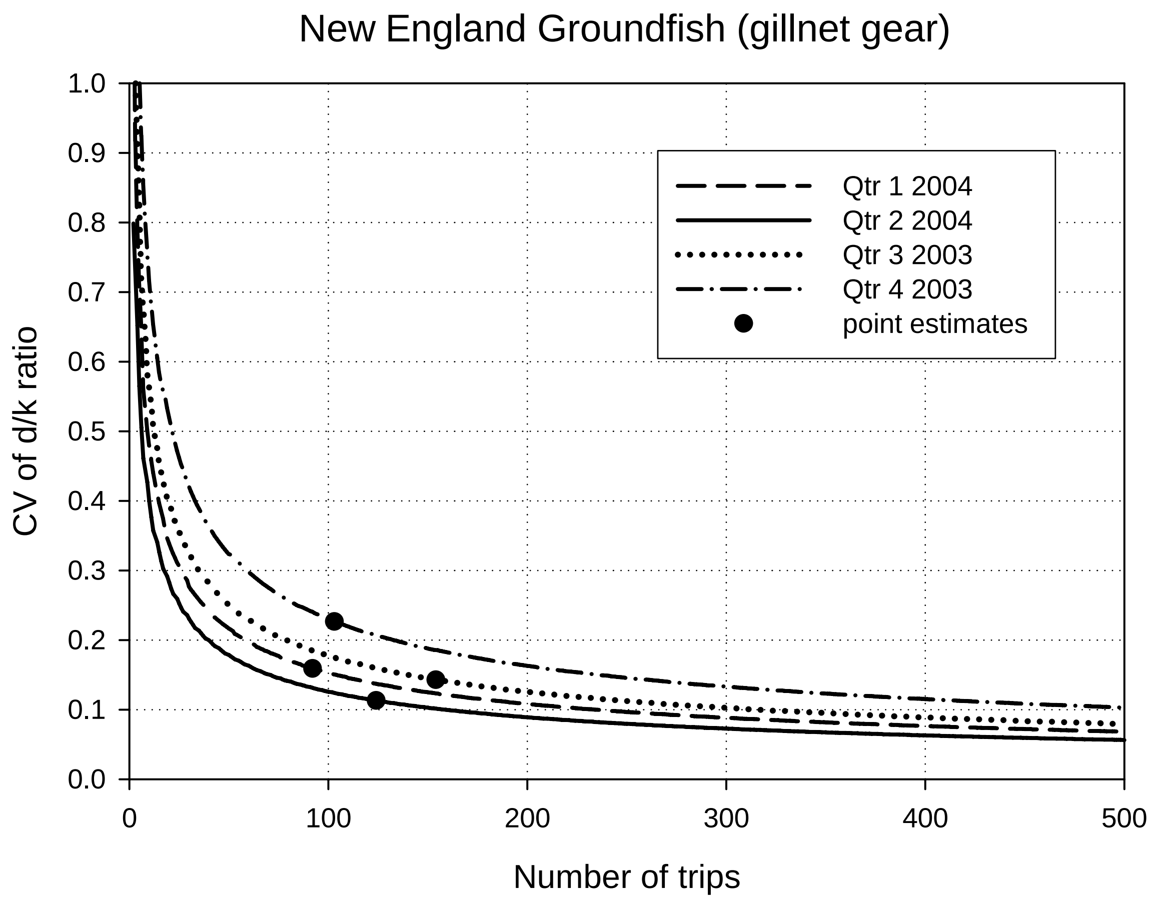


Figure 12. The 2003/2004 point estimates of the coefficient of variation (CV) of the discard to kept (d/k) ratio for New England groundfish caught with gillnet gear, and the expected coefficient of variation of the discard to kept ratio over a range of sample sizes (number of trips).

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Appendix B
Detailed Tables and Figures from Chapter 5

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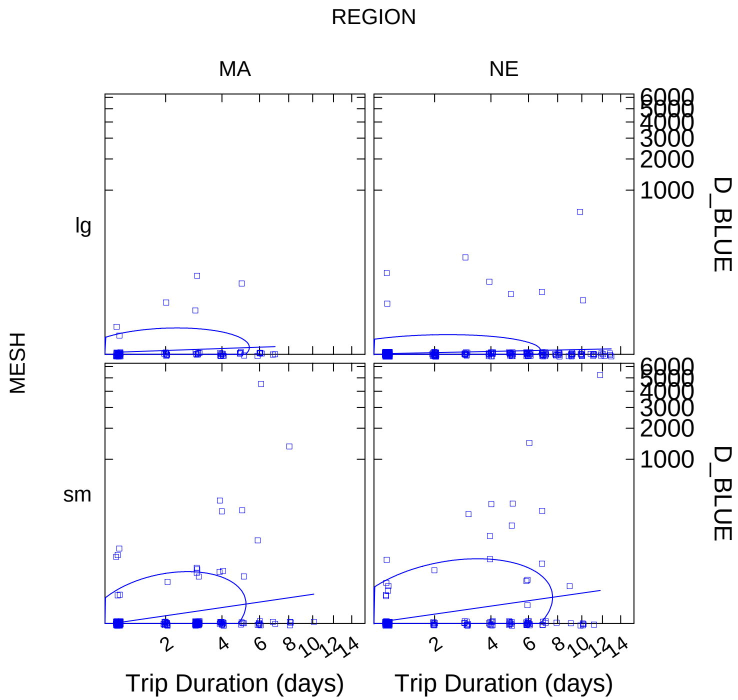


Figure B-1a. Comparison of bluefish discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

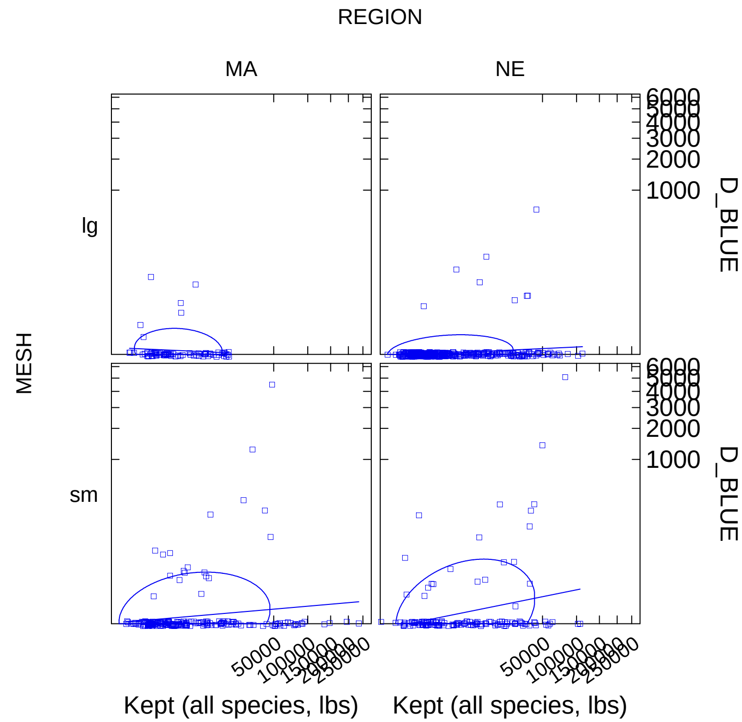


Figure B-1b. Comparison of bluefish discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

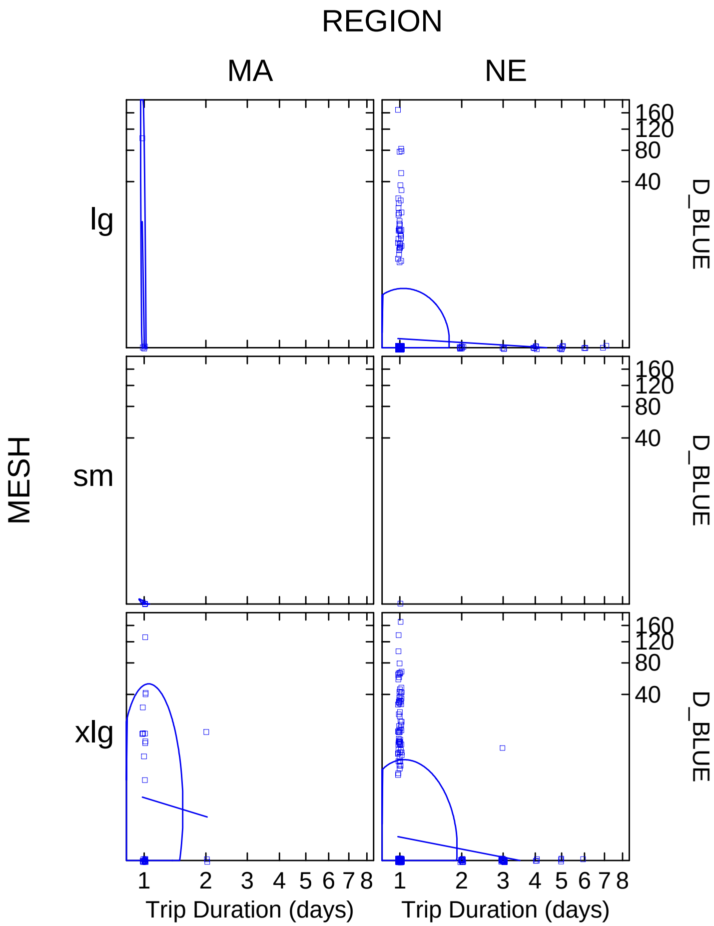


Figure B-1c. Comparison of bluefish discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

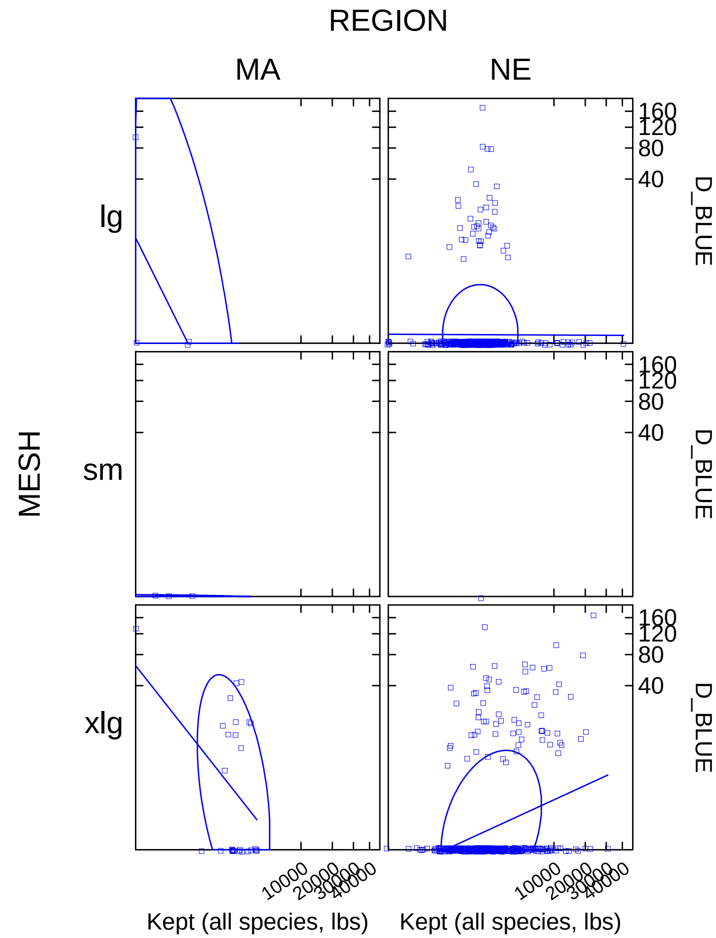


Figure B-1d. Comparison of bluefish discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

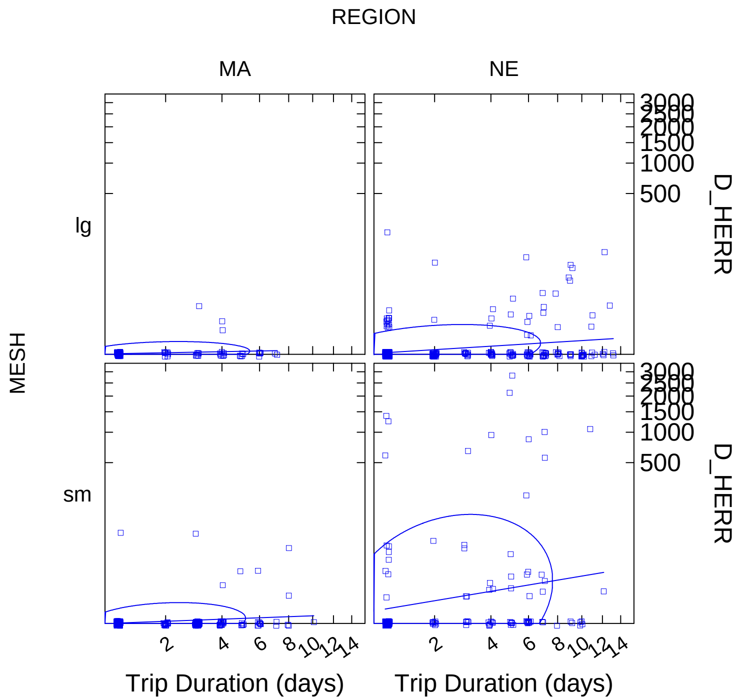


Figure B-1e. Comparison of herring discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

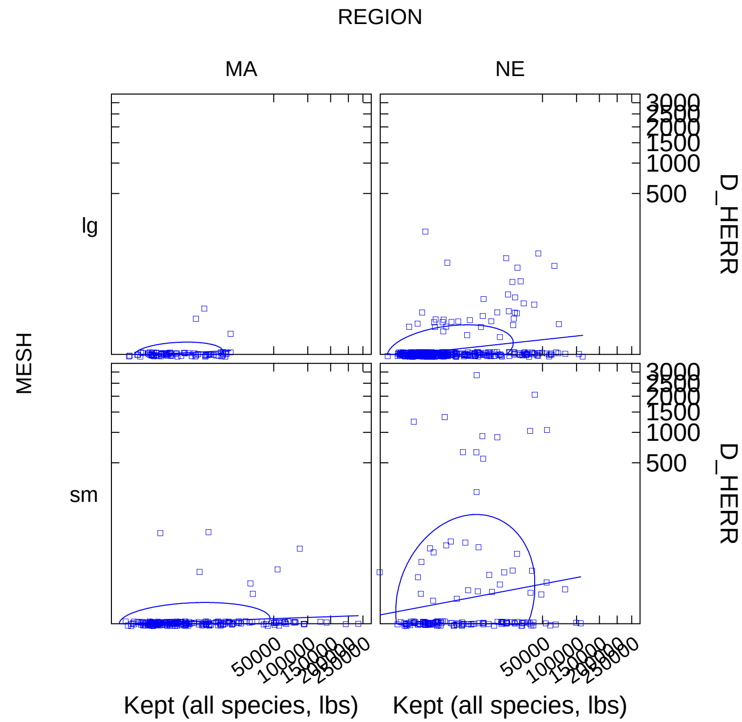


Figure B-1f. Comparison of herring discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

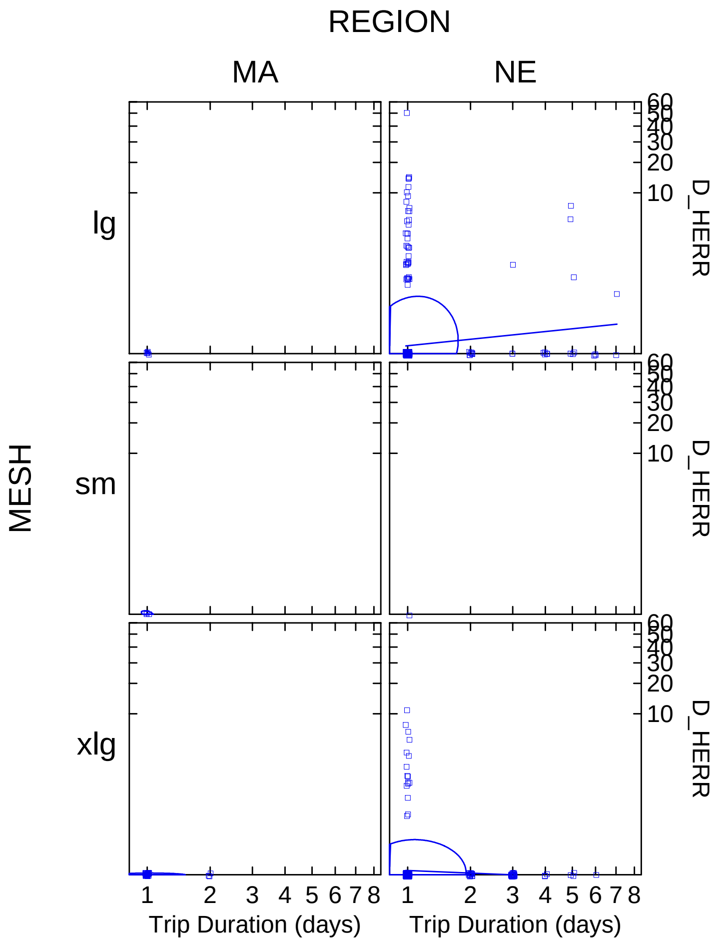


Figure B-1g. Comparison of herring discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

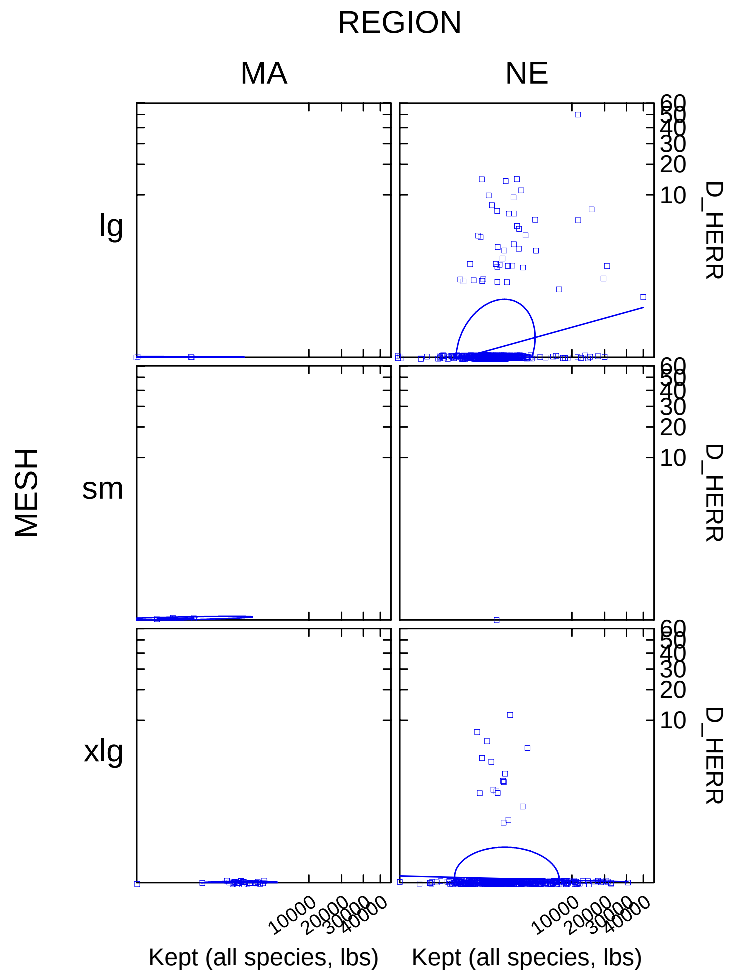


Figure B-1h. Comparison of herring discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

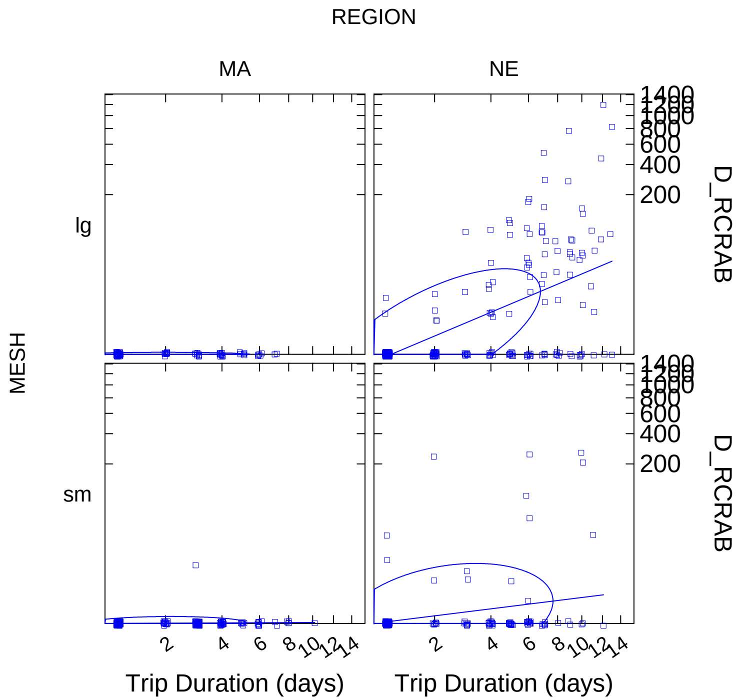


Figure B-1i. Comparison of red crab discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

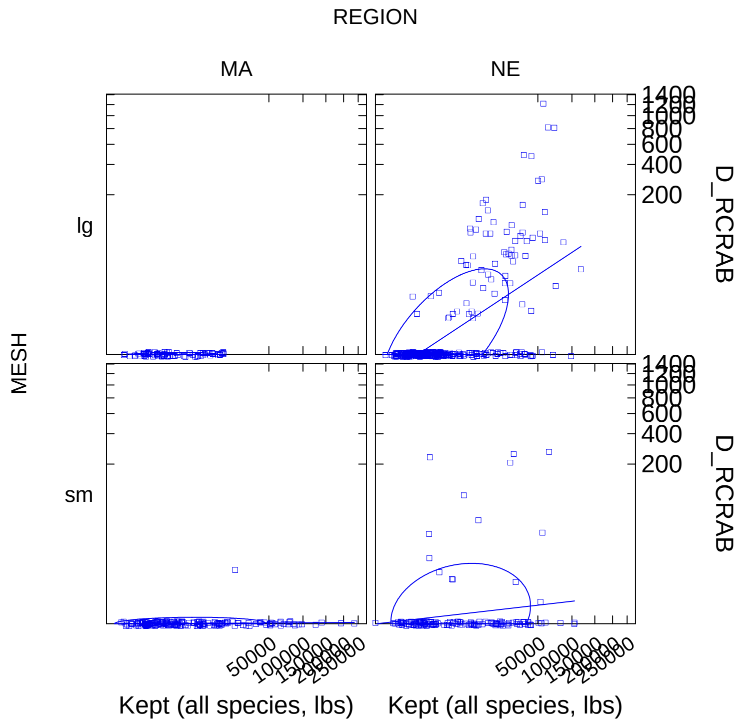


Figure B-1j. Comparison of red crab discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

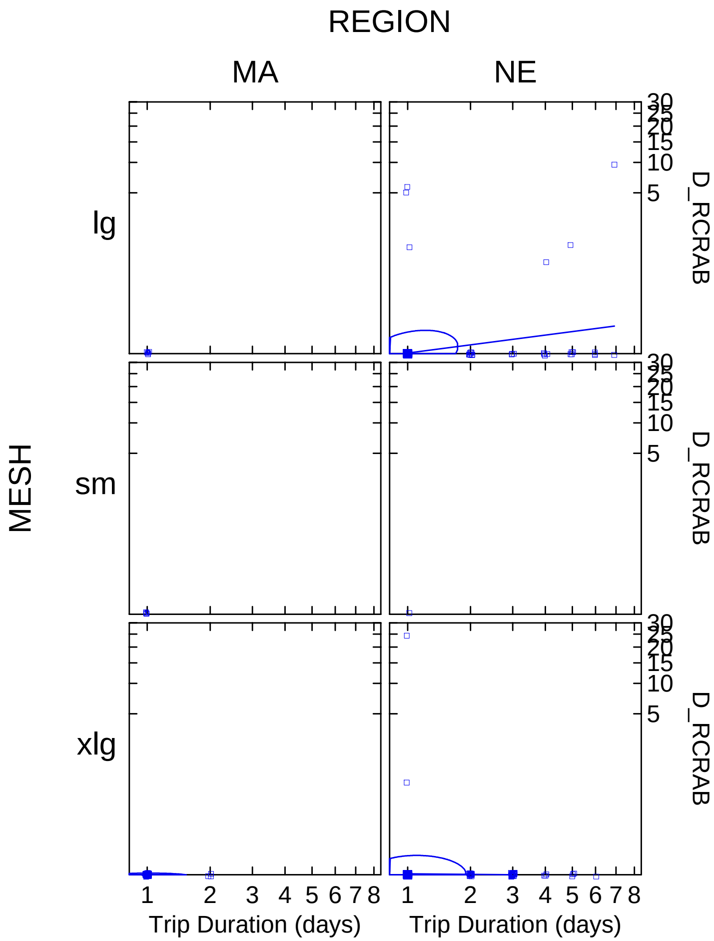


Figure B-1k. Comparison of red crab discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

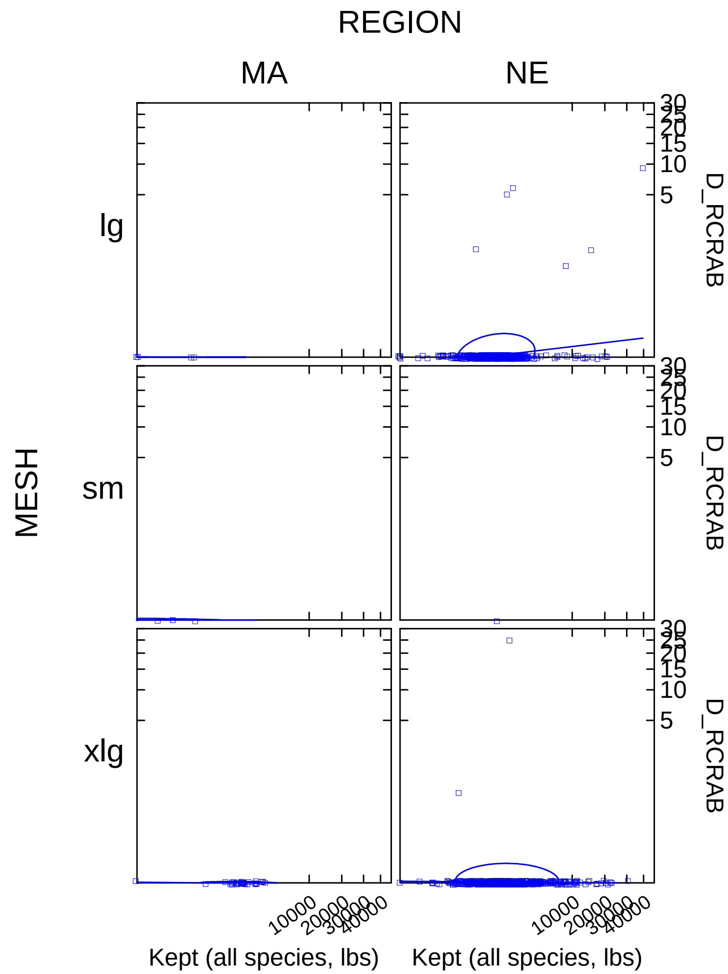


Figure B-1l. Comparison of red crab discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

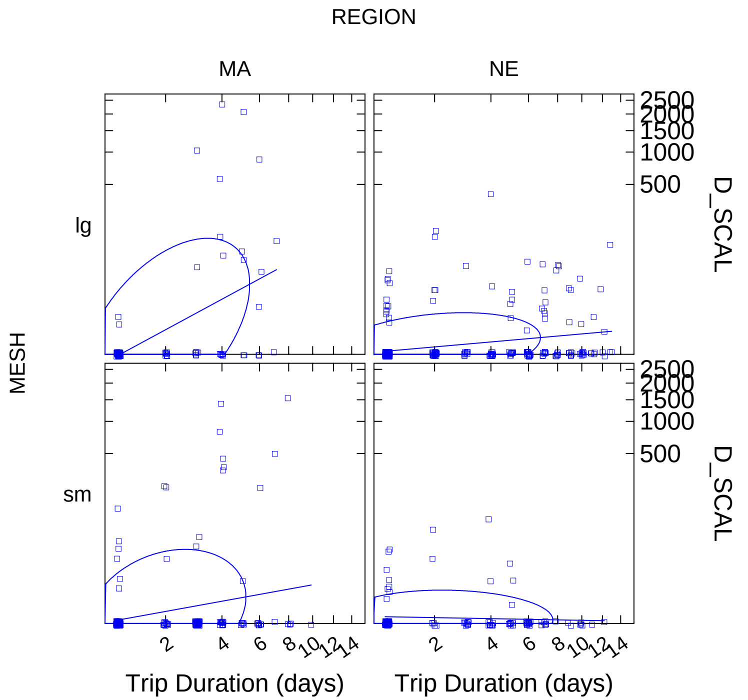


Figure B-1m. Comparison of scallop discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

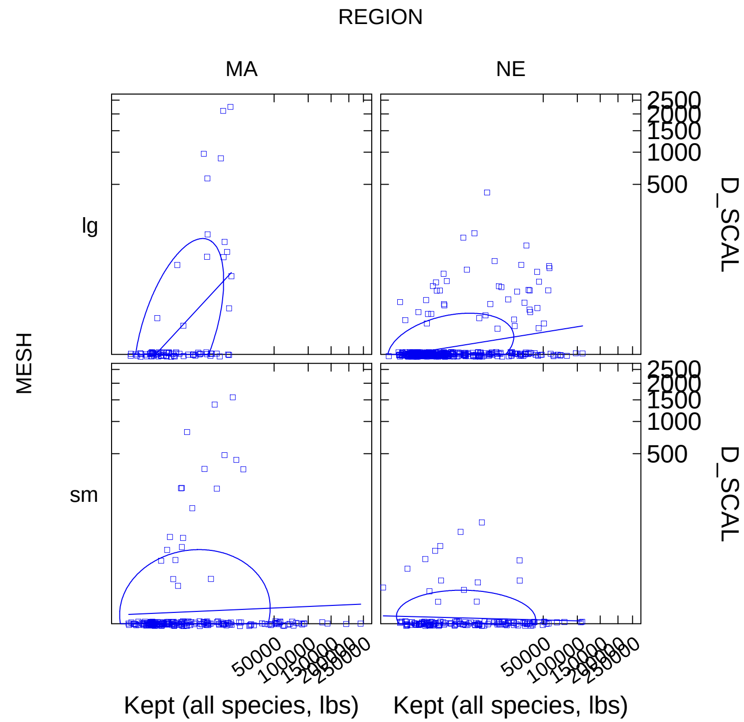


Figure B-1n. Comparison of scallop discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

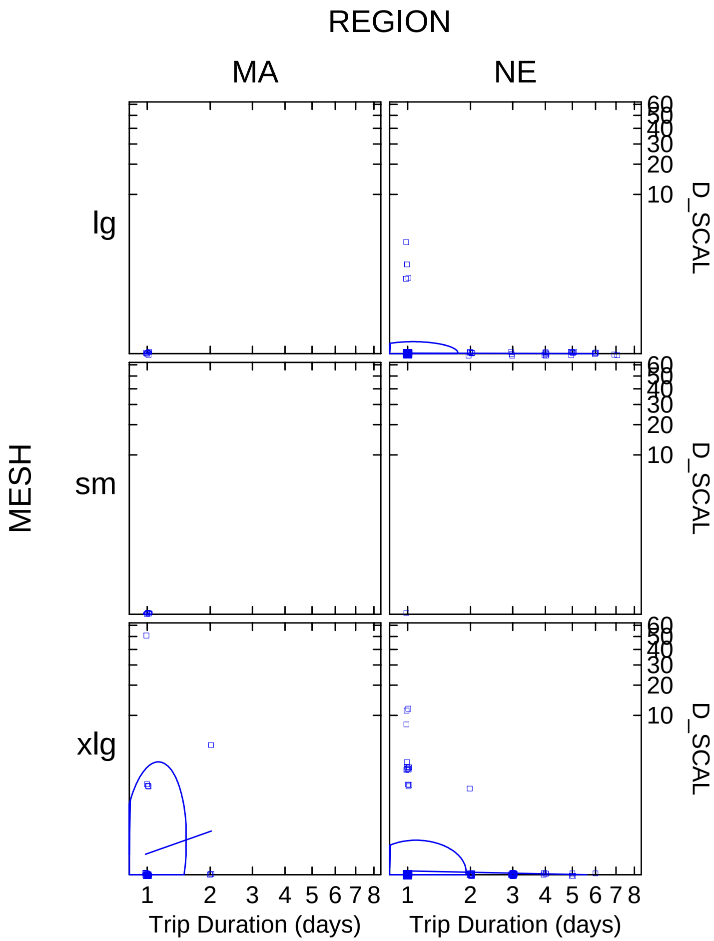


Figure B-1o. Comparison of scallop discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

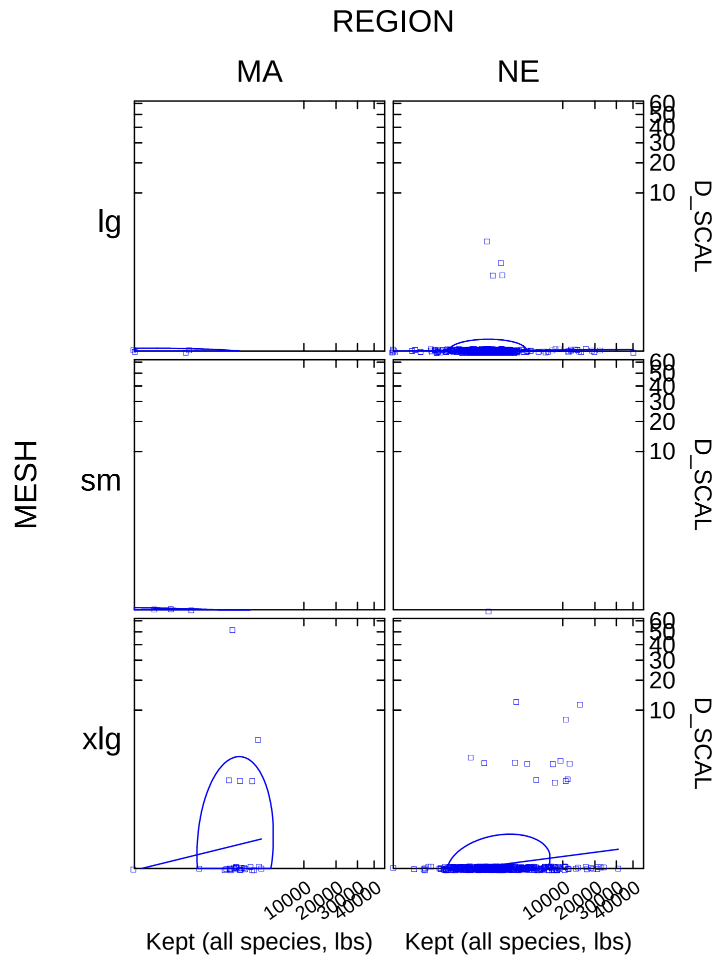


Figure B-1p. Comparison of scallop discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

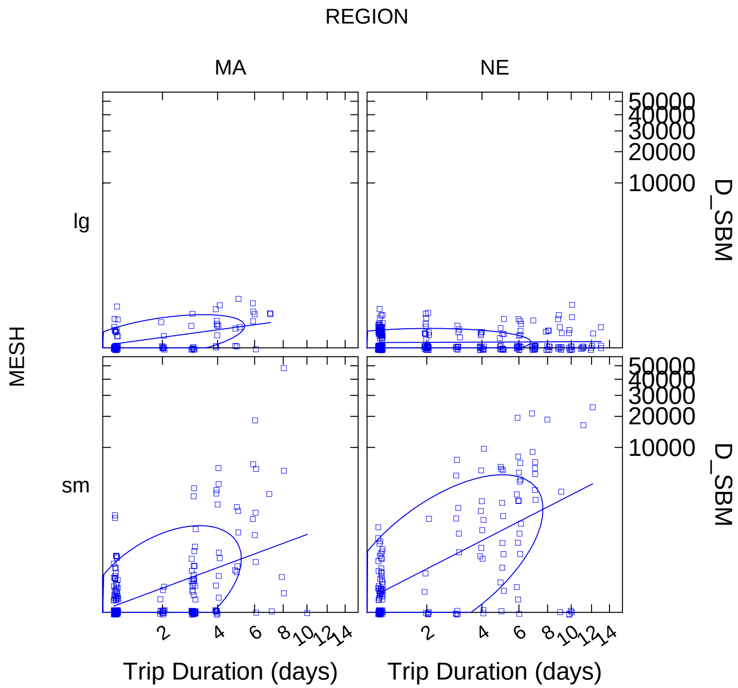


Figure B-1q. Comparison of squid-butterfish-mackerel discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

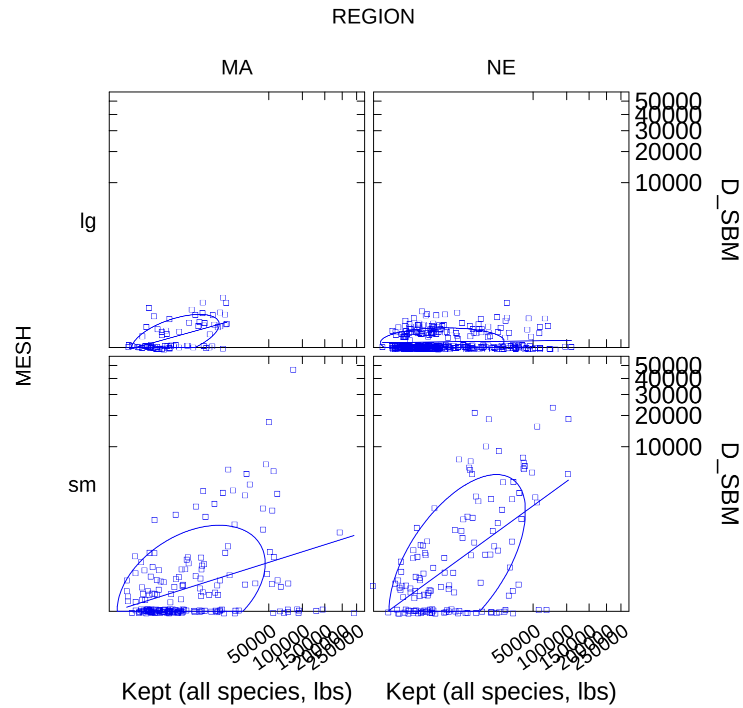


Figure B-1r. Comparison of squid-butterfish-mackerel discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

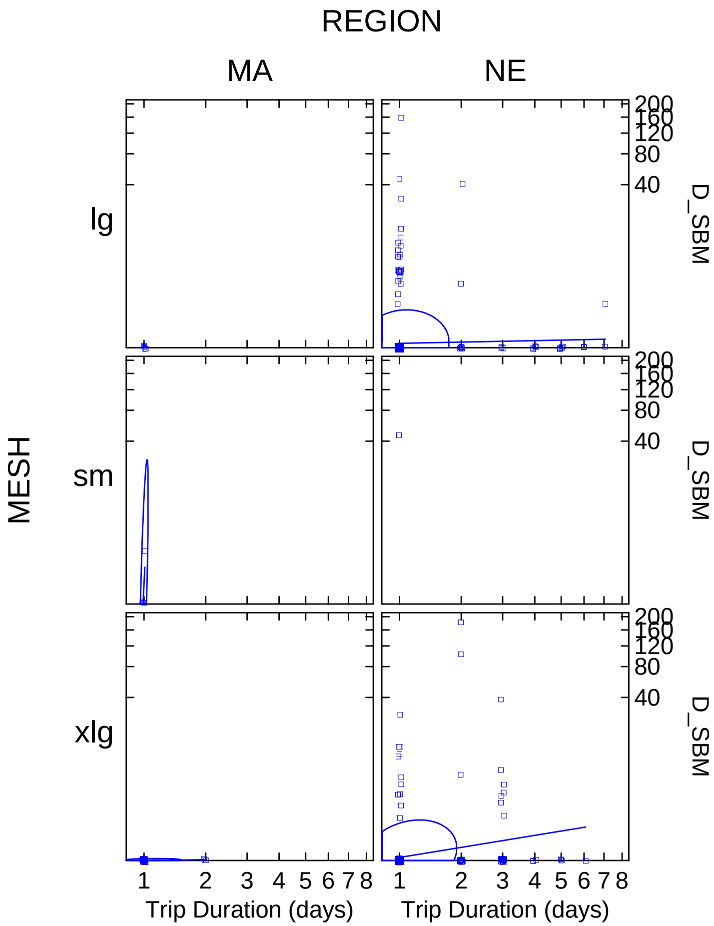


Figure B-1s. Comparison of squid-butterfish-mackerel discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

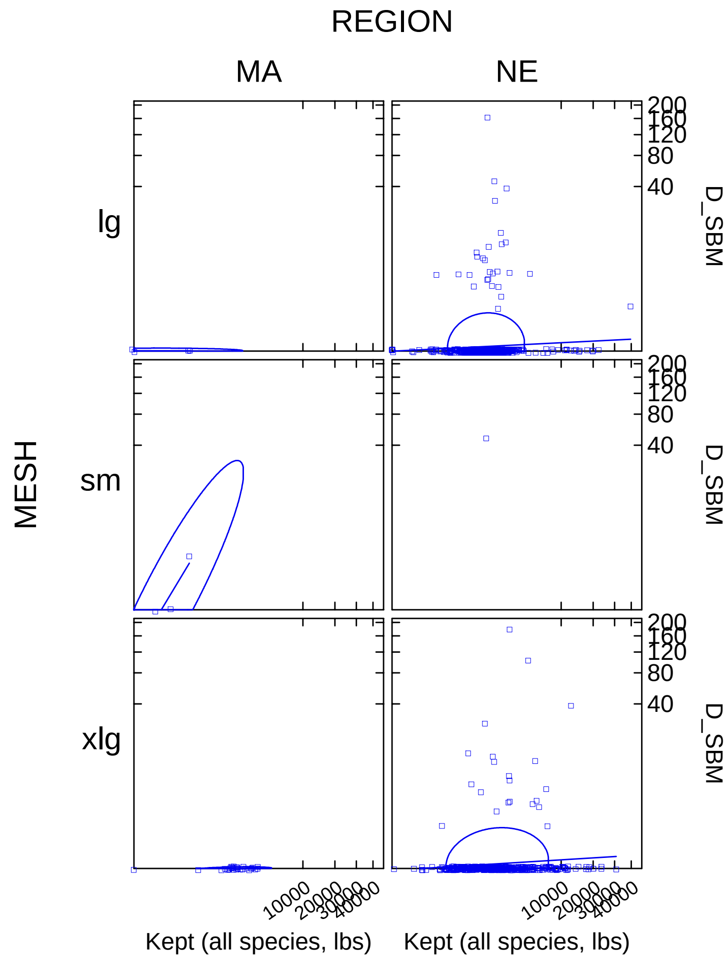


Figure B-1t. Comparison of squid-butterfish-mackerel discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

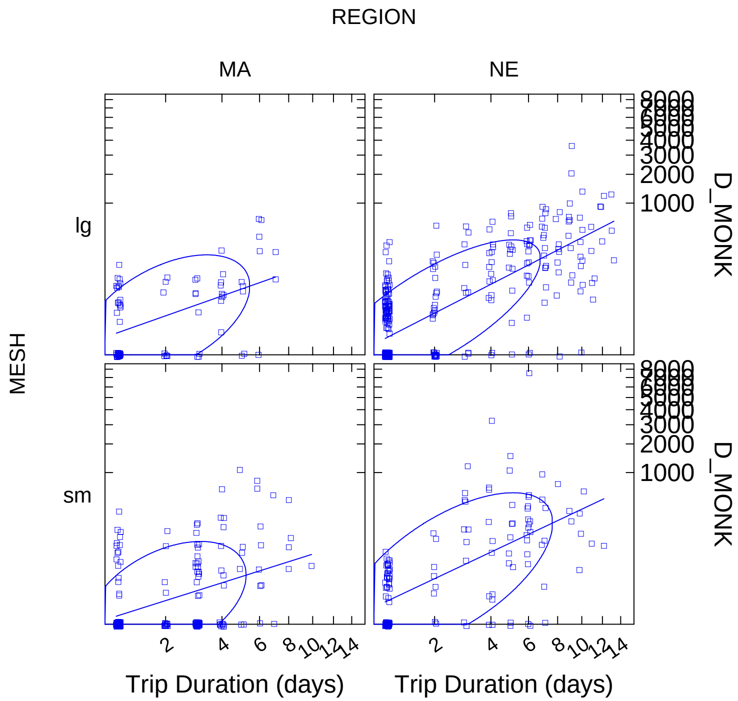


Figure B-1u. Comparison of monkfish discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

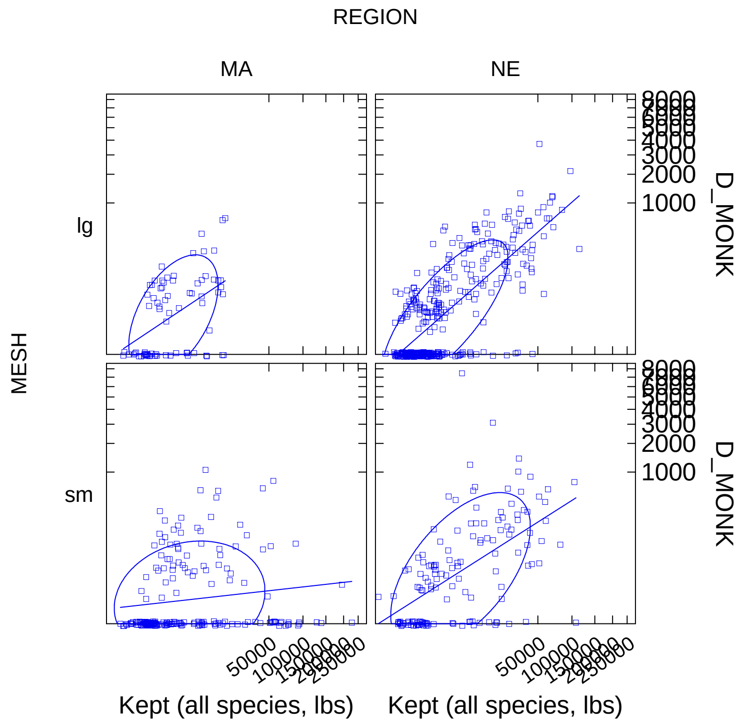


Figure B-1v. Comparison of monkfish discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches)); fourth root transformation used, each dot represents a trip.

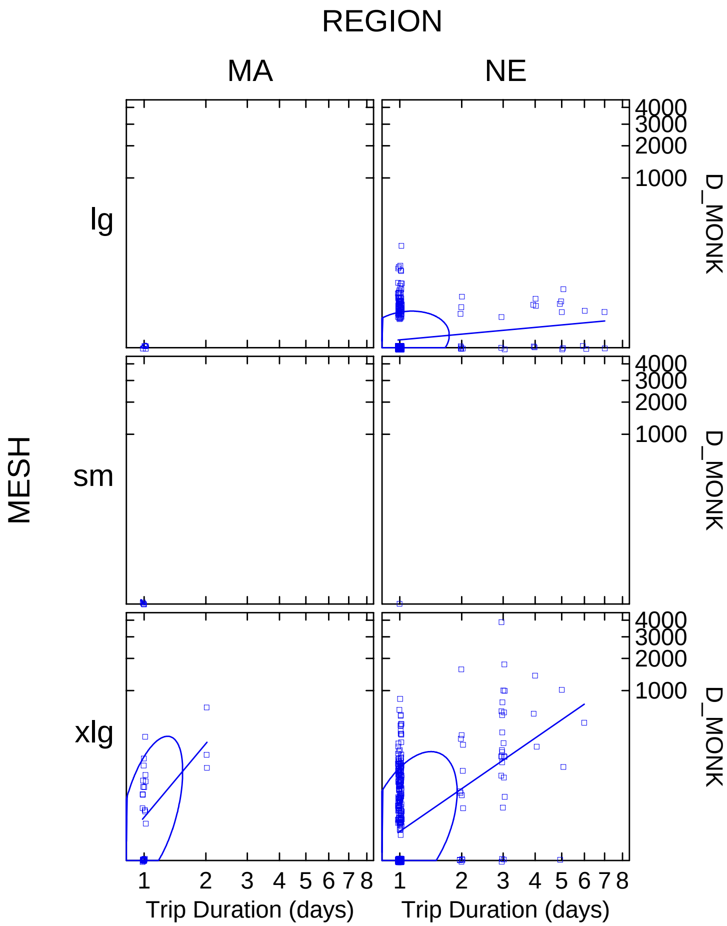


Figure B-1w. Comparison of monkfish discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

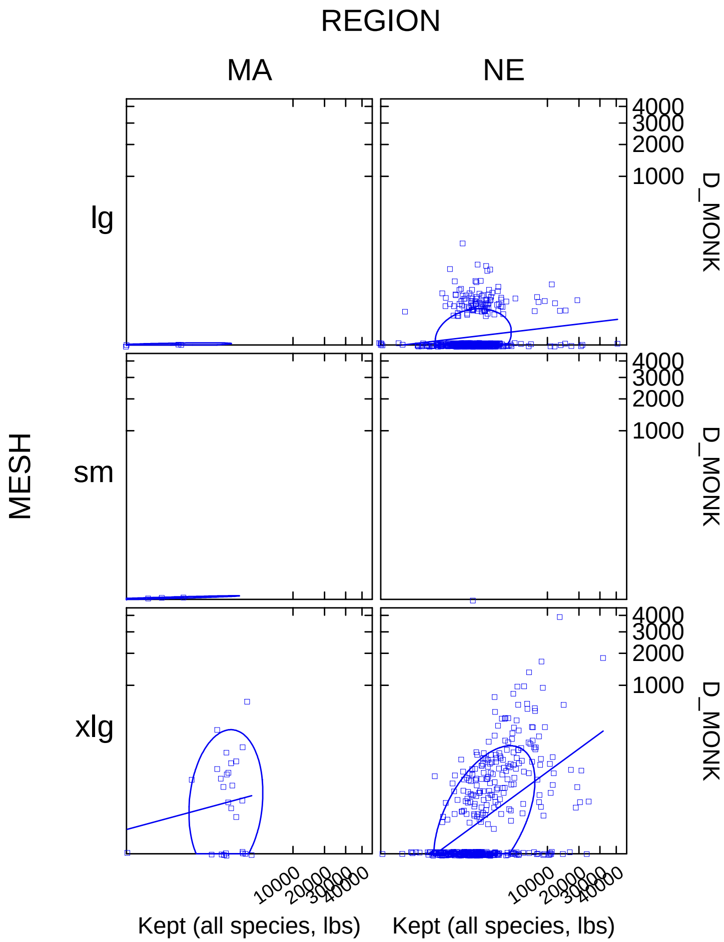


Figure B-1x. Comparison of monkfish discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

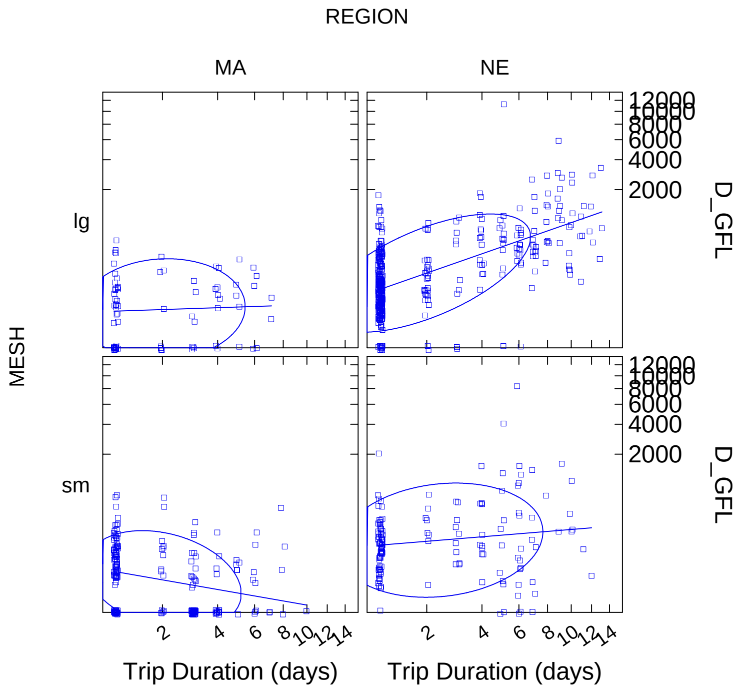


Figure B-1y. Comparison of Northeast multispecies (large-mesh) discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

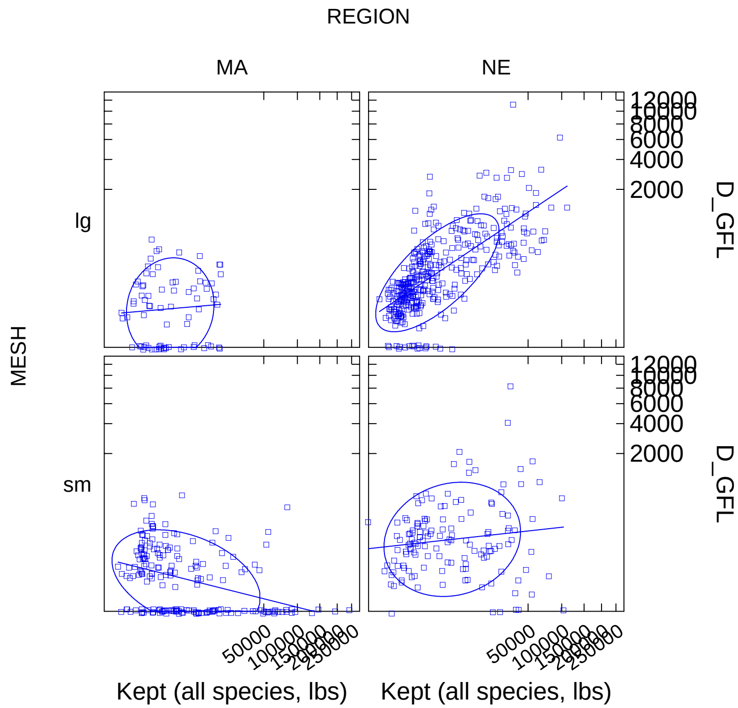


Figure B-1z. Comparison of Northeast multispecies (large-mesh) discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

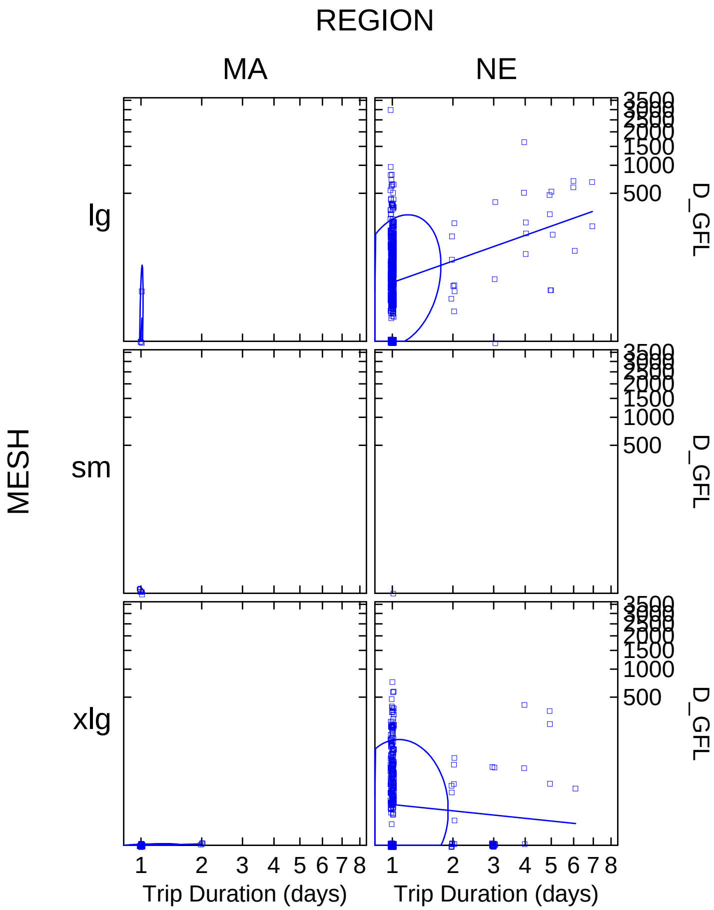


Figure B-1aa. Comparison of Northeast multispecies (large-mesh) discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

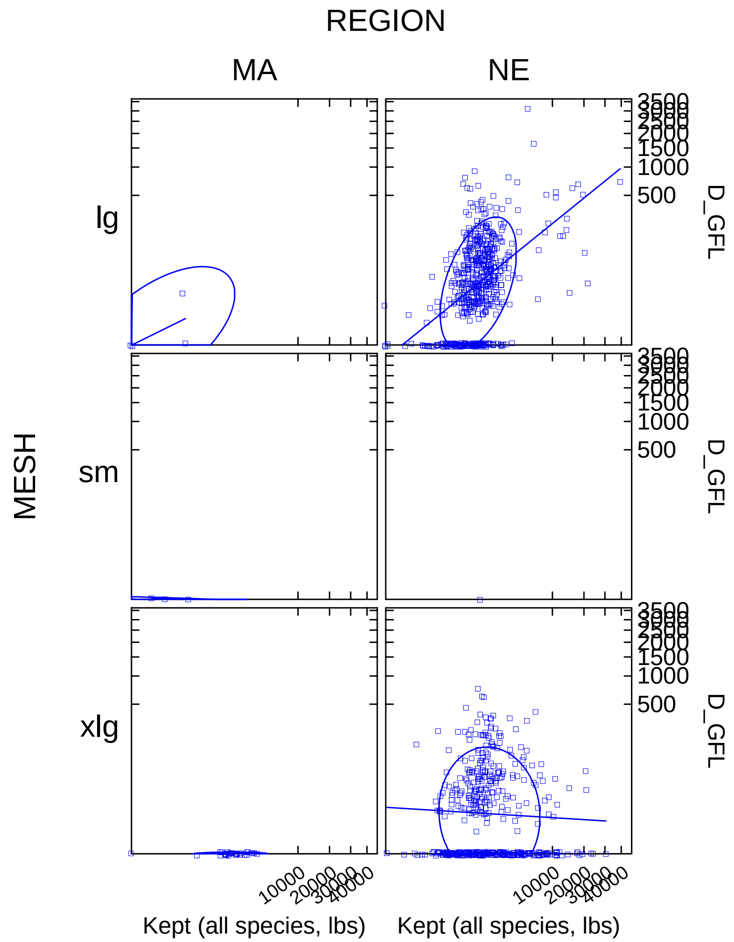


Figure B-1bb. Comparison of Northeast multispecies (large-mesh) discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

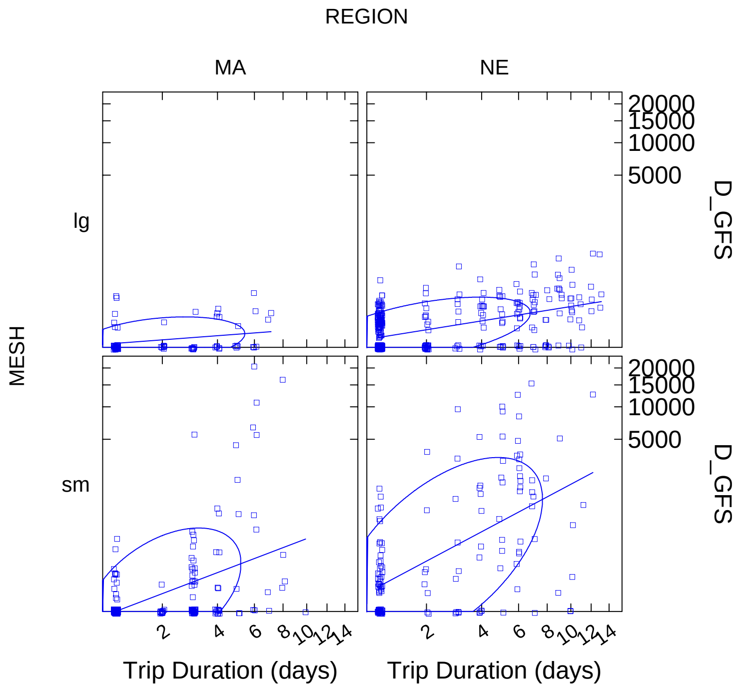


Figure B-1cc. Comparison of Northeast multispecies (small-mesh) discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

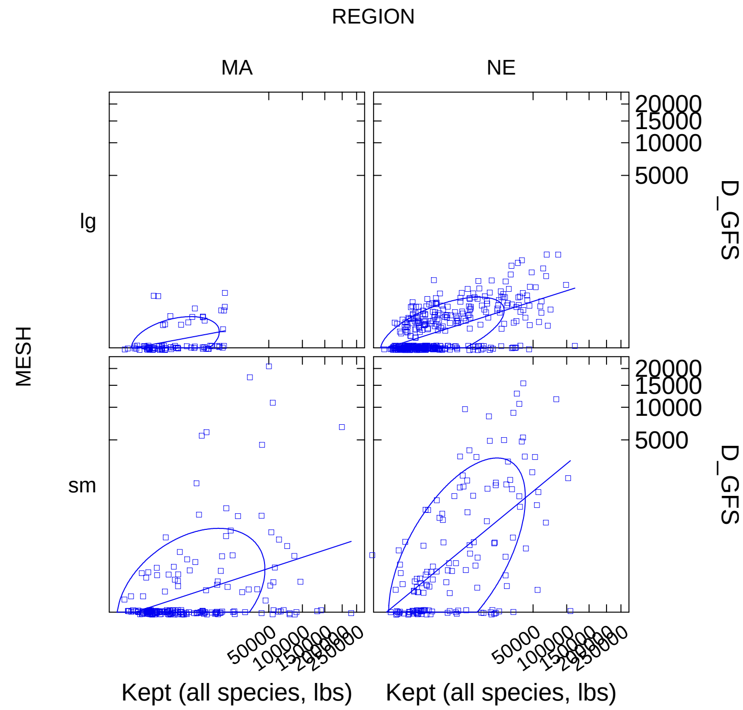


Figure B-1dd. Comparison of Northeast multispecies (small-mesh) discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

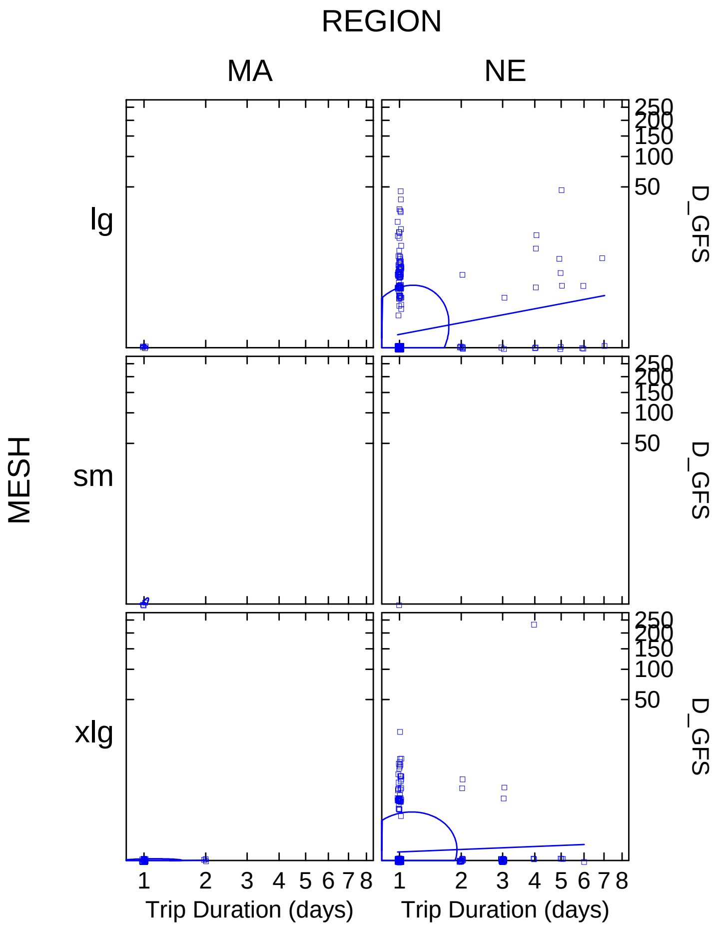


Figure B-1ee. Comparison of Northeast multispecies (small-mesh) discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

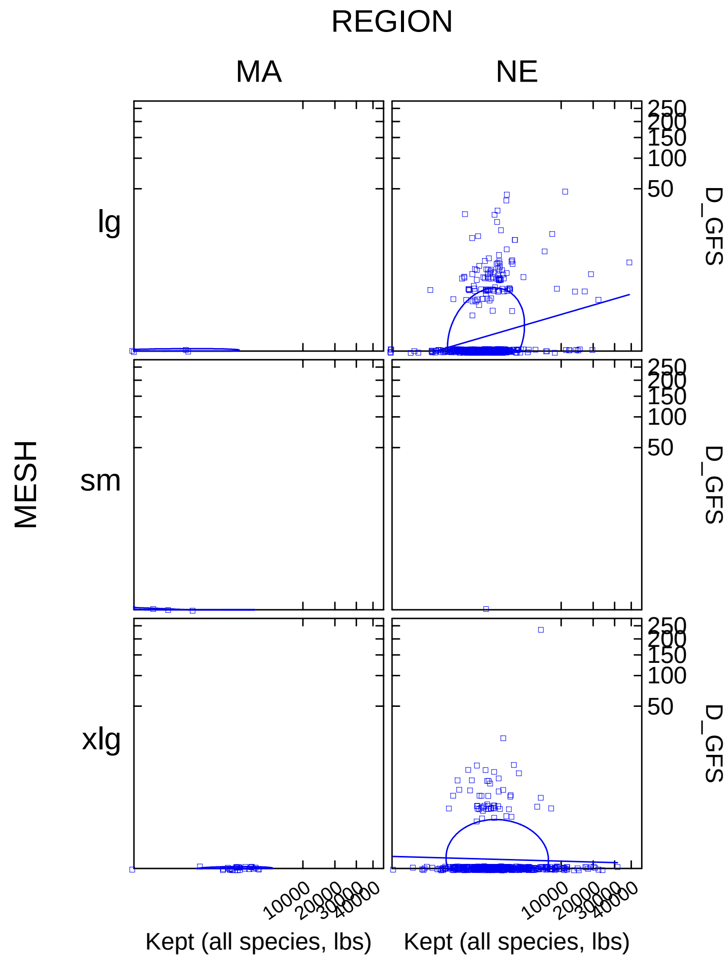


Figure B-1ff. Comparison of Northeast multispecies (small-mesh) discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

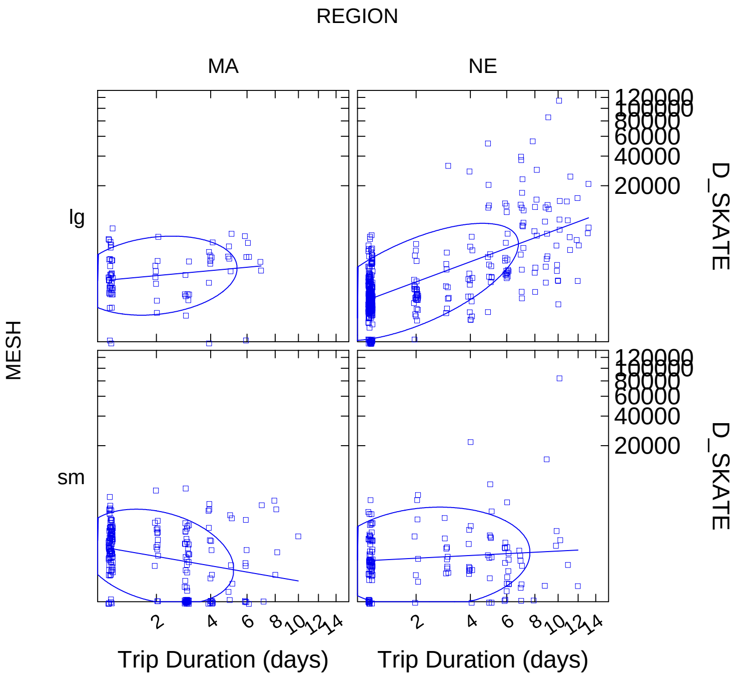


Figure B-1gg. Comparison of skates discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

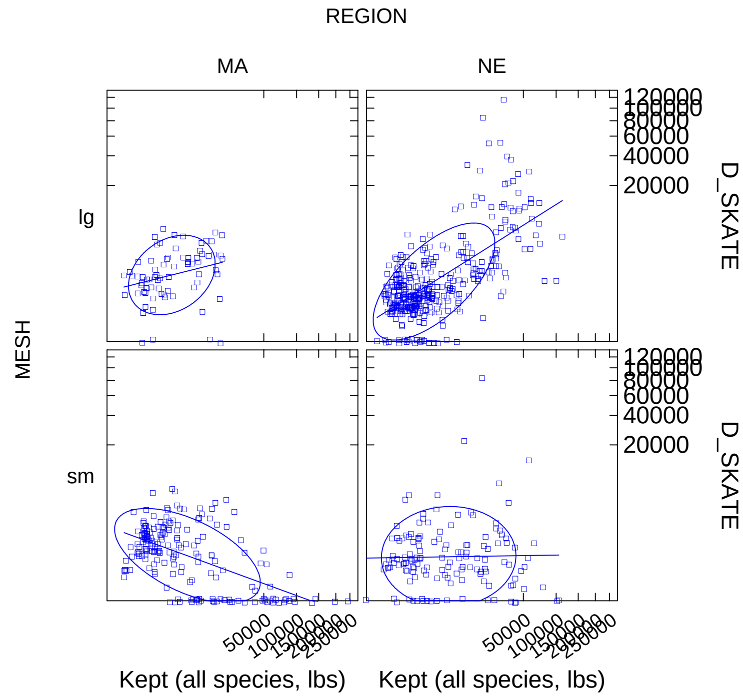


Figure B-1hh. Comparison of skates discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

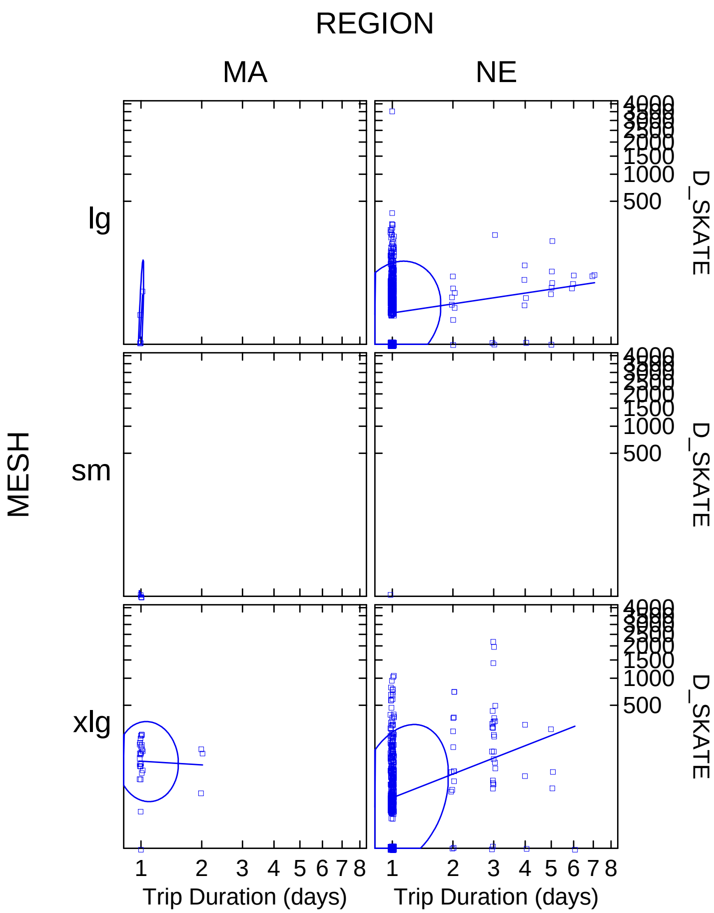


Figure B-1ii. Comparison of skates discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

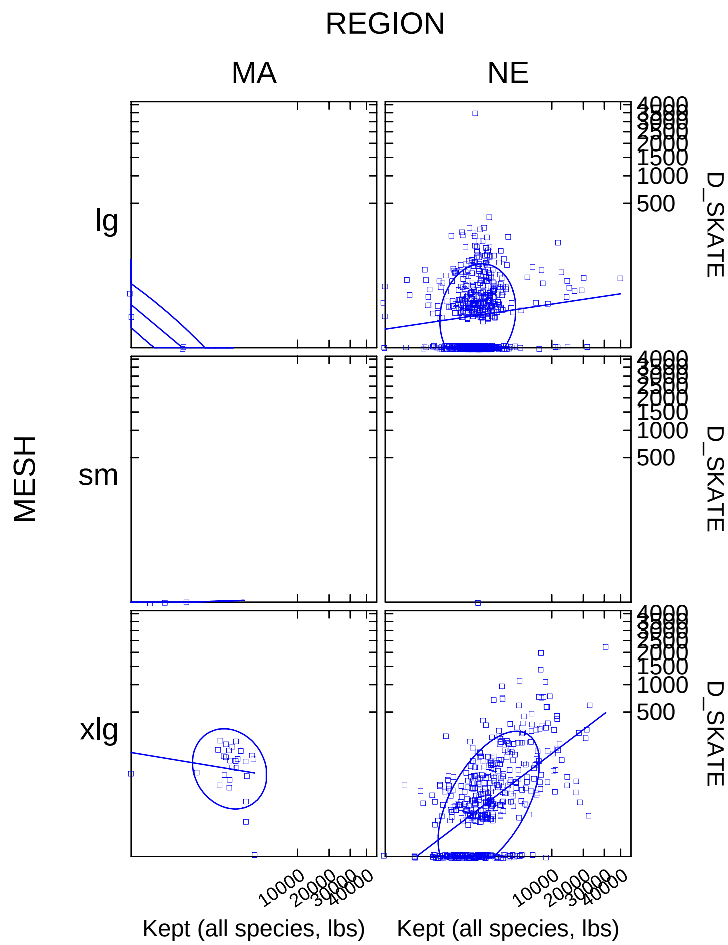


Figure B-1jj. Comparison of skates discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

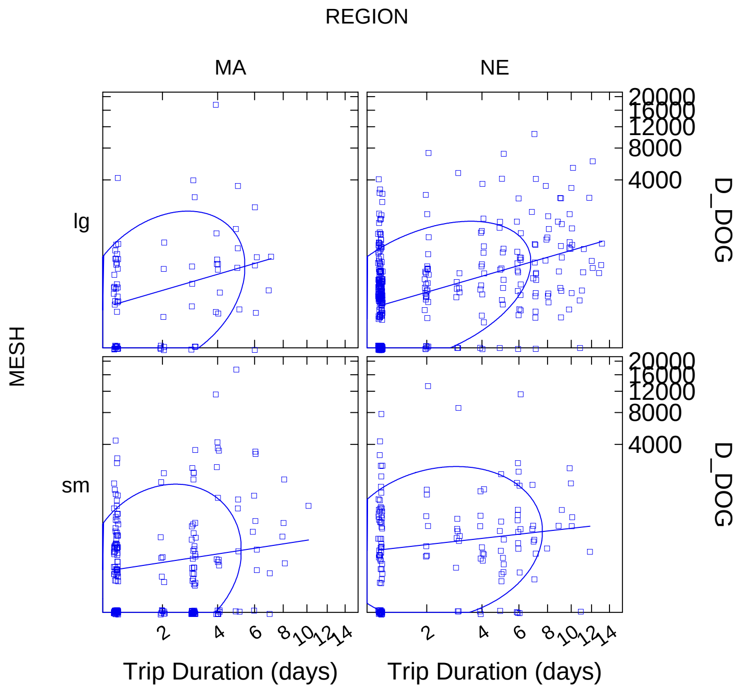


Figure B-1kk. Comparison of spiny dogfish discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

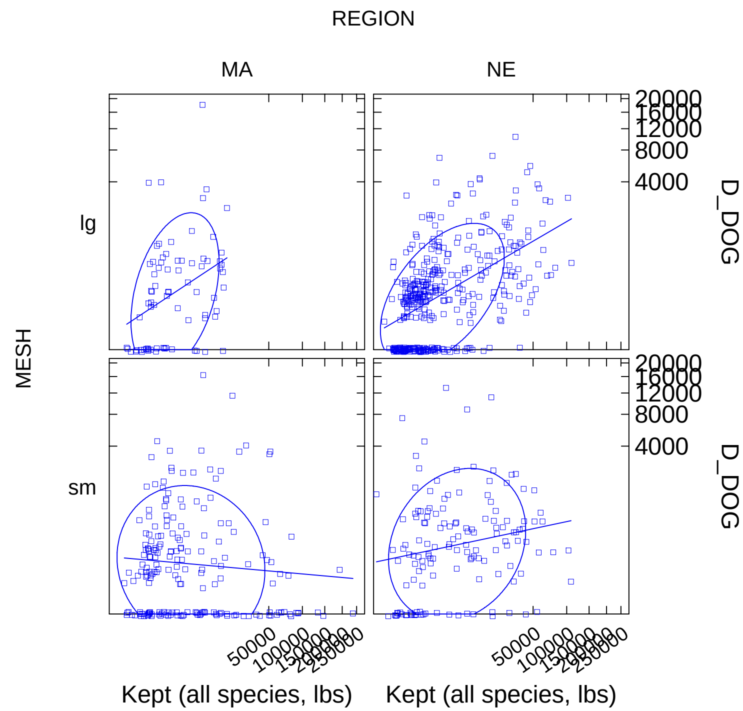


Figure B-1ll. Comparison of spiny dogfish discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

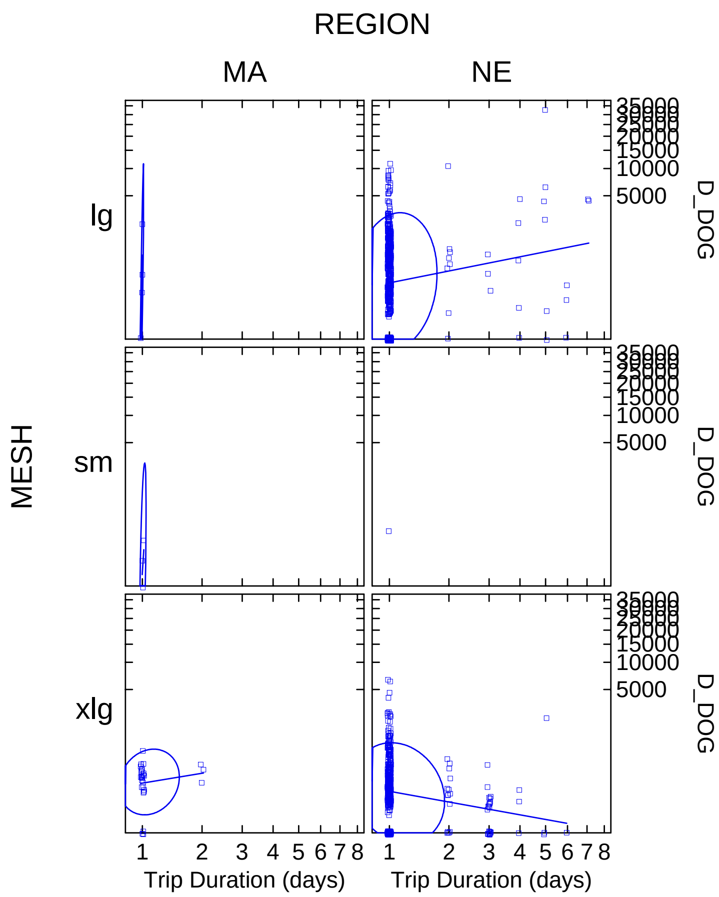


Figure B-1mm. Comparison of spiny dogfish discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

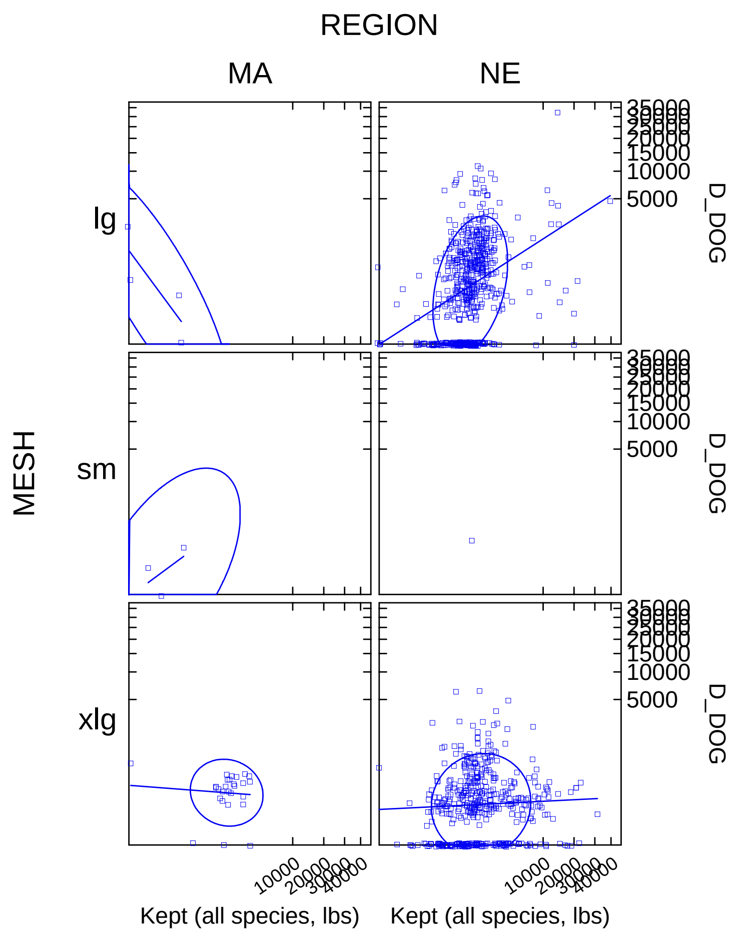


Figure B-1nn. Comparison of spiny dogfish discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

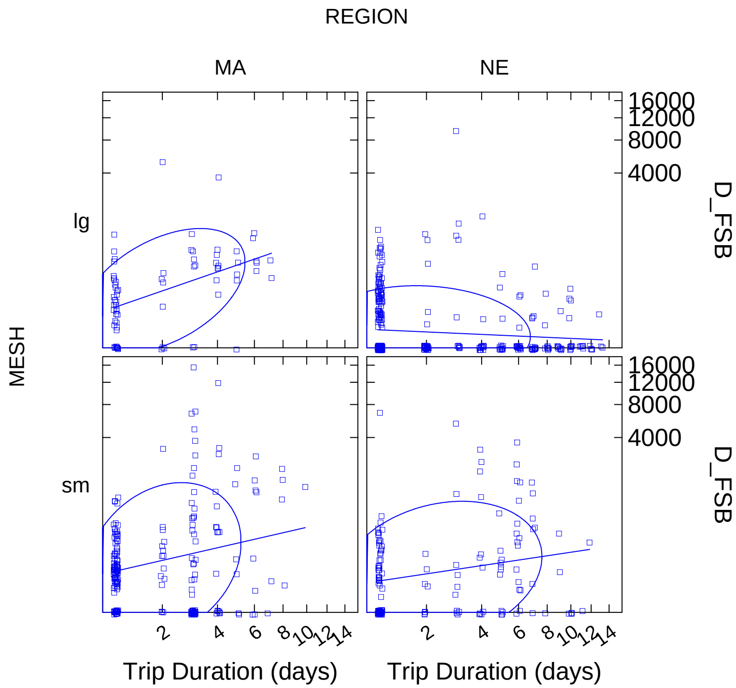


Figure B-1oo. Comparison of fluke-scup-black sea bass discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (; sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

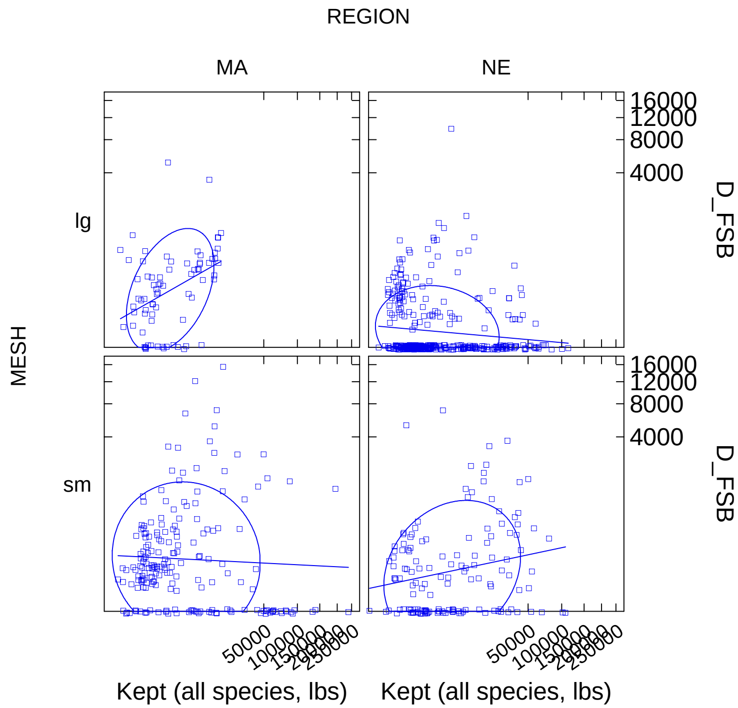


Figure B-1pp. Comparison of fluke-scup-black sea bass discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

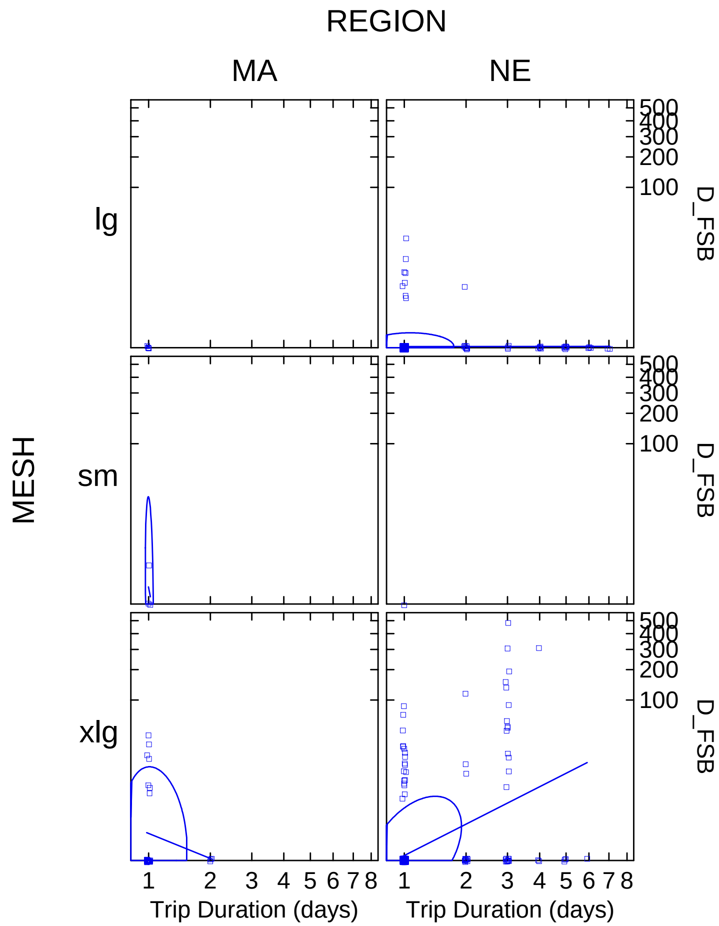


Figure B-1qq. Comparison of fluke-scup-black sea bass discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

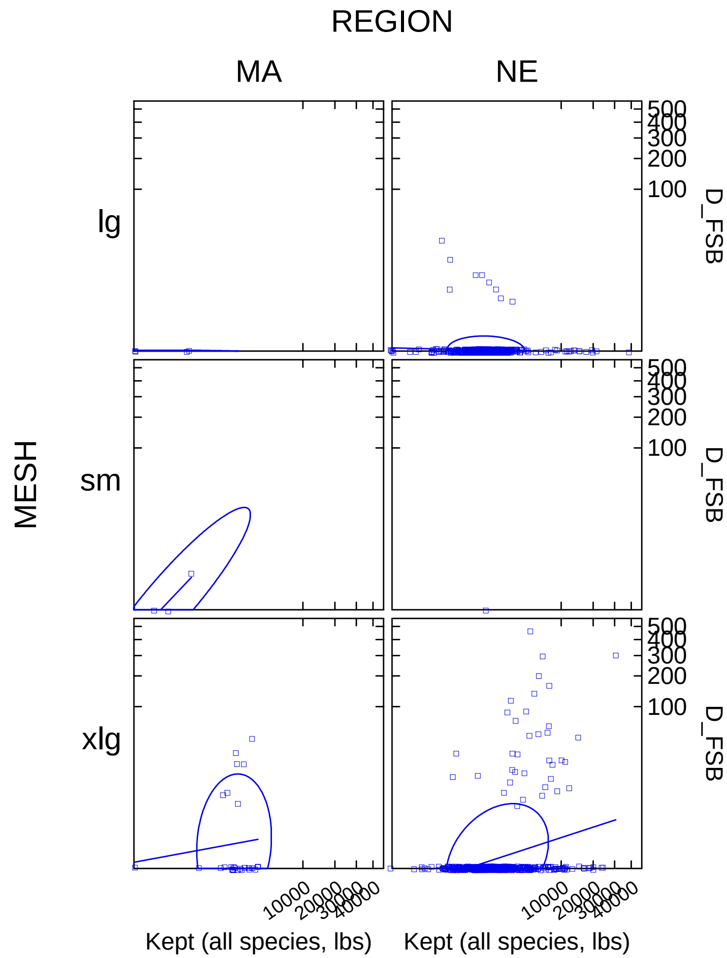


Figure B-1rr. Comparison of fluke-scup-black sea bass discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

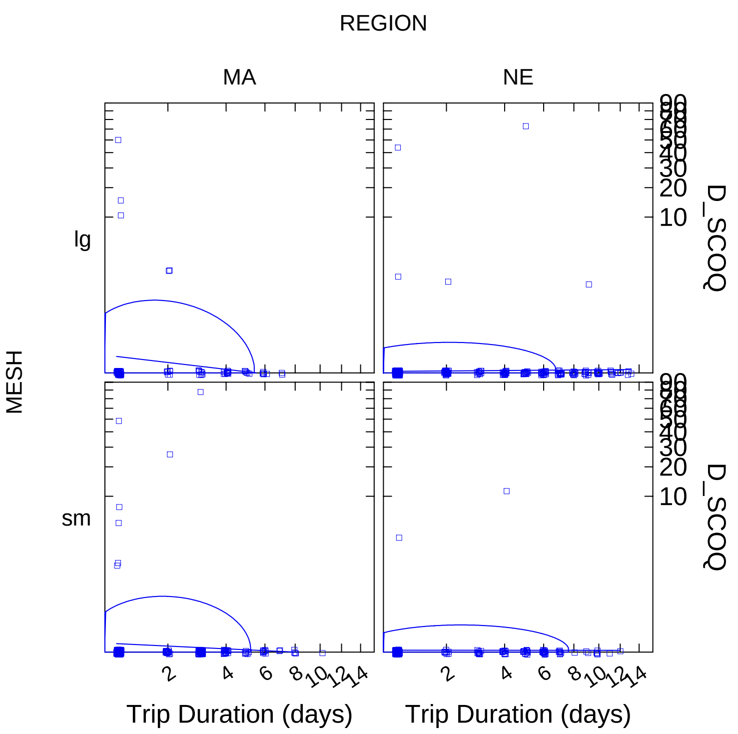


Figure B-1ss. Comparison of surfclams/quahogs discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

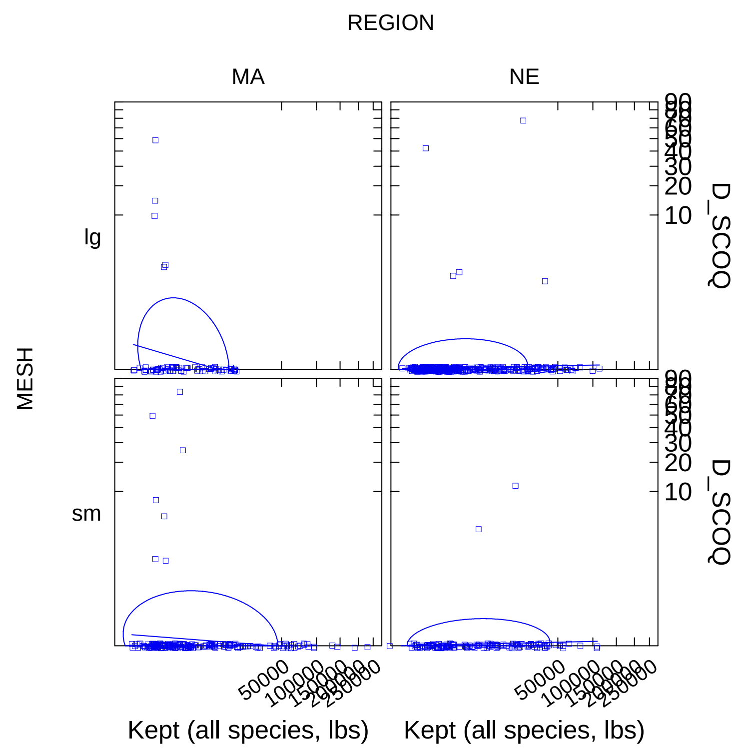


Figure B-1tt. Comparison of surfclams/quahogs discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

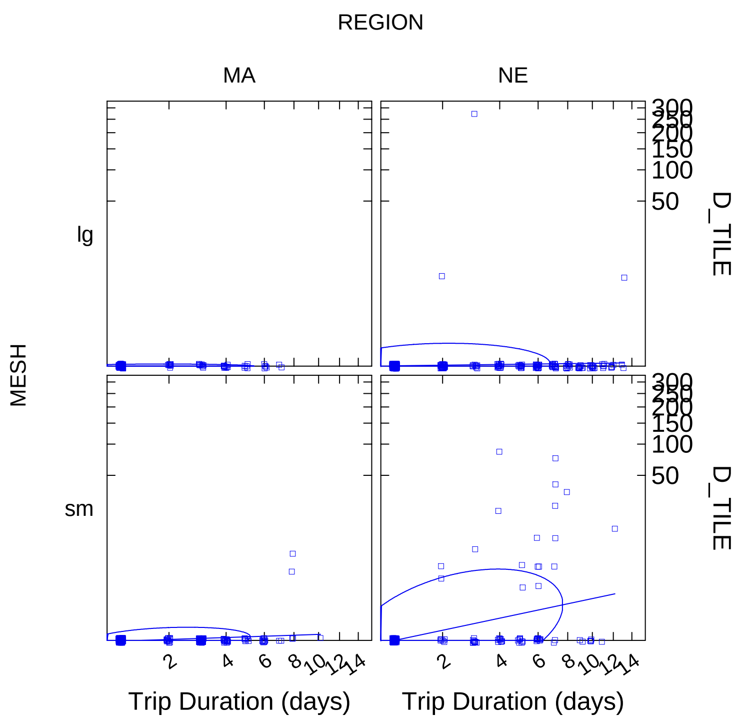


Figure B-1uu. Comparison of tilefish discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

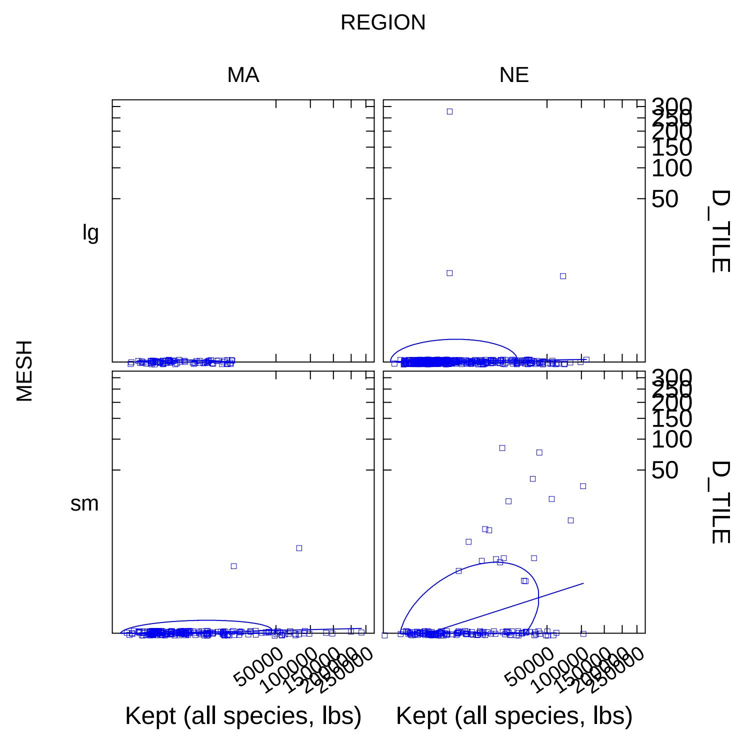


Figure B-1vv. Comparison of tilefish discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

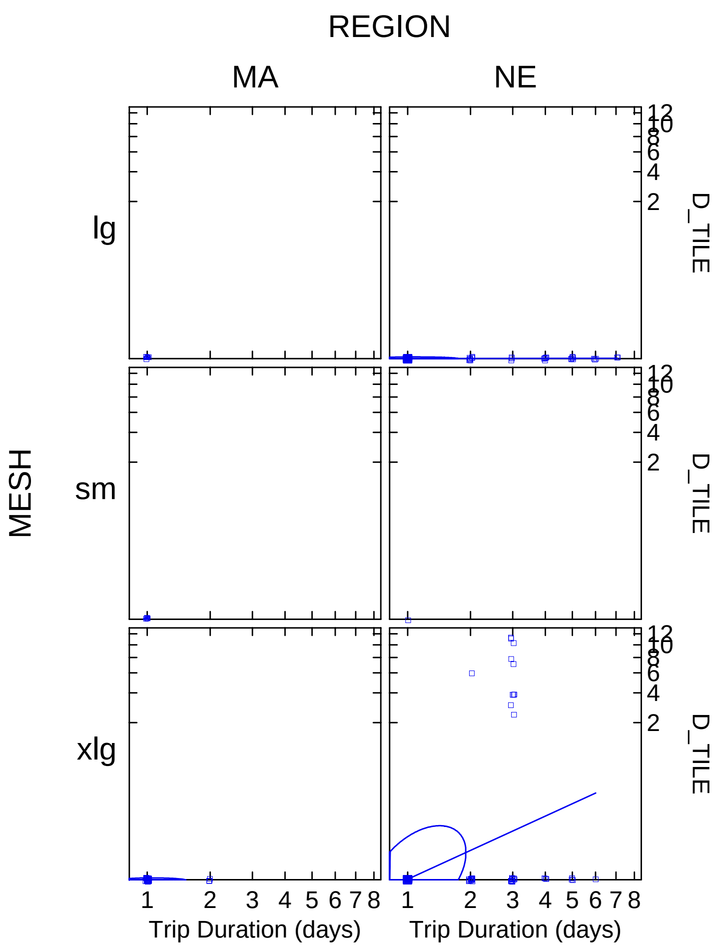


Figure B-1ww. Comparison of tilefish discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

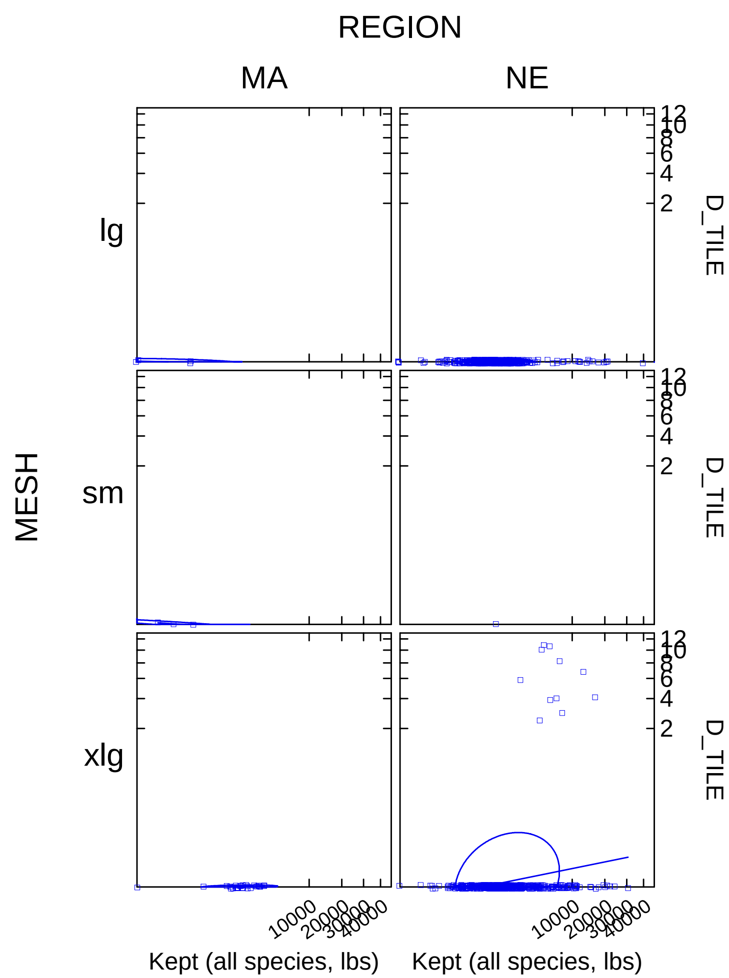


Figure B-1xx. Comparison of tilefish discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

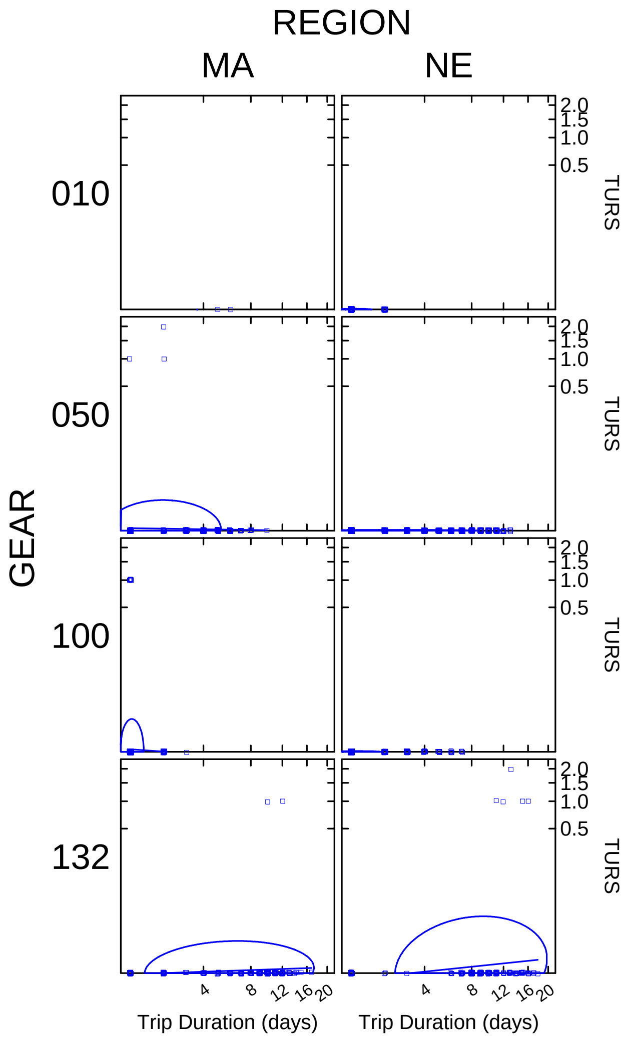


Figure B-2a. Comparison of sea turtles and trip duration (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

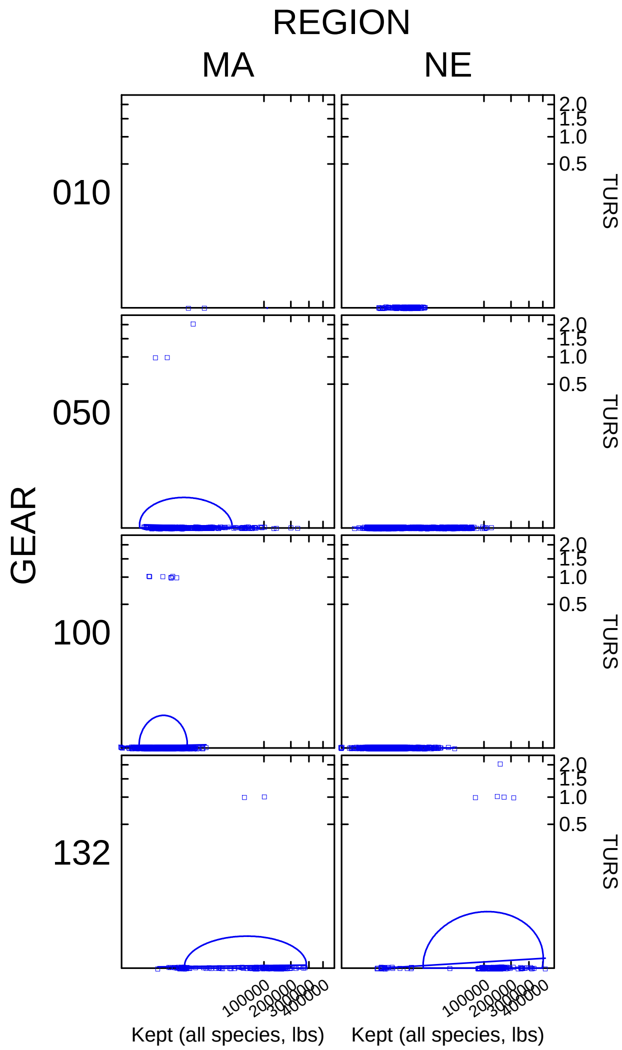


Figure B-2b. Comparison of sea turtles and kept weight of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

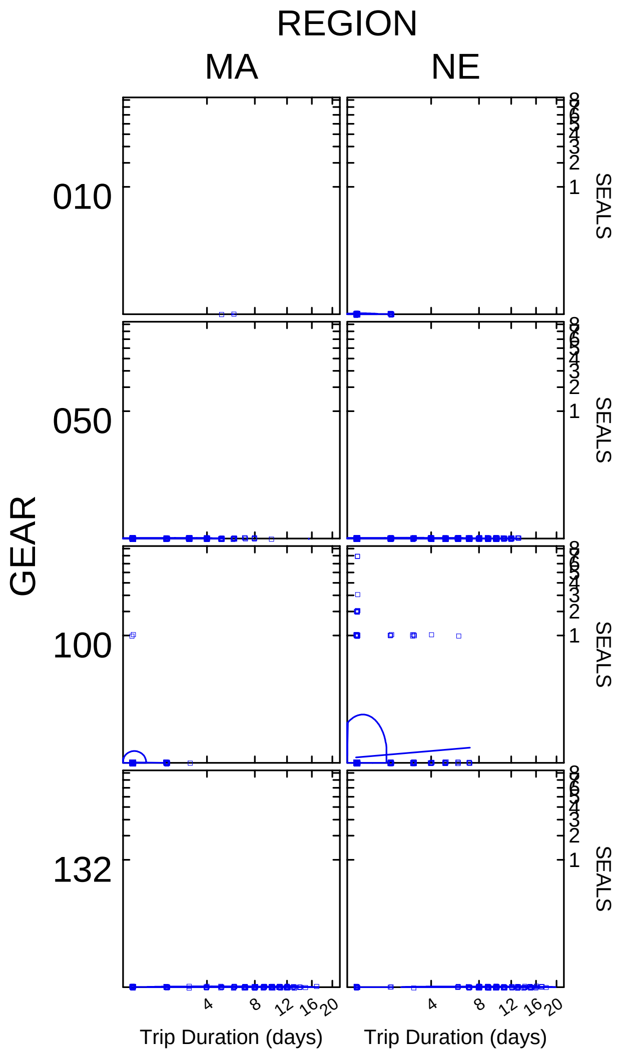


Figure B-2c. Comparison of seals and trip duration (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

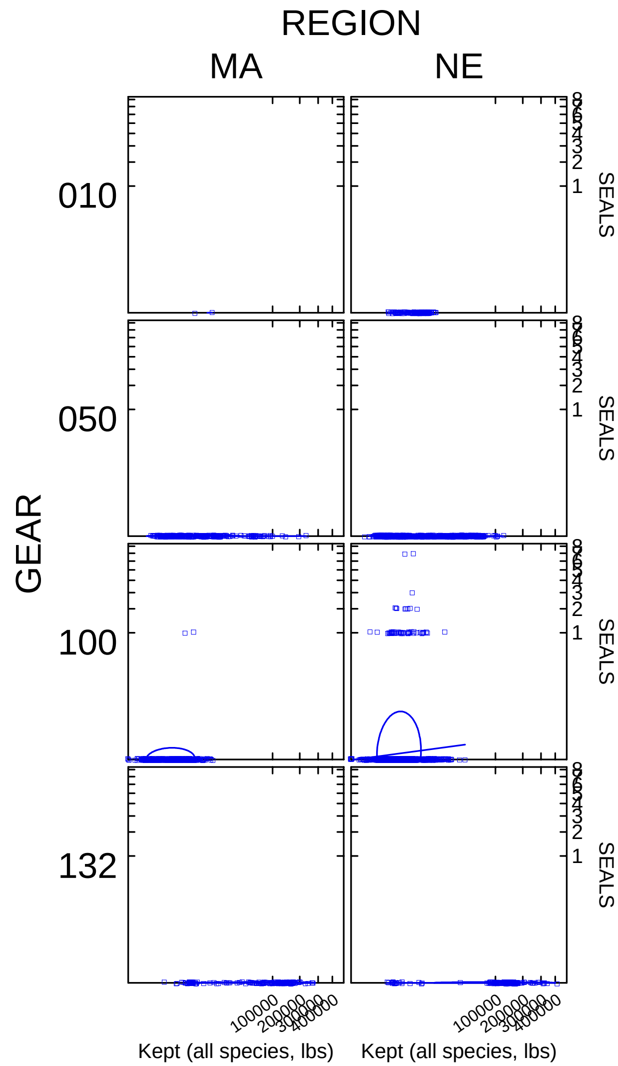


Figure B-2d. Comparison of seals and kept weight of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

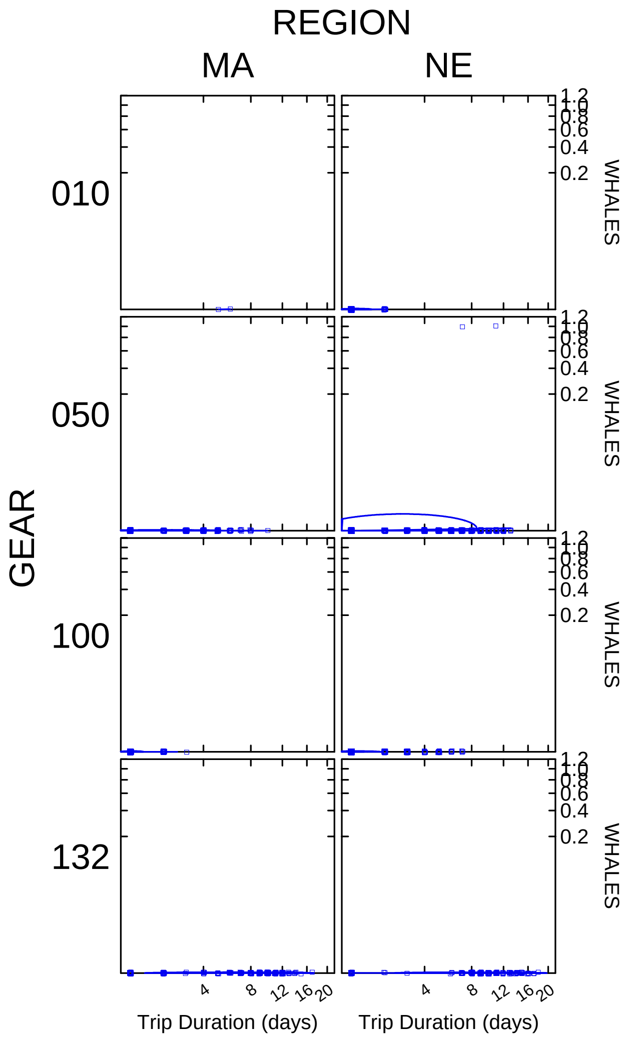


Figure B-2e. Comparison of whales and trip duration (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

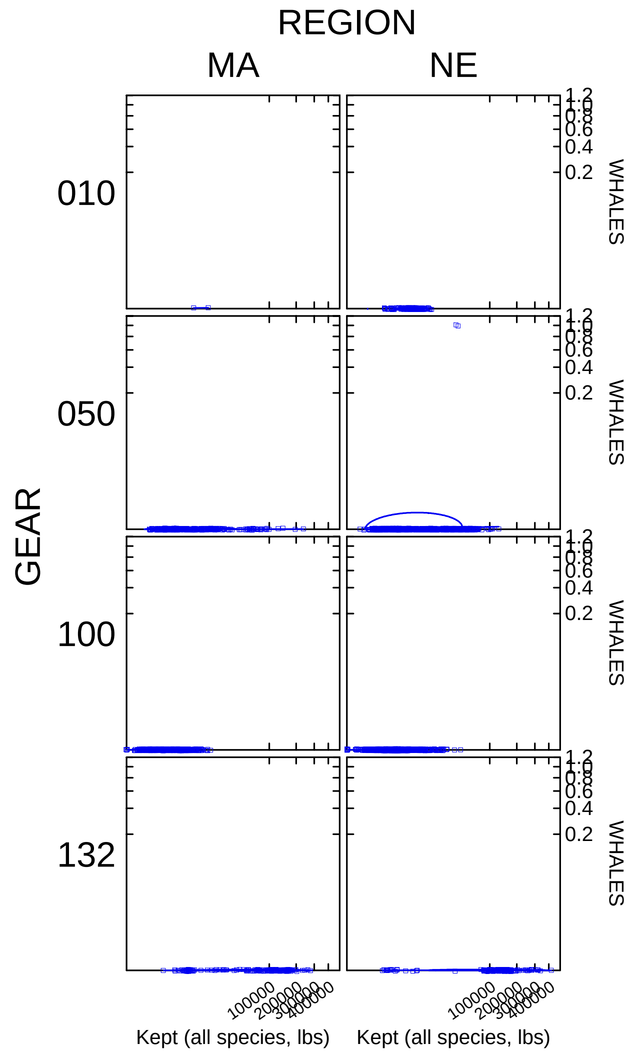


Figure B-2f. Comparison of whales and kept weight of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

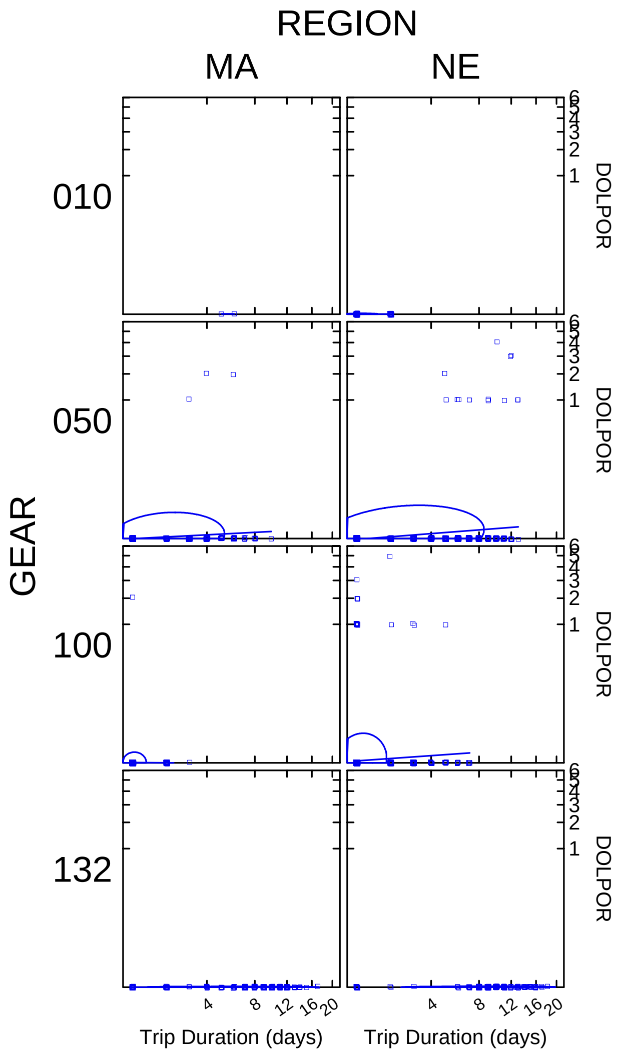


Figure B-2g. Comparison of dolphins/porpoises and trip duration (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

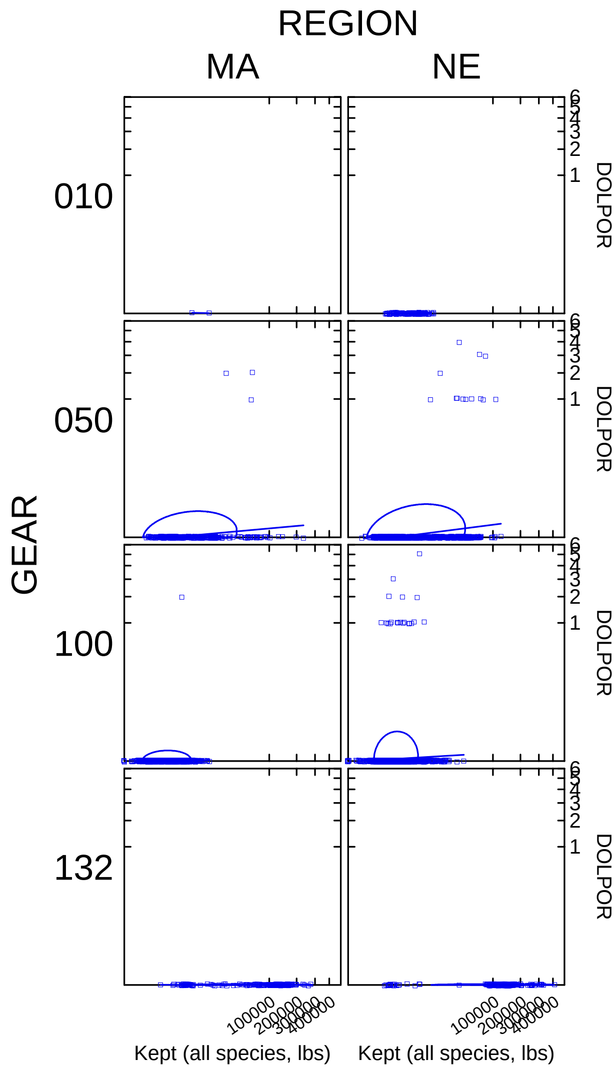


Figure B-2h. Comparison of dolphins/porpoises and kept weight of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

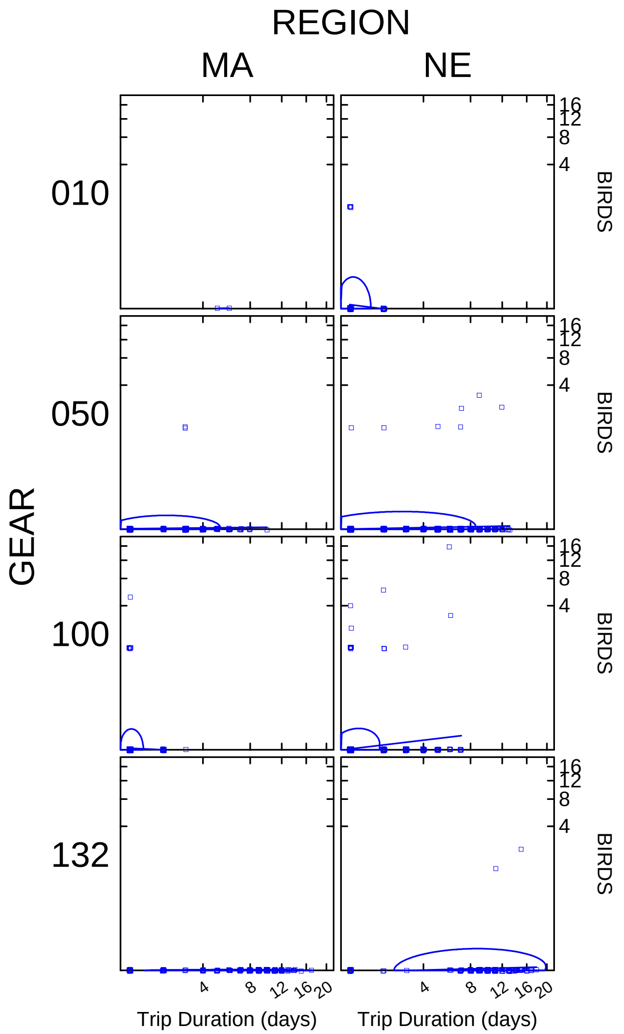


Figure B-2i. Comparison of sea birds and trip duration (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

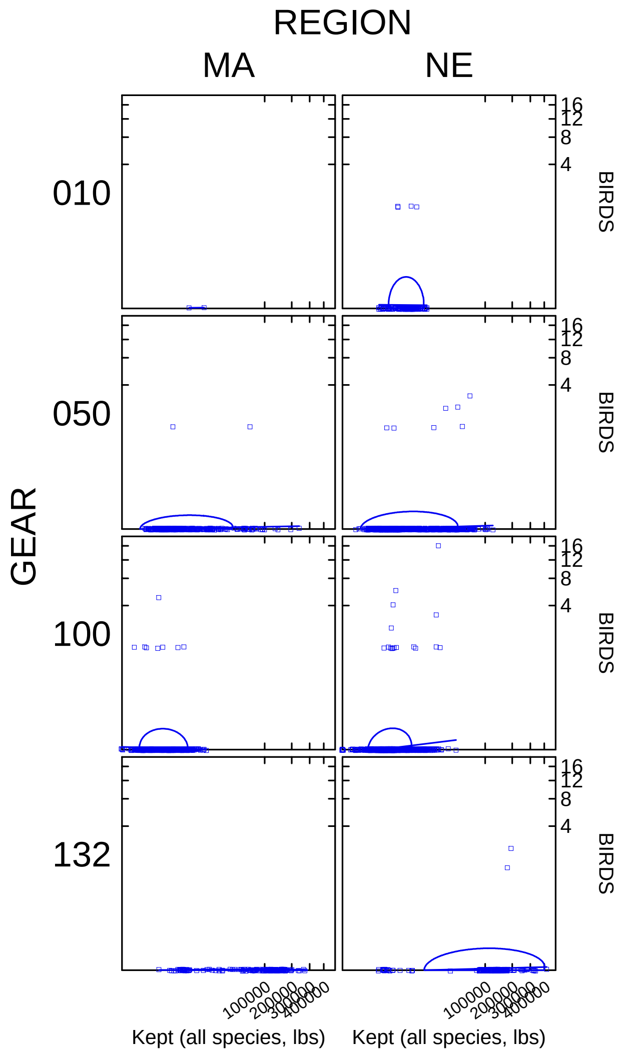


Figure B-2j. Comparison of sea birds and kept weight of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

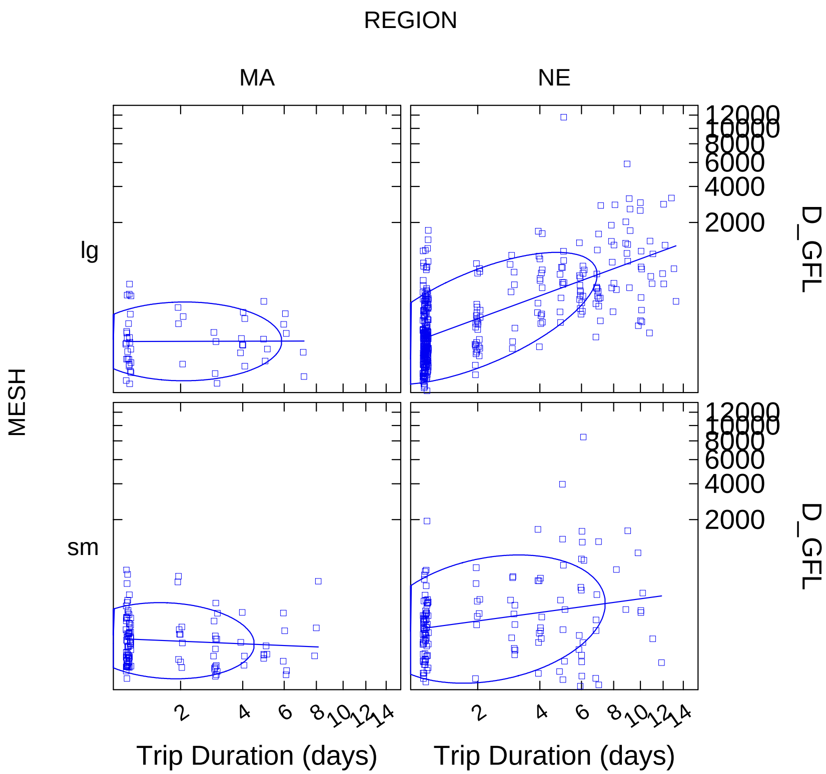


Figure B-3a. Comparison of Northeast multispecies (large-mesh) discards (pounds) and trip duration (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip. Trips with zero discards of Northeast multispecies (large-mesh) are excluded.

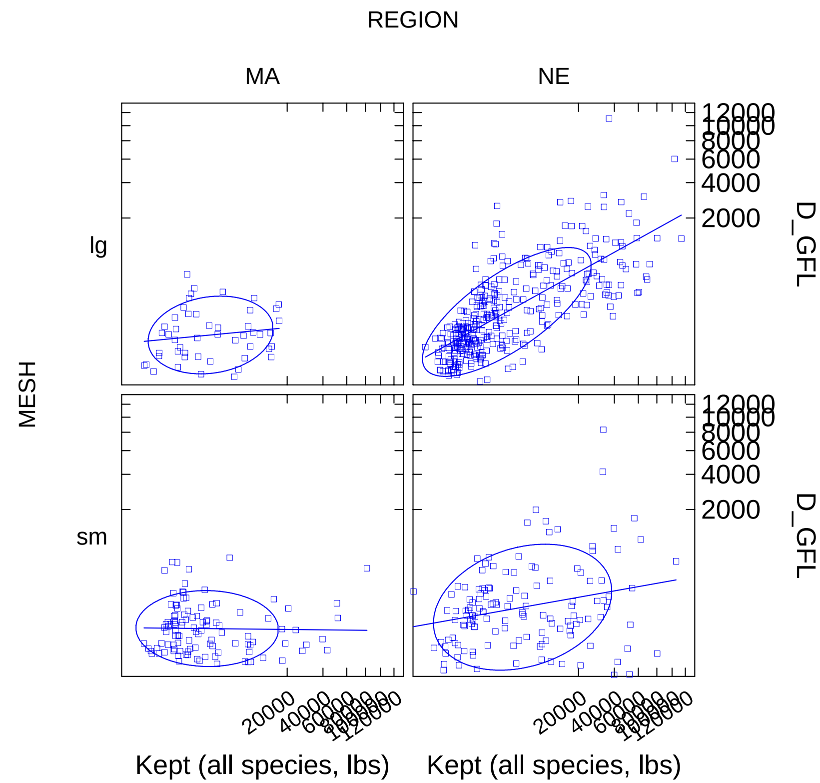


Figure B-3b. Comparison of Northeast multispecies (large-mesh) discards (pounds) and kept weight of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip. Trips with zero discards of Northeast multispecies (large-mesh) are excluded

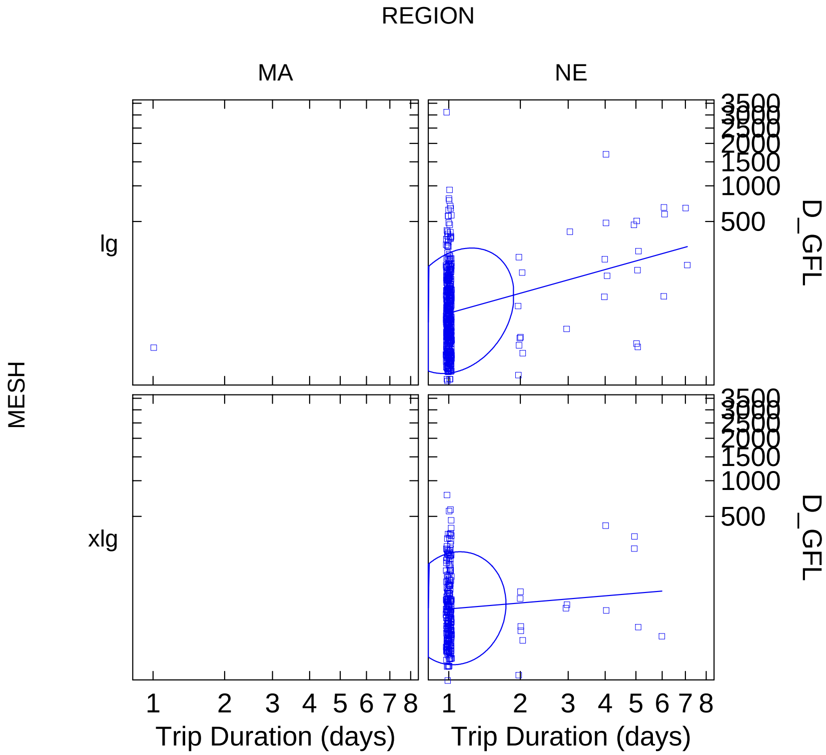


Figure B-3c. Comparison of Northeast multispecies (large-mesh) discards (pounds) and trip duration (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip. Trips with zero discards of Northeast multispecies (large-mesh) are excluded.

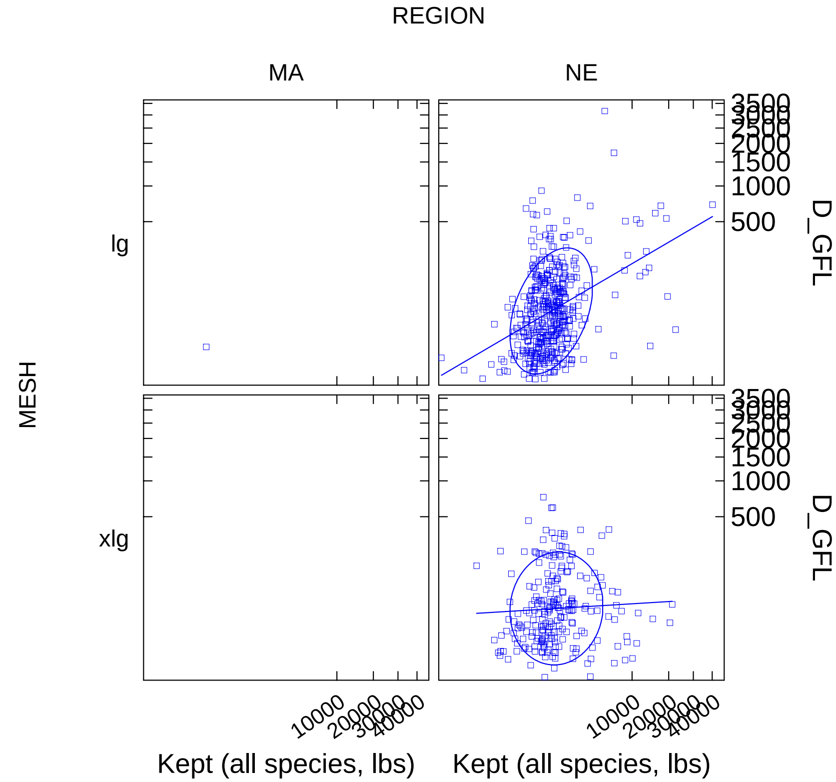


Figure B-3d. Comparison of Northeast multispecies (large-mesh) discards (pounds) and kept weight of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip. Trips with zero discards of Northeast multispecies (large-mesh) are excluded.

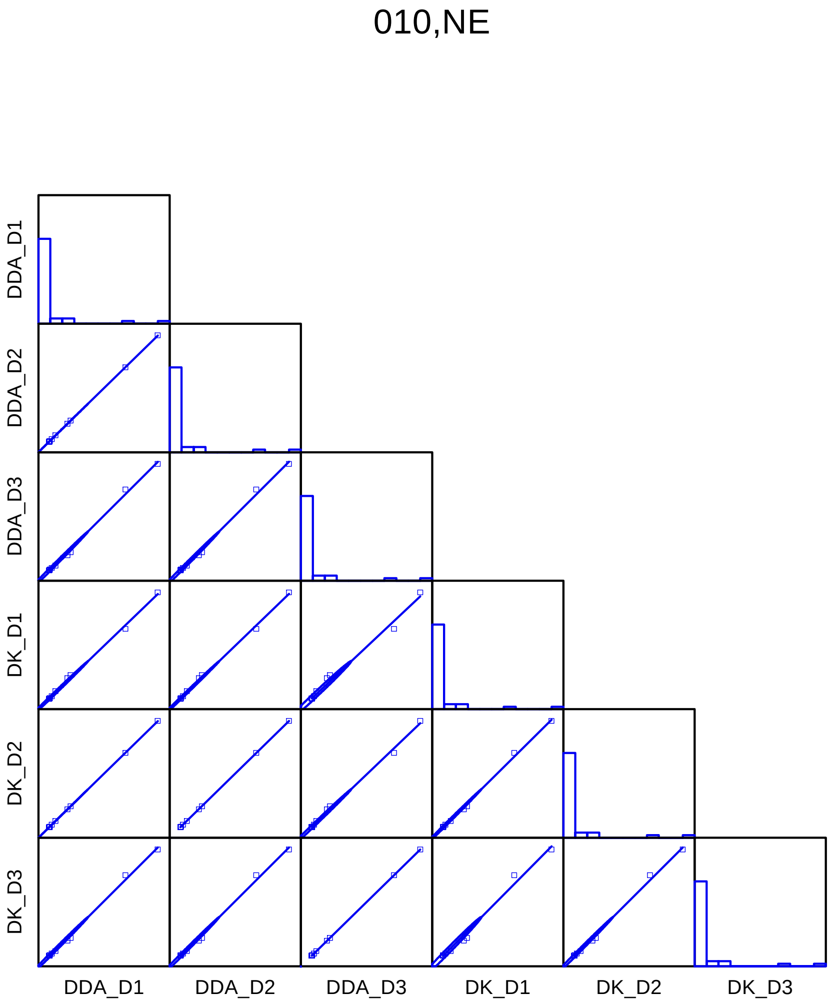


Figure B-4a. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England longline; each dot represents a species group and mesh size.

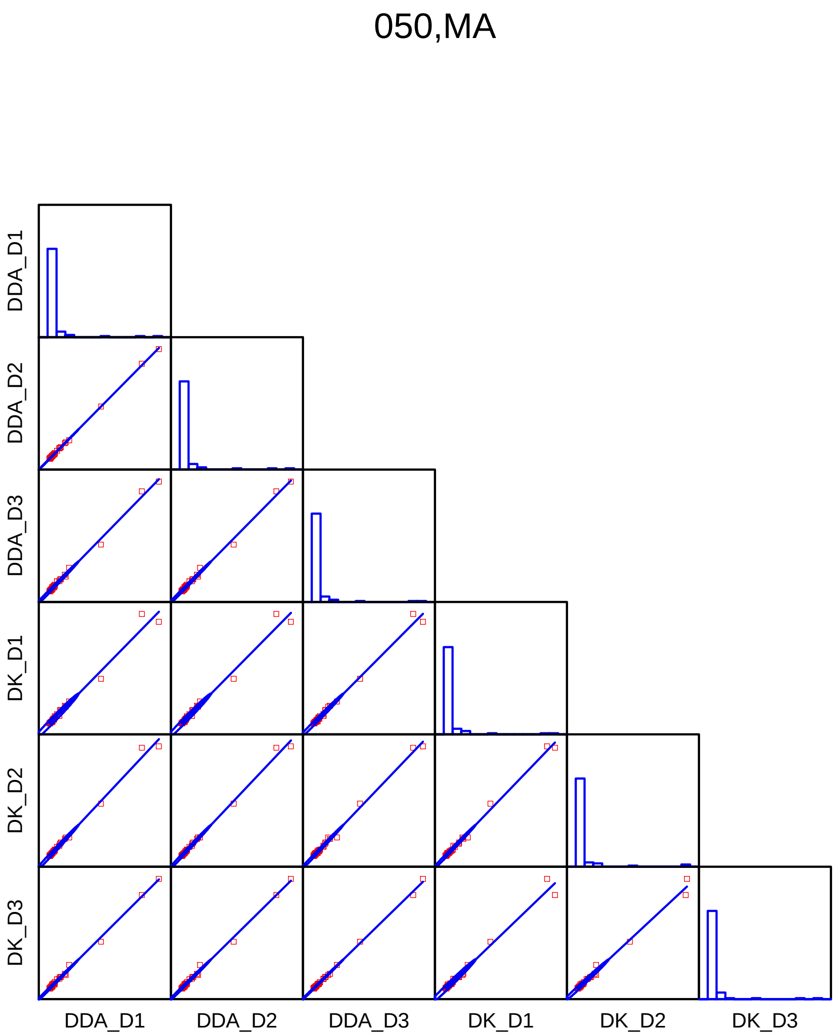


Figure B-4b. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic otter trawl; each dot represents a species group and mesh size.

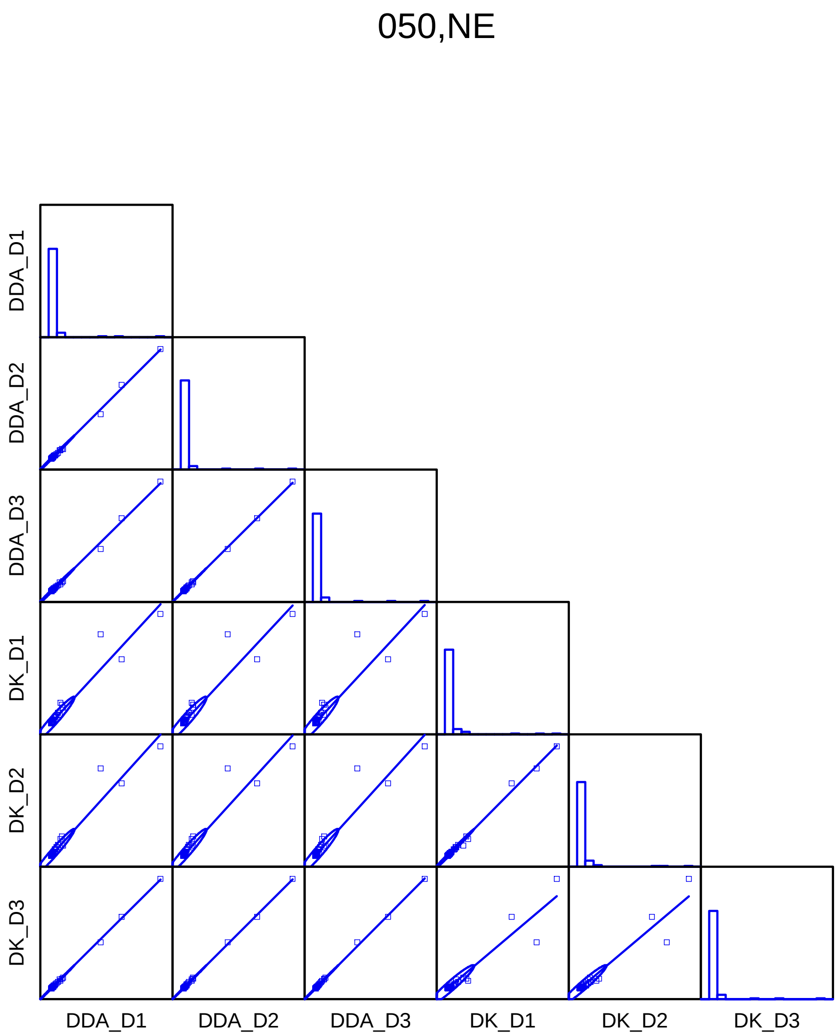


Figure B-4c. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England otter trawl; each dot represents a species group and mesh size.

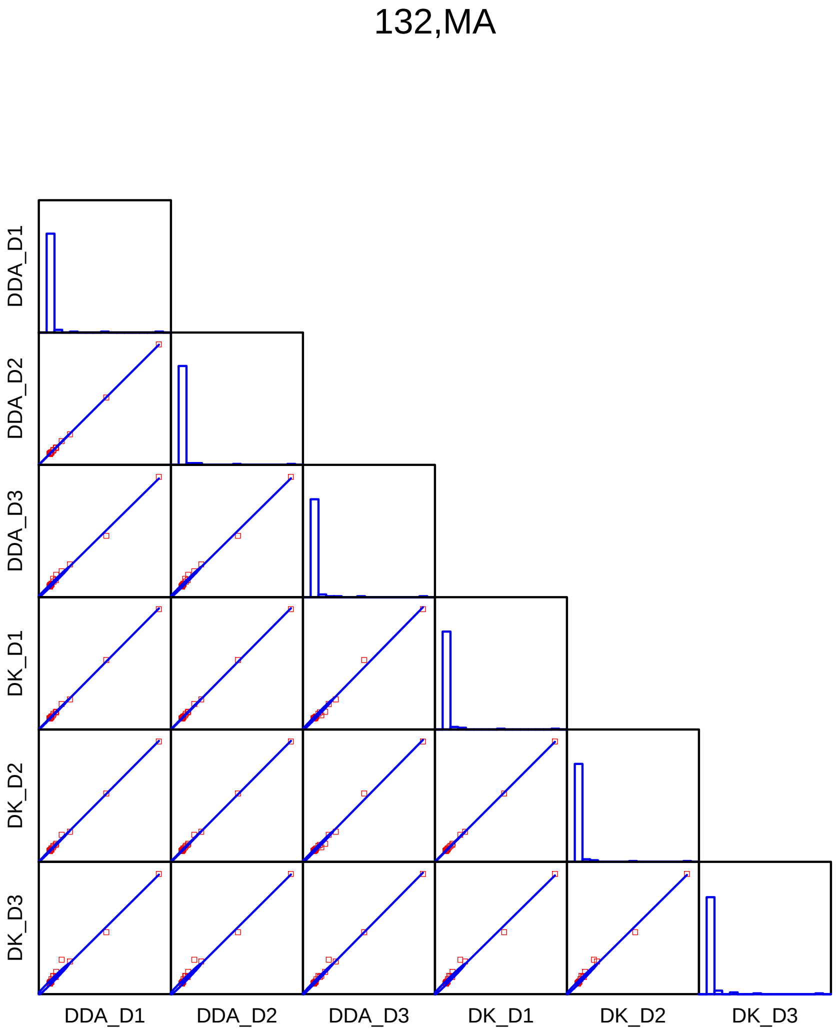


Figure B-4d. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic scallop dredge; each dot represents a species group and mesh size.

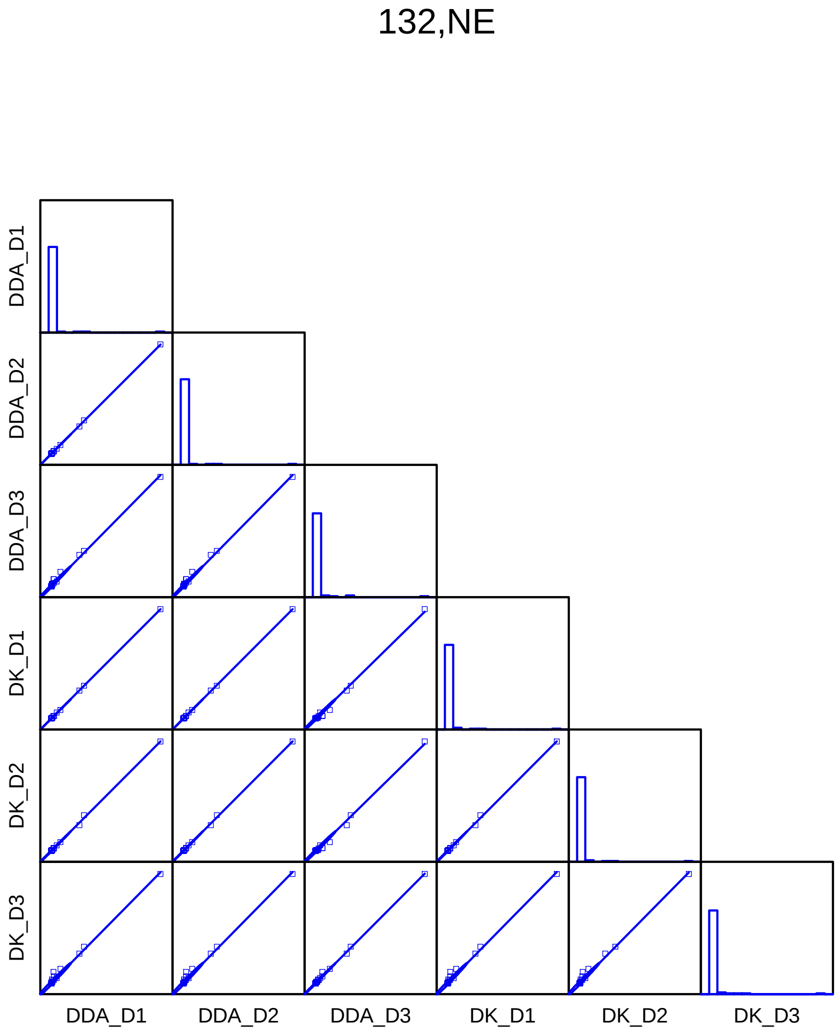


Figure B-4e. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England scallop dredge; each dot represents a species group and mesh size.

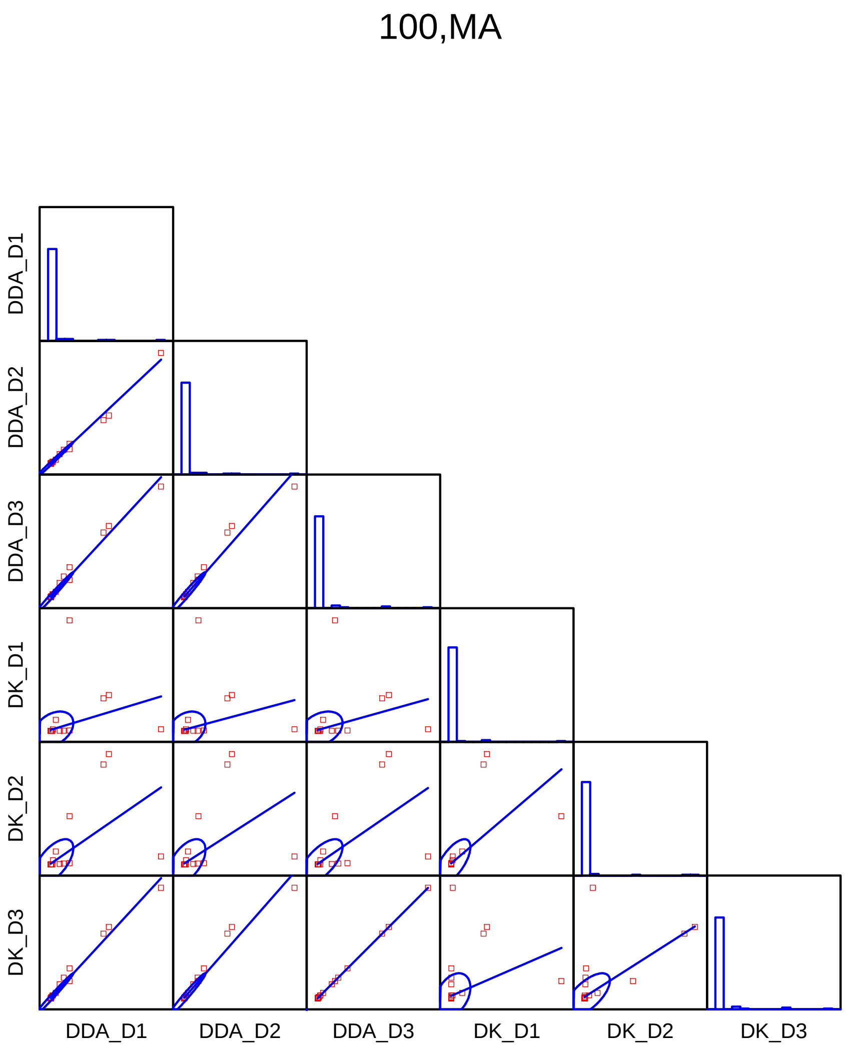


Figure B-4f. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic gillnet; each dot represents a species group and mesh size.

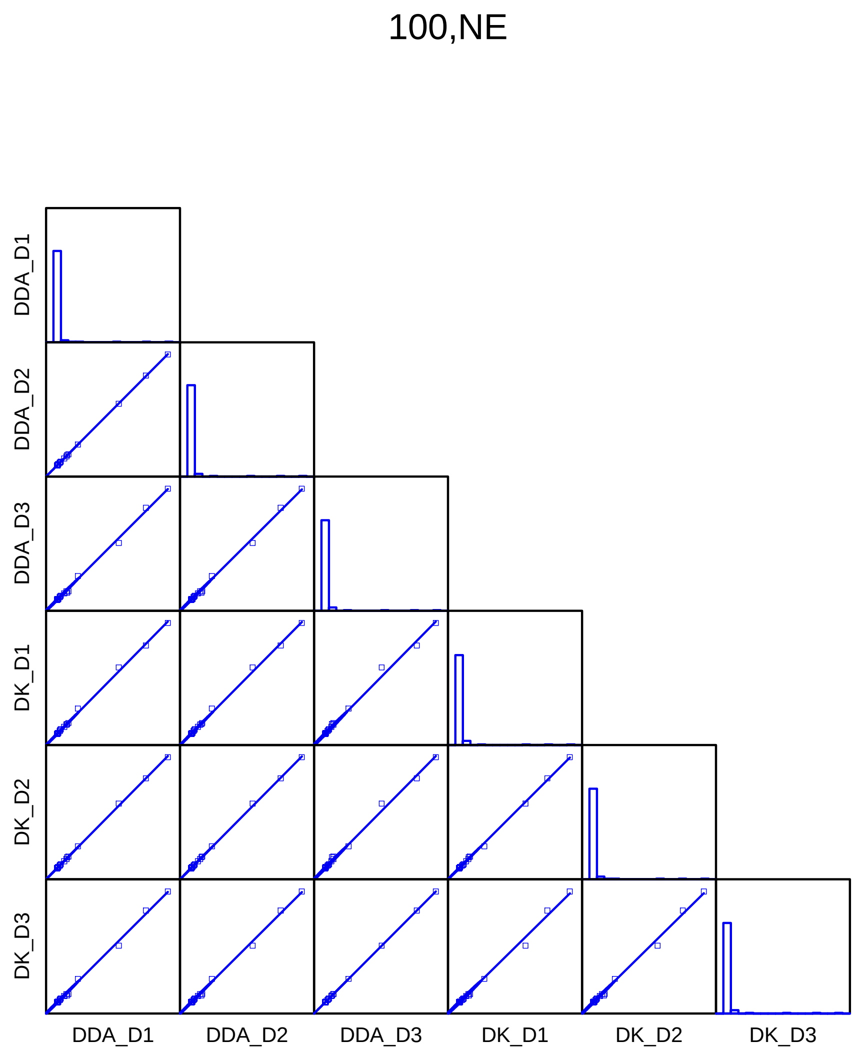


Figure B-4g. Comparisons of the total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England gillnet; each dot represents a species group and mesh size.

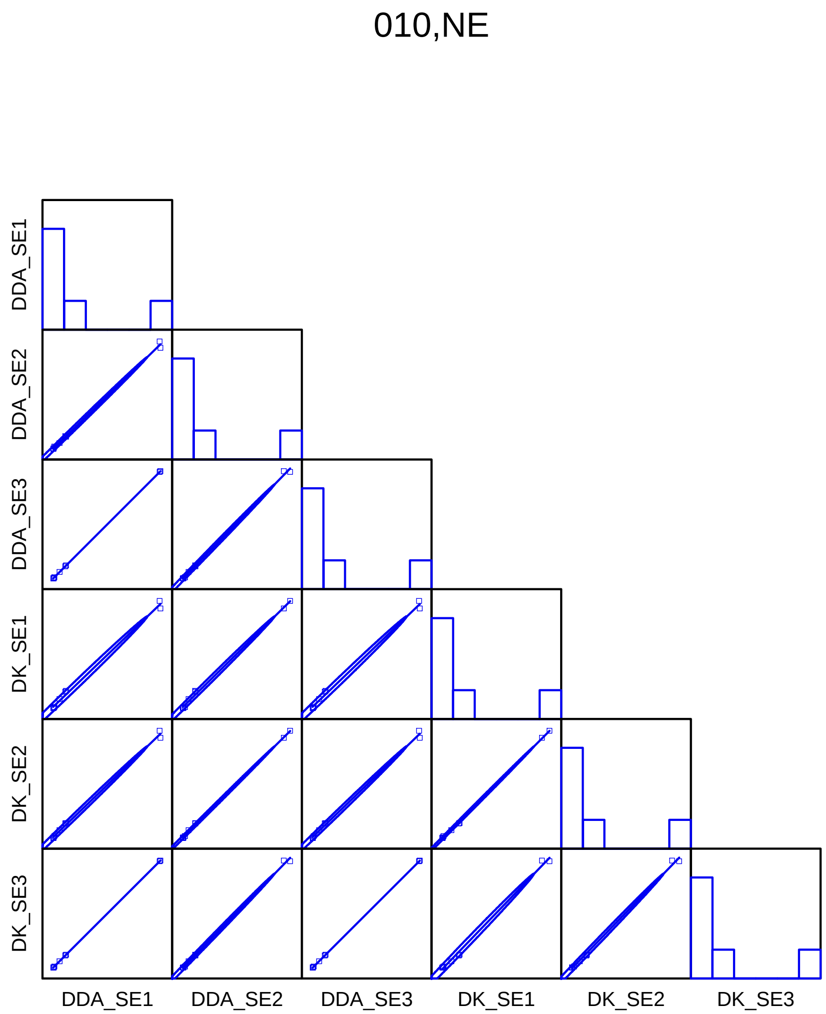


Figure B-5a. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England longline; each dot represents a species group and mesh size.

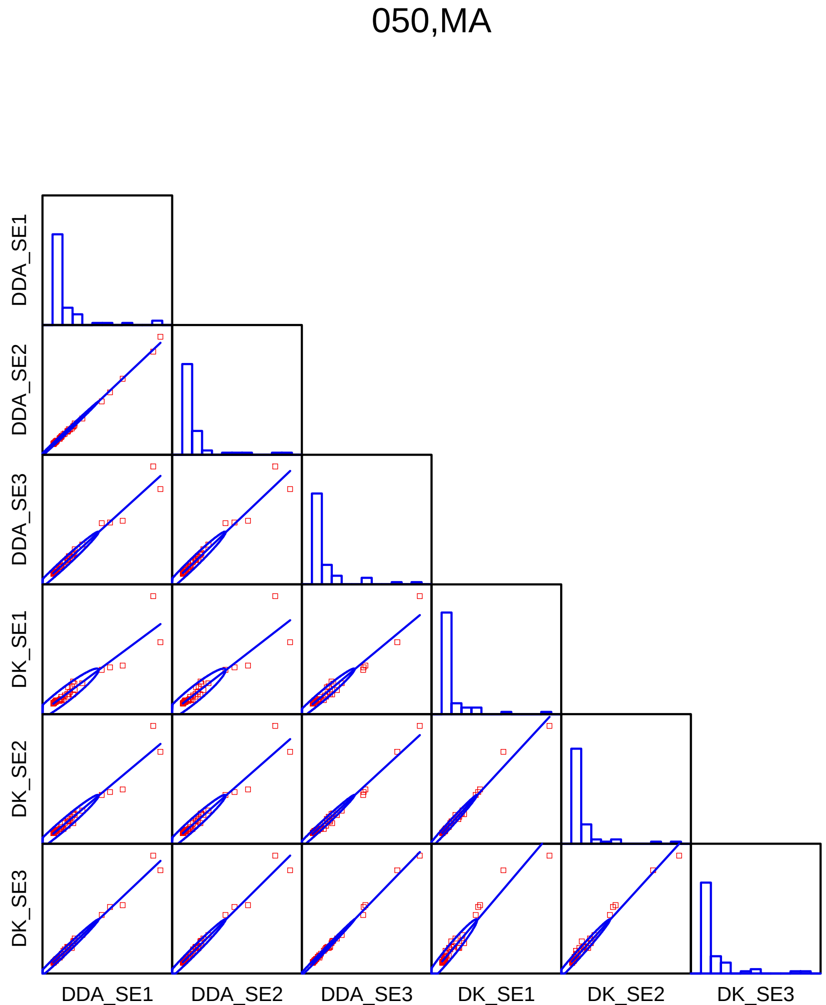


Figure B-5b. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic otter trawl; each dot represents a species group and mesh size.

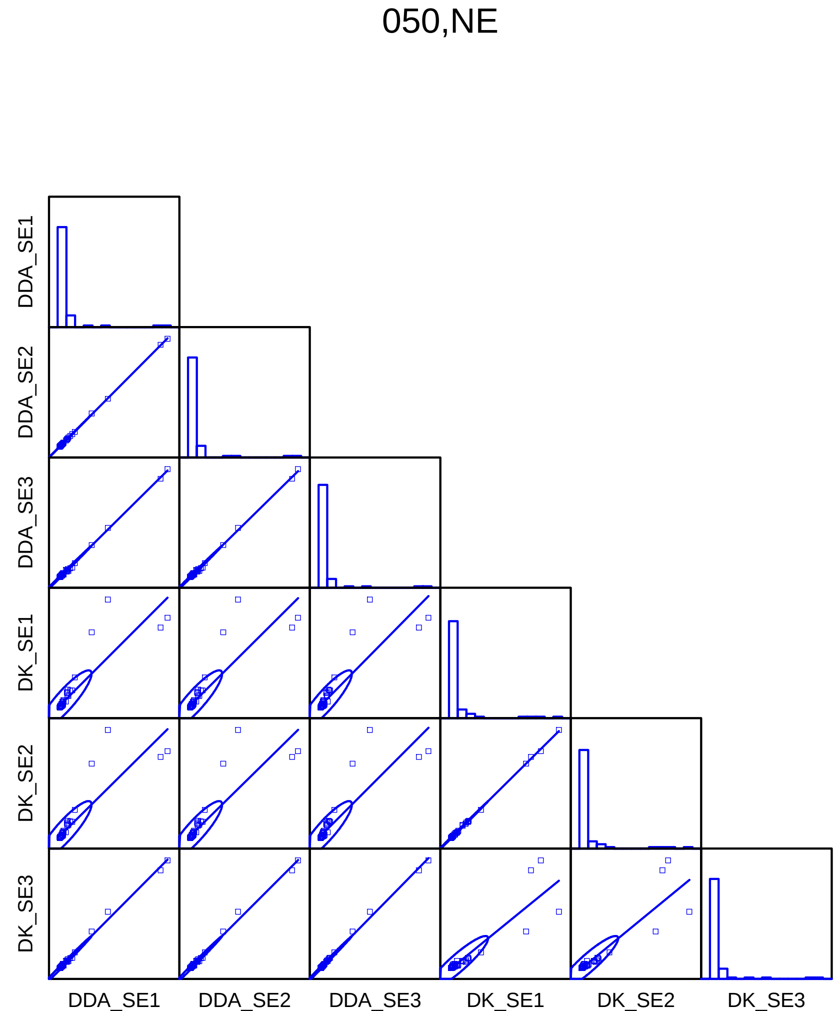


Figure B-5c. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England otter trawl; each dot represents a species group and mesh size.

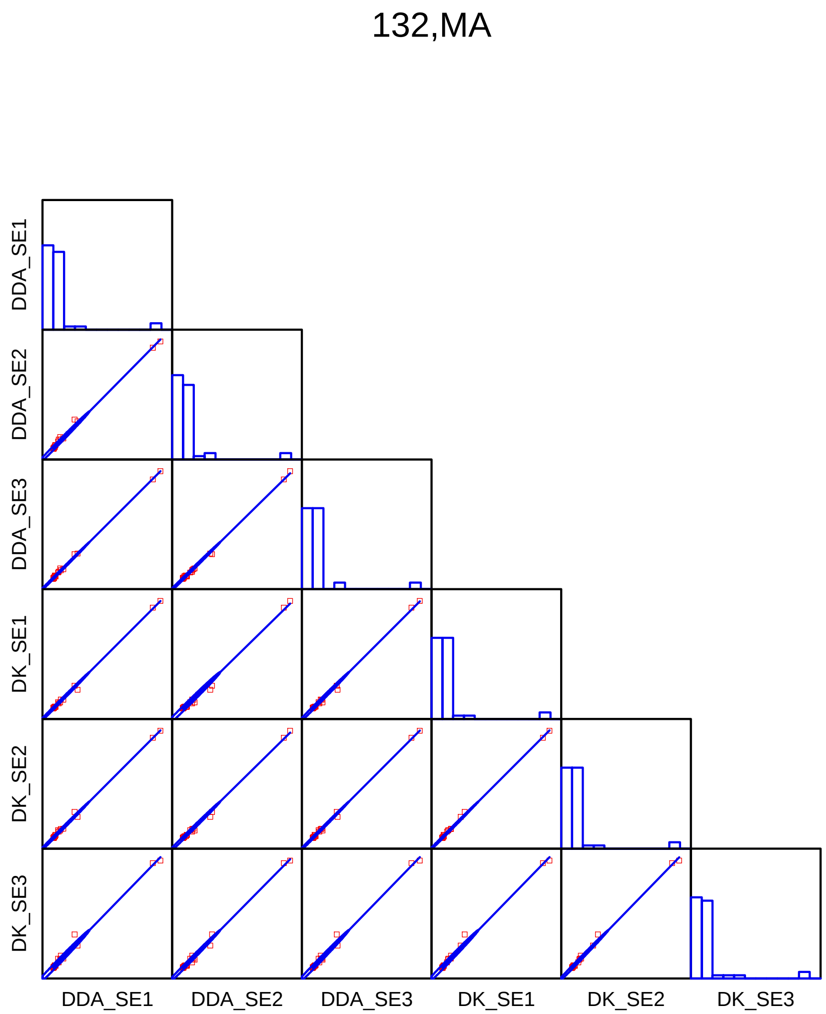


Figure B-5d. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic scallop dredge each dot represents a species group and mesh size

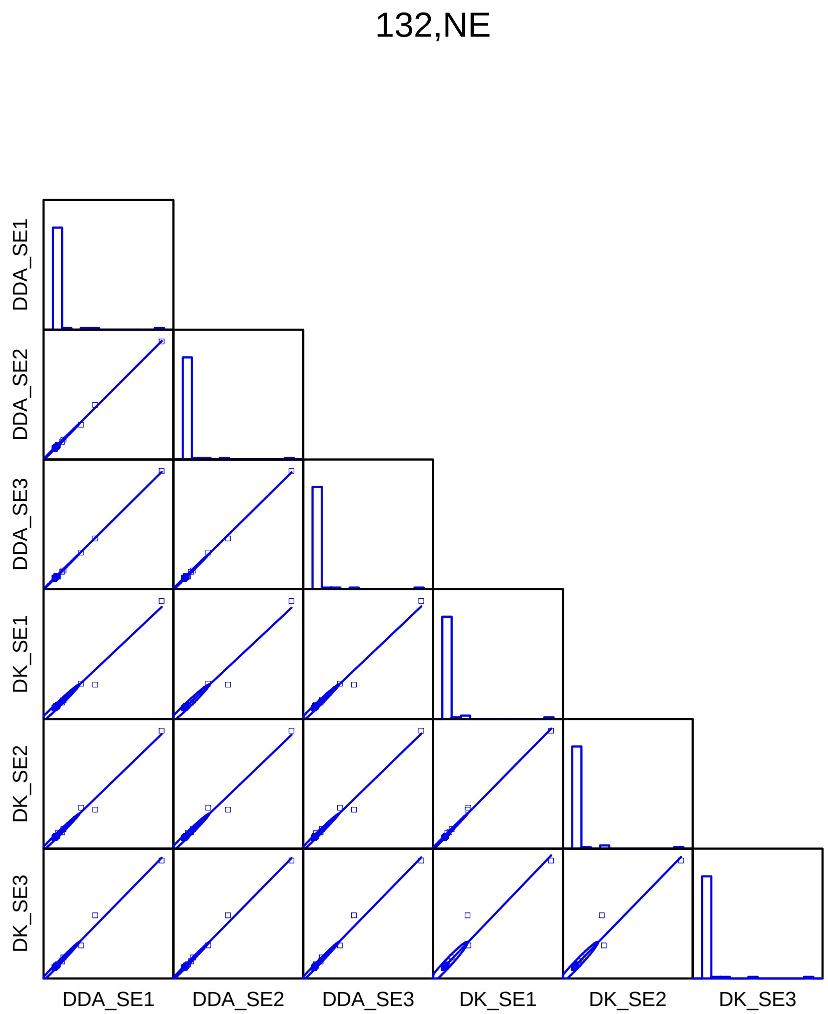


Figure B-5e. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England scallop dredge each dot represents a species group and mesh size

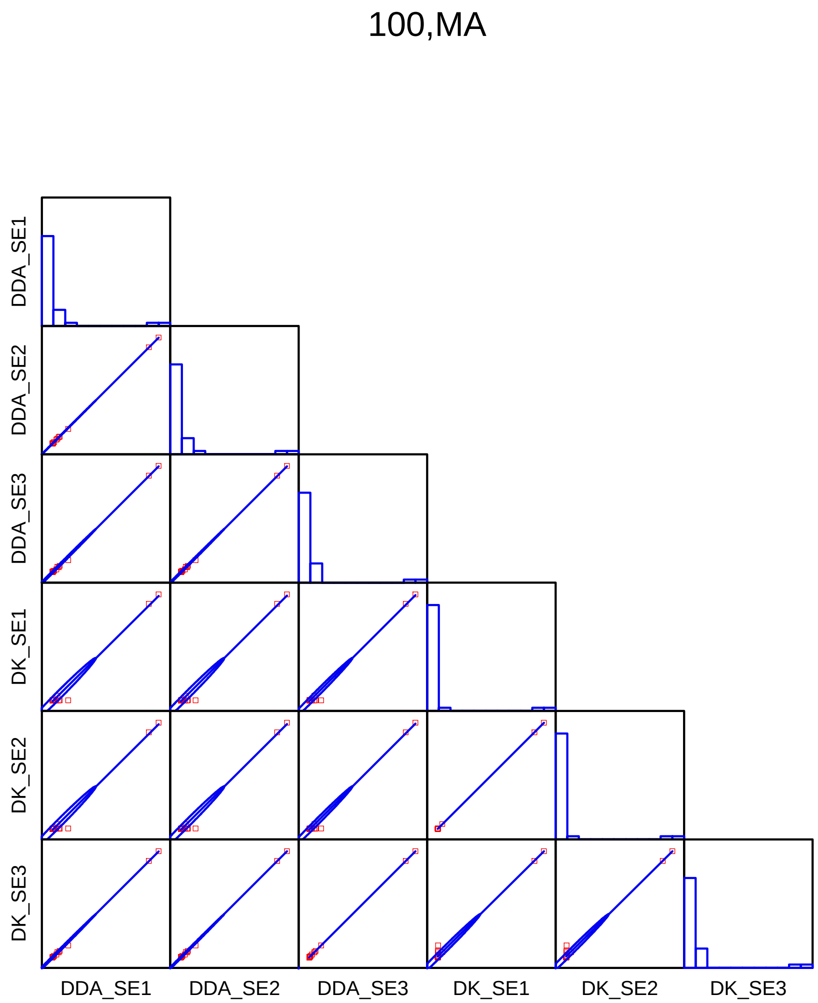


Figure B-5f. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic gillnet each dot represents a species group and mesh size.

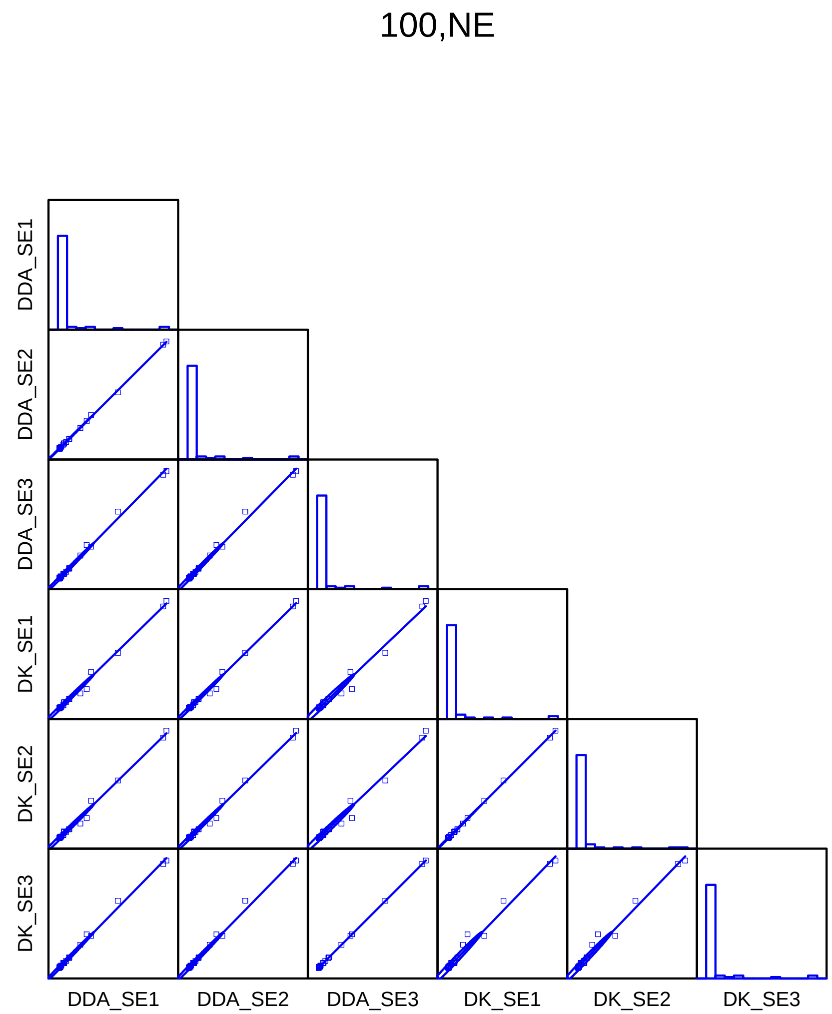


Figure B-5g. Comparisons of the standard error (SE) of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England gillnet each dot represents a species group and mesh size.

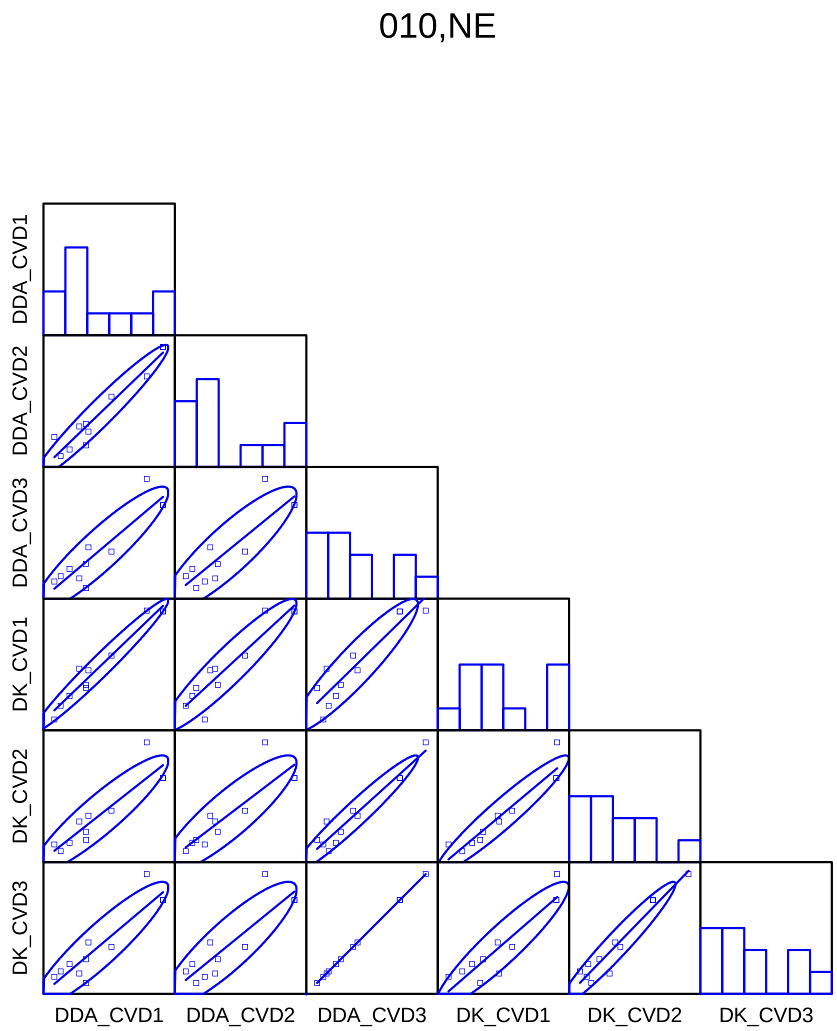


Figure B-5h. Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England longline; each dot represents a species group and mesh size.

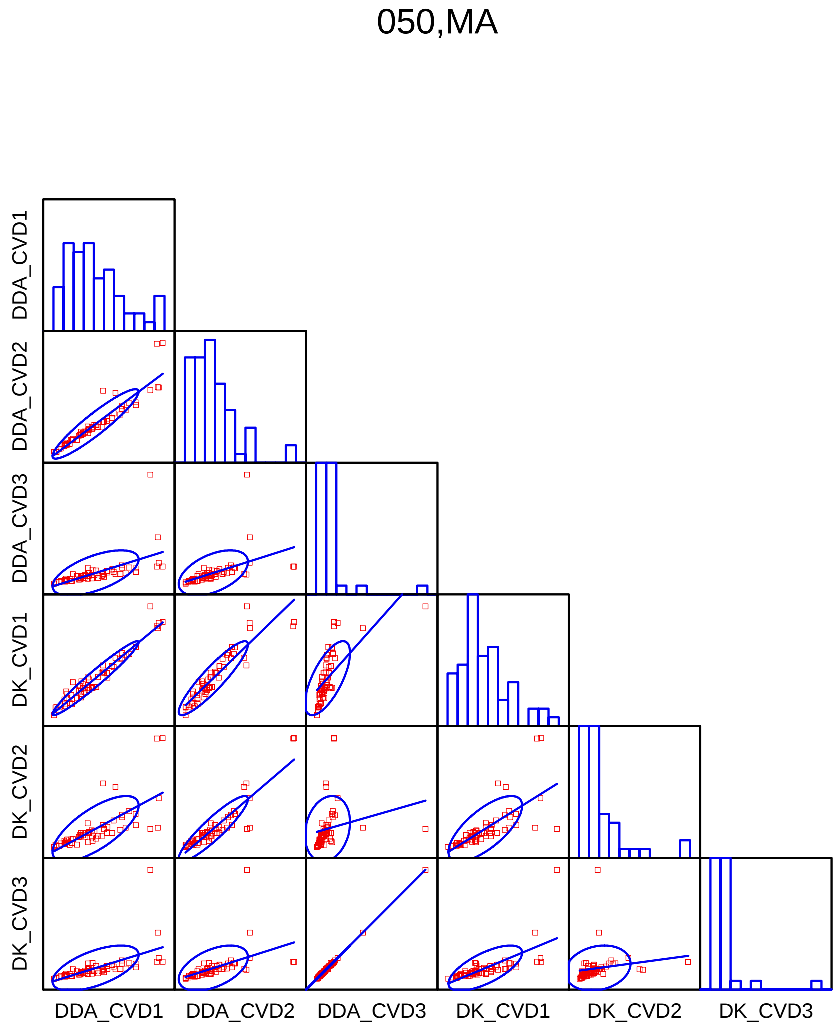


Figure B-5i. Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic otter trawl; each dot represents a species group and mesh size.

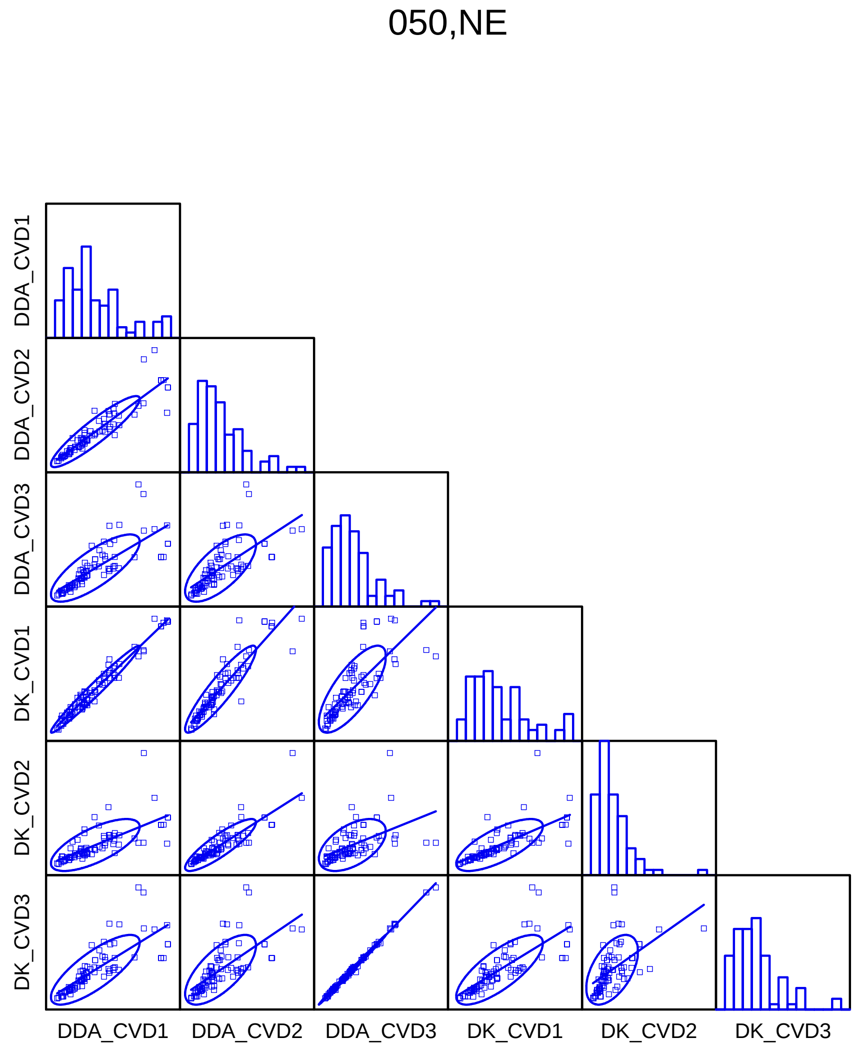


Figure B-5j Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England otter trawl; each dot represents a species group and mesh size.

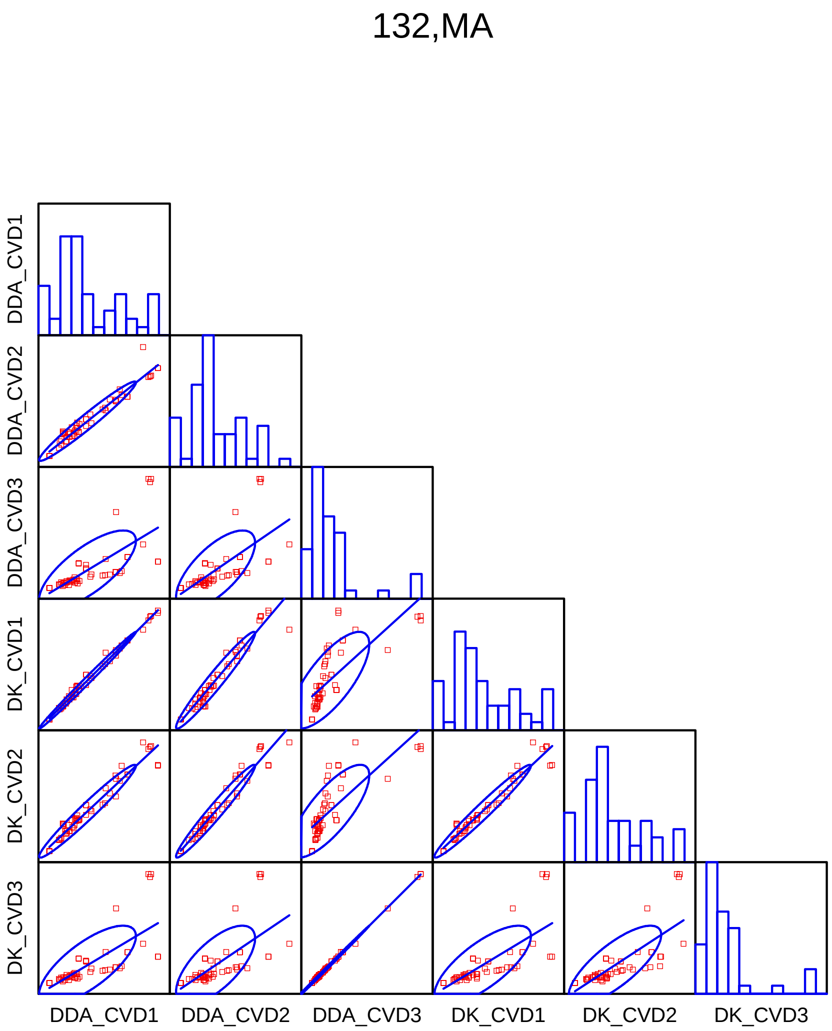


Figure B-5k. Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic scallop dredge each dot represents a species group and mesh size

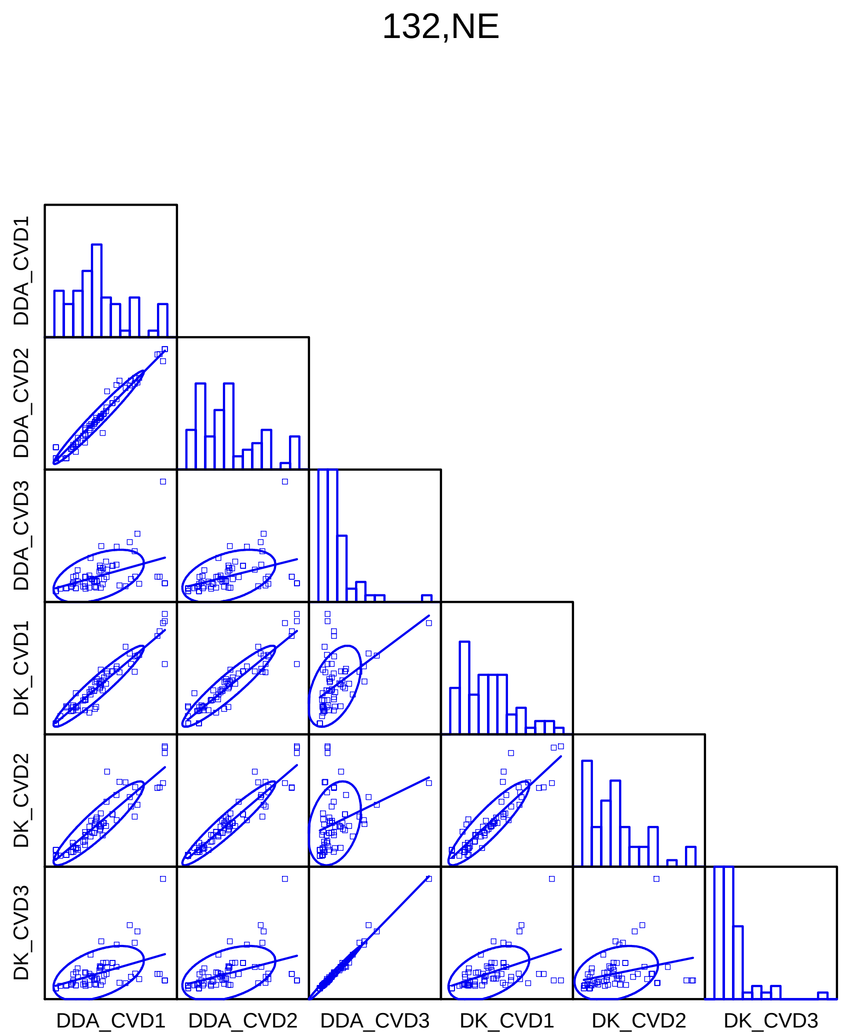


Figure B-5l. Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England scallop dredge each dot represents a species group and mesh size

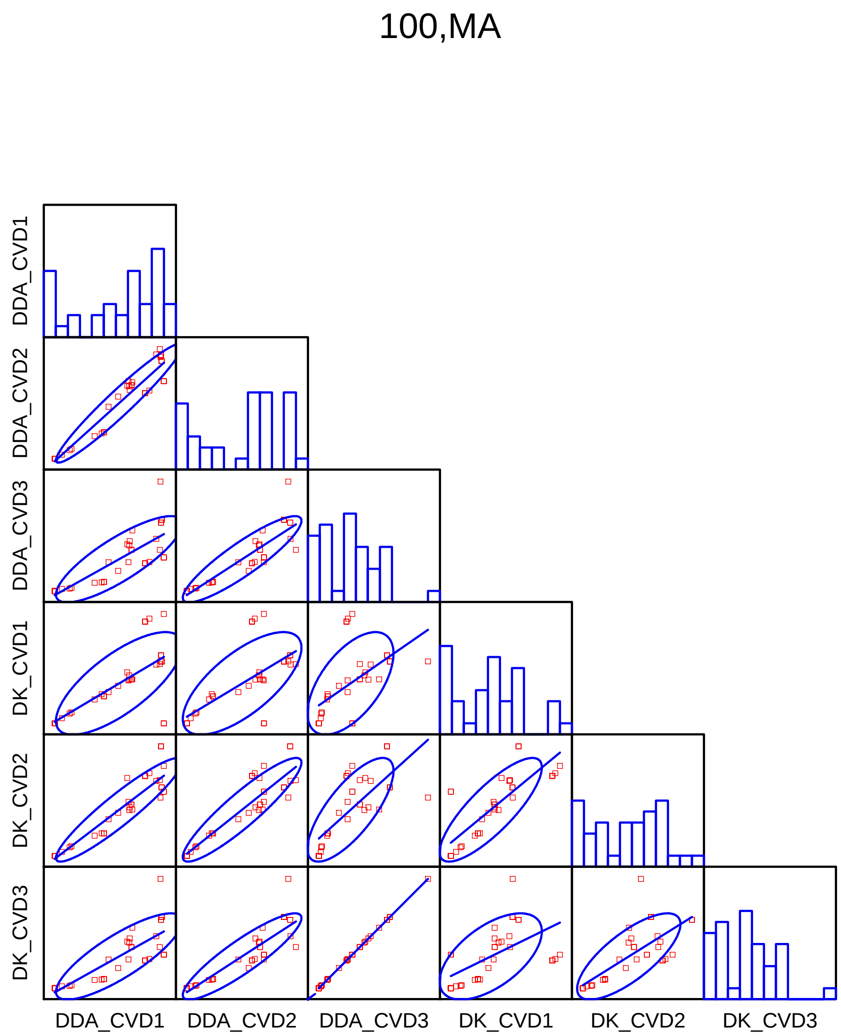


Figure B-5m. Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for Mid-Atlantic gillnet each dot represents a species group and mesh size.

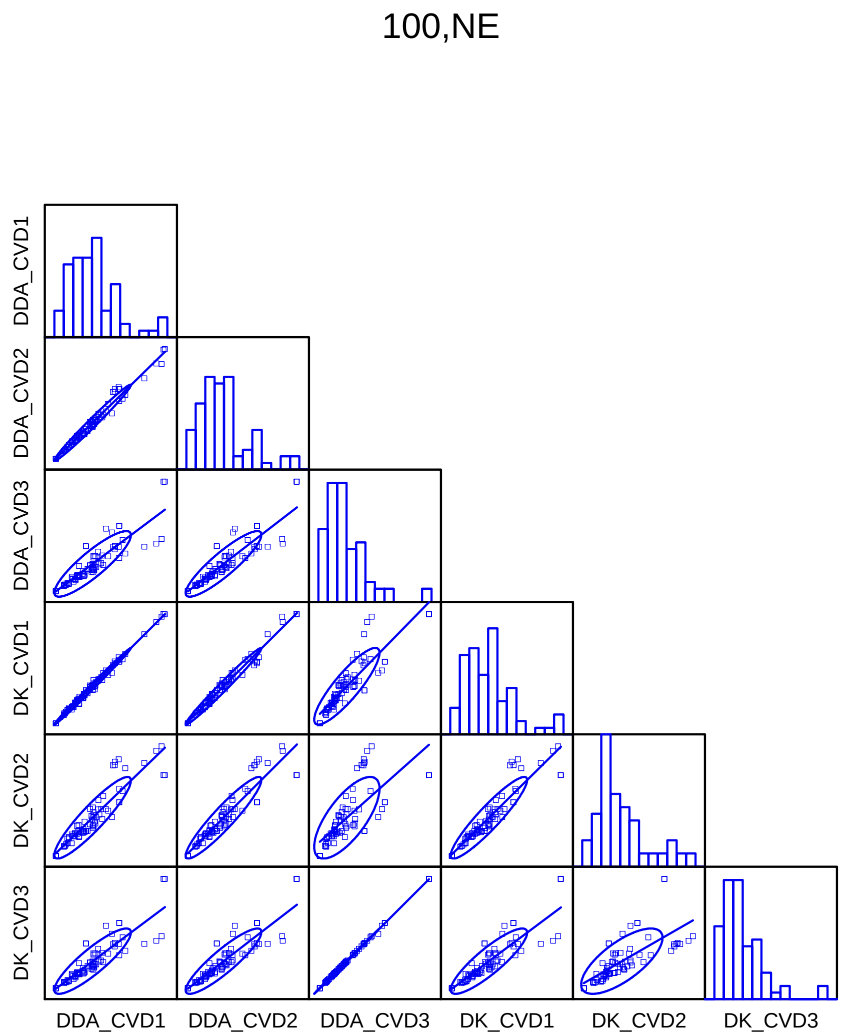
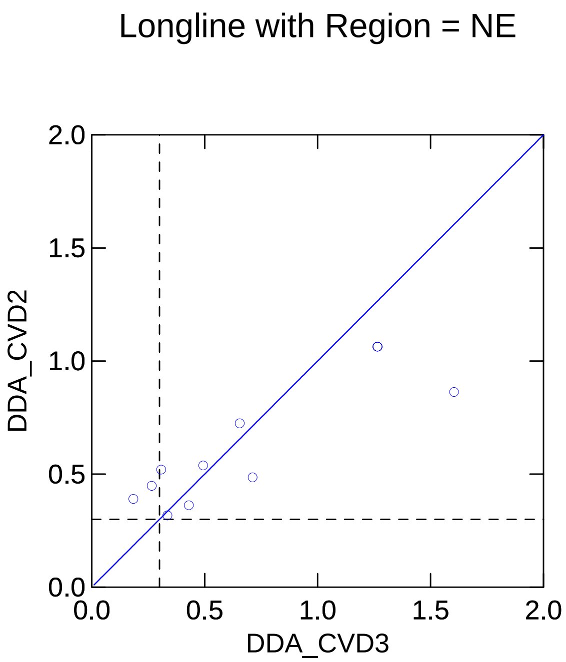


Figure B-5n. Comparisons of the CV of total discards derived by the two bycatch ratios (discard-to-days-absent [DDA] and discard-to-kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for New England gillnet each dot represents a species group and mesh size.



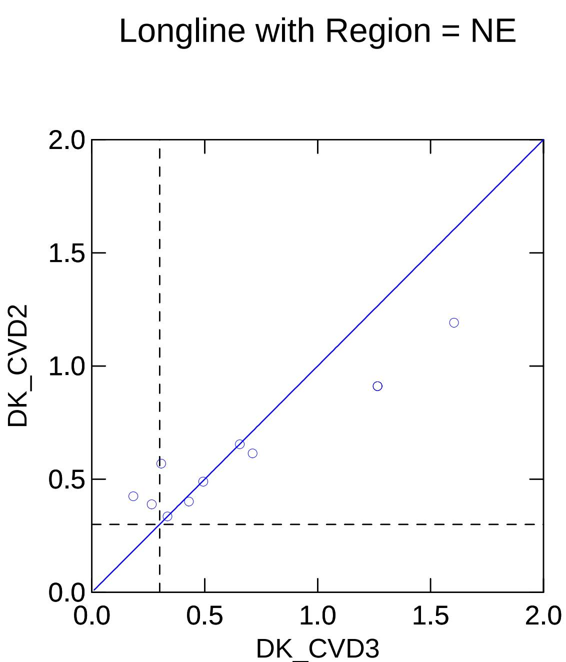


Figure B-6a. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard-to-days-absent (DDA), top panel, and discard-to-kept (DK), bottom panel, for New England longline; each dot represents a species group and mesh size.

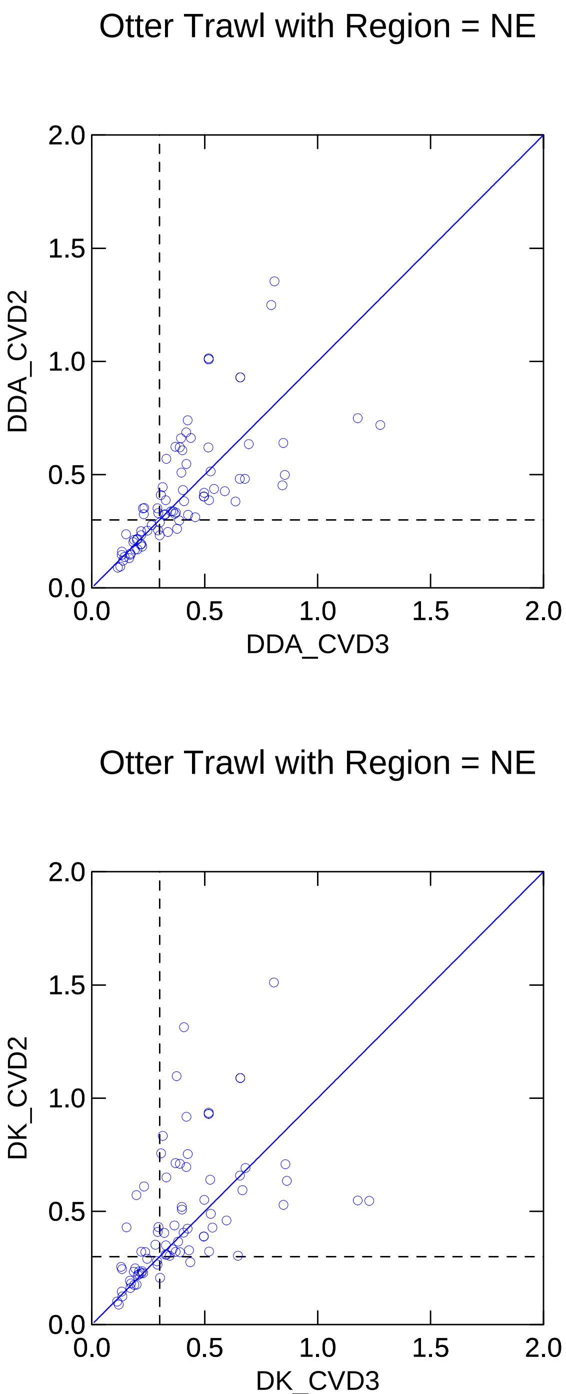


Figure B-6b. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3)for discard-to-days-absent (DDA), top panel, and discard-to-kept (DK), bottom panel, for New England otter trawl; each dot represents a species group and mesh size.

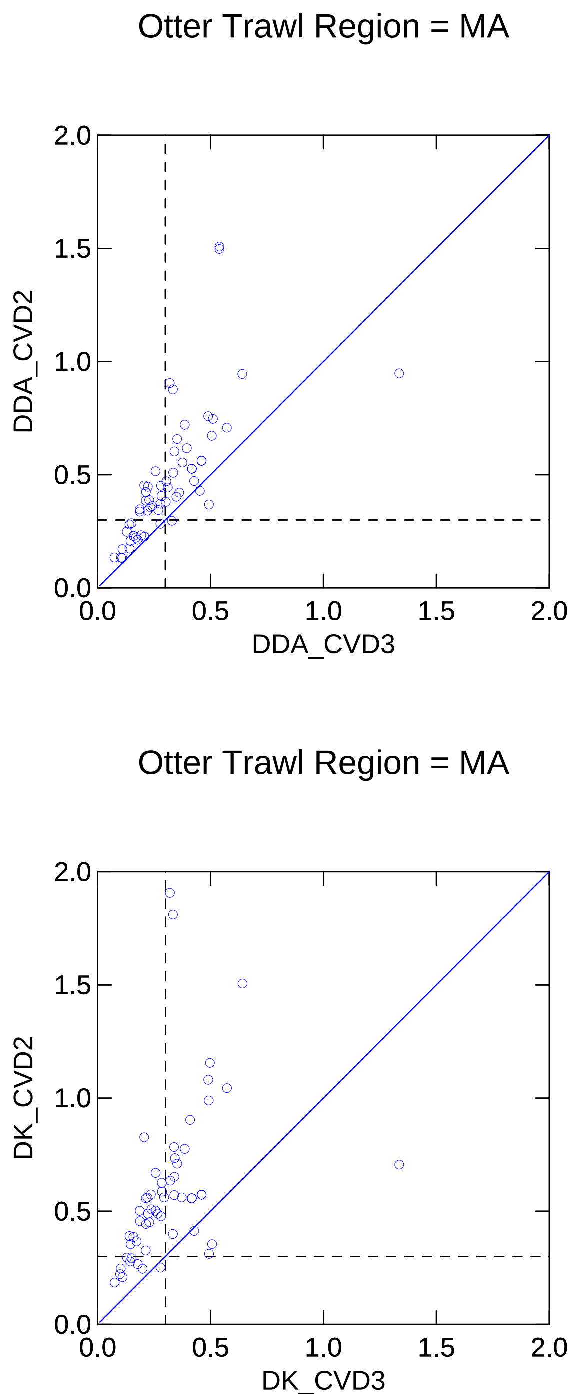


Figure B-6c. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3)for discard-to-days-absent (DDA), top panel, and discard-to-kept (DK), bottom panel, for Mid-Atlantic otter trawl; each dot represents a species group and mesh size.

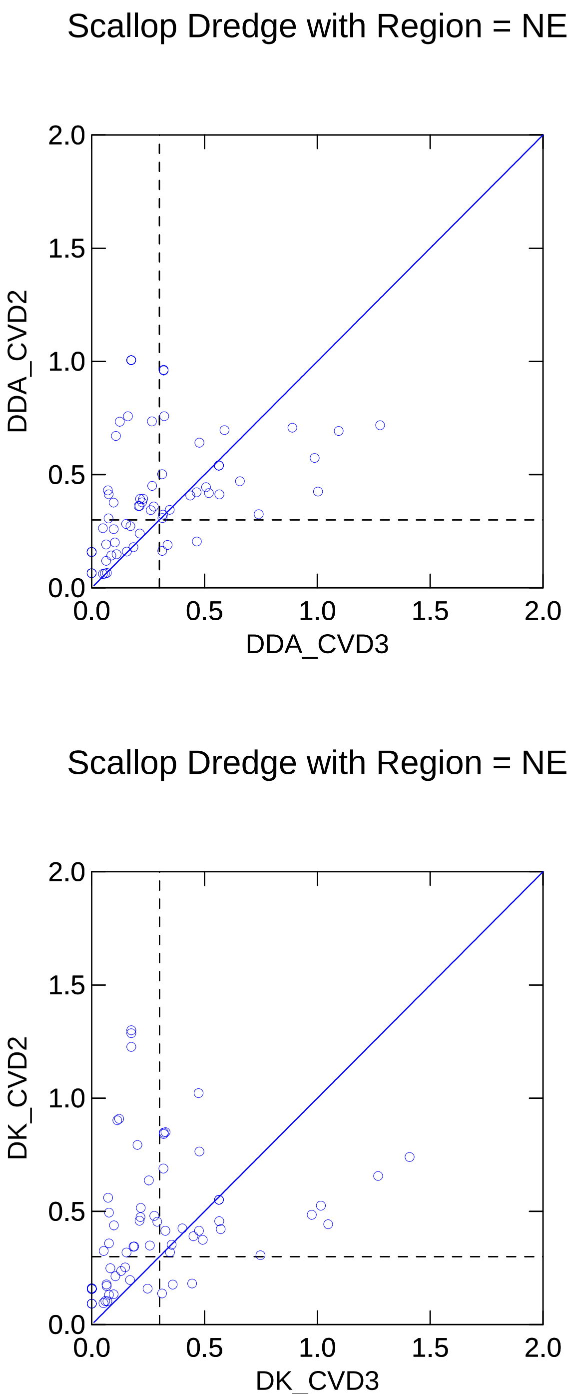


Figure B-6d. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard-to-days-absent (DDA), top panel, and discard-to-kept (DK), bottom panel, for New England scallop dredge; each dot represents a species group and mesh size.

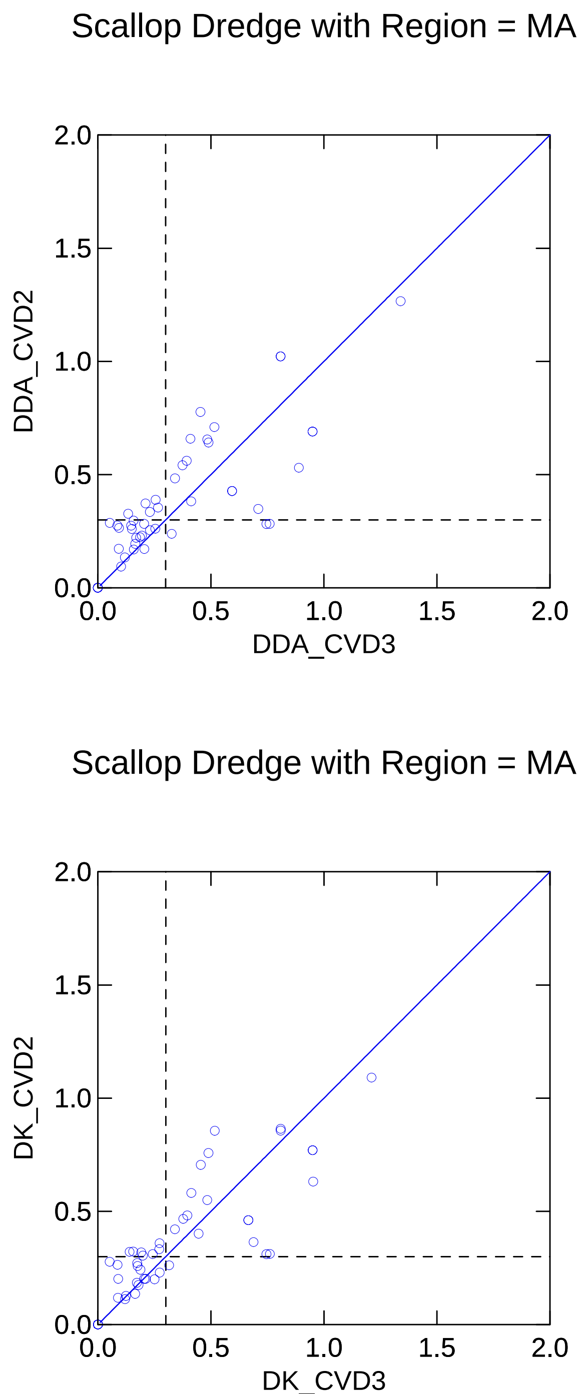


Figure B-6e. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard-to-days-absent (DDA), top panel, and discard-to-kept (DK), bottom panel, for Mid-Atlantic otter trawl; each dot represents a species group and mesh size.

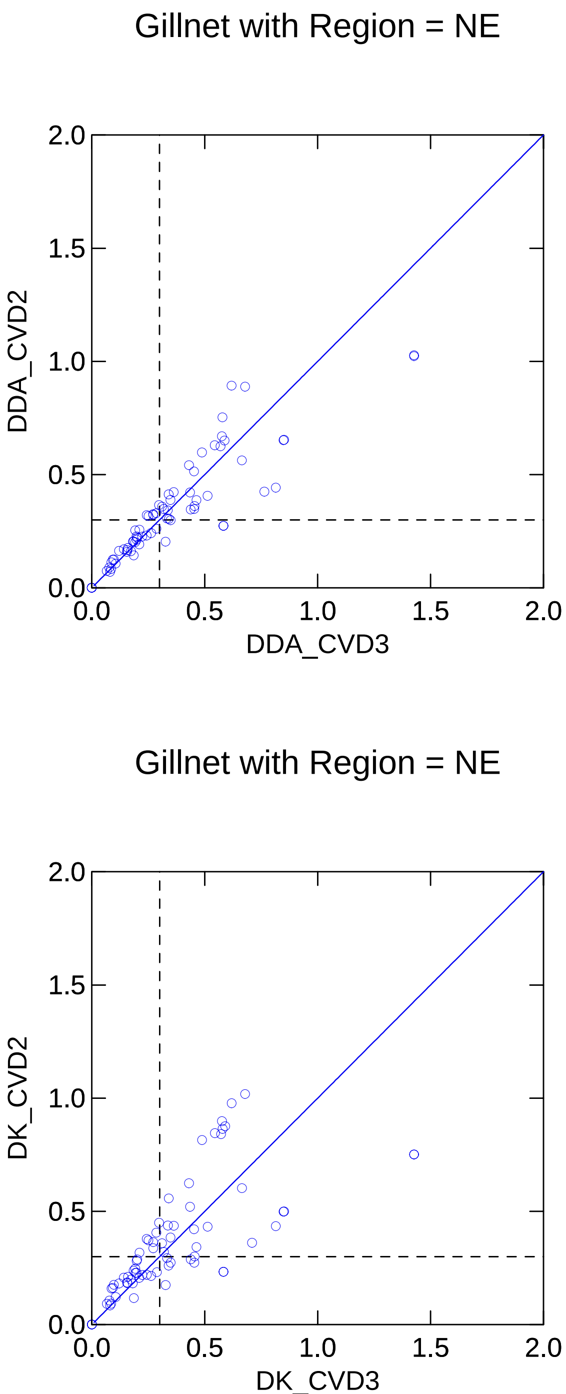


Figure B-6f. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard-to-days-absent (DDA), top panel, and discard-to-kept (DK), bottom panel, for New England gillnet; each dot represents a species group and mesh size.

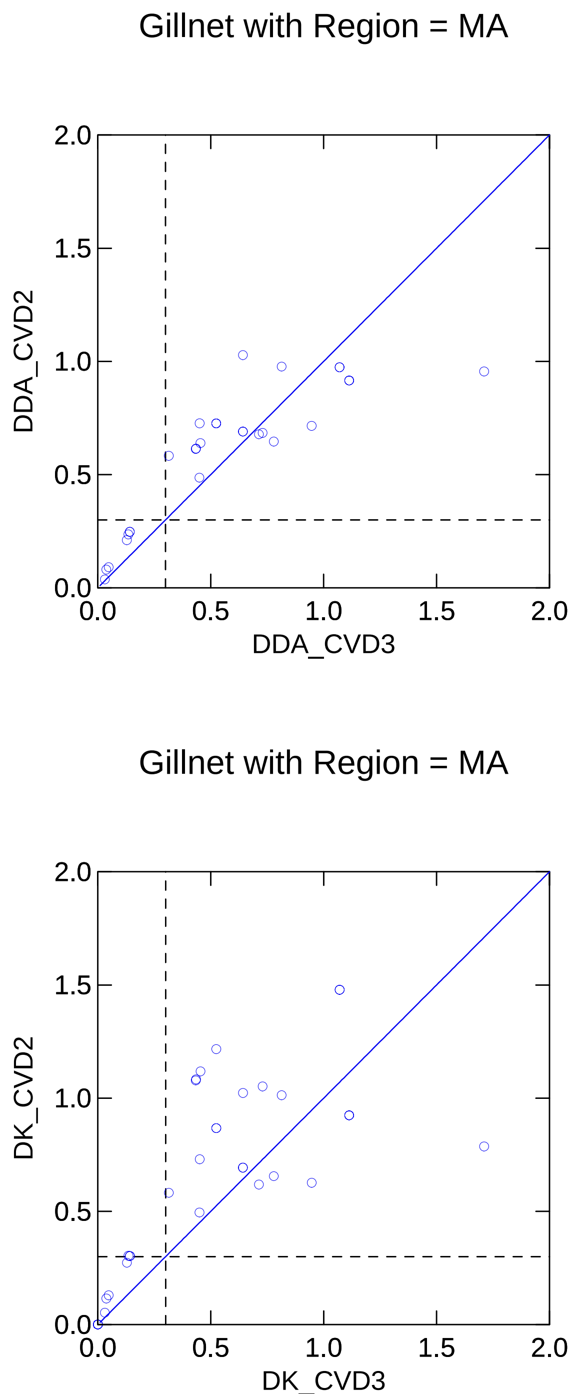
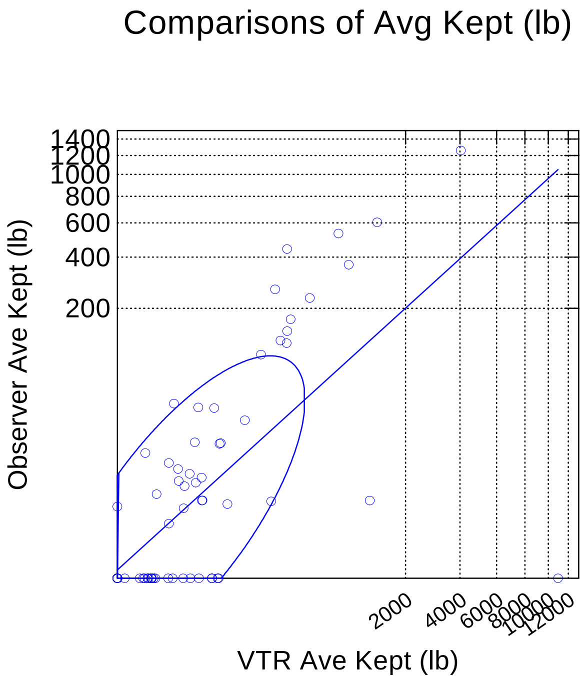
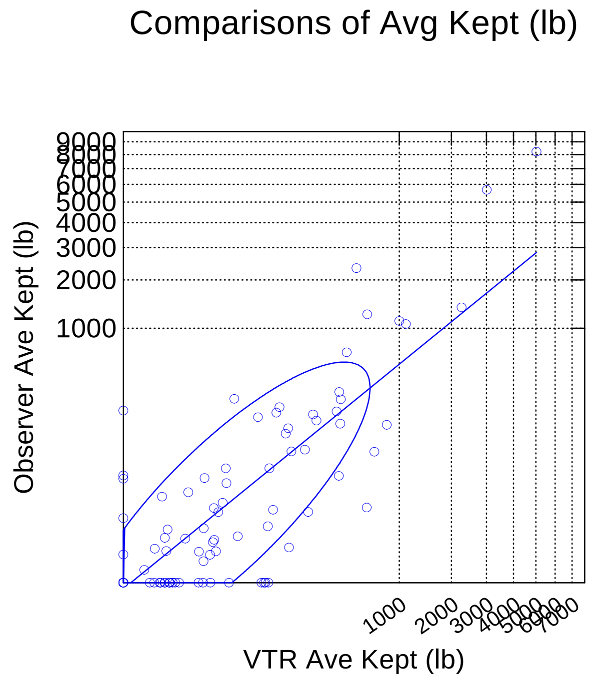


Figure B-6g. Comparisons of CV of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard-to-days-absent (DDA), top panel, and discard-to-kept (DK), bottom panel, for Mid-Atlantic gillnet; each dot represents a species group and mesh size.

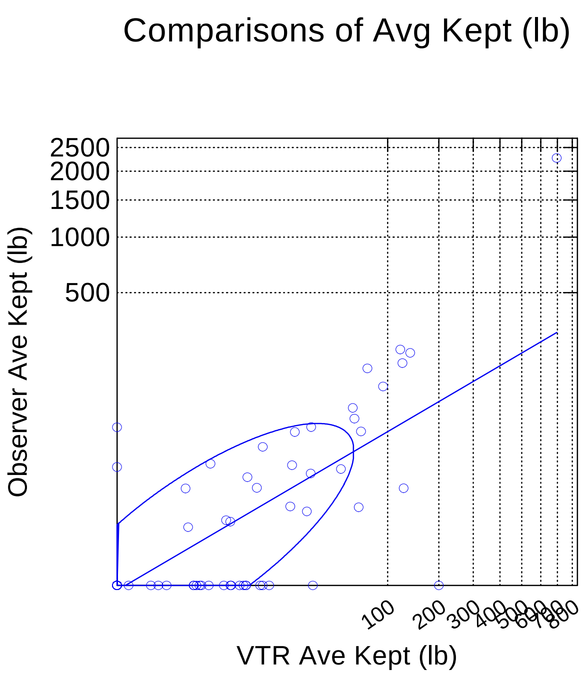
Bluefish



Fluke-Scup-Black Sea Bass



Spiny Dogfish



Northeast multispecies (Large-mesh)

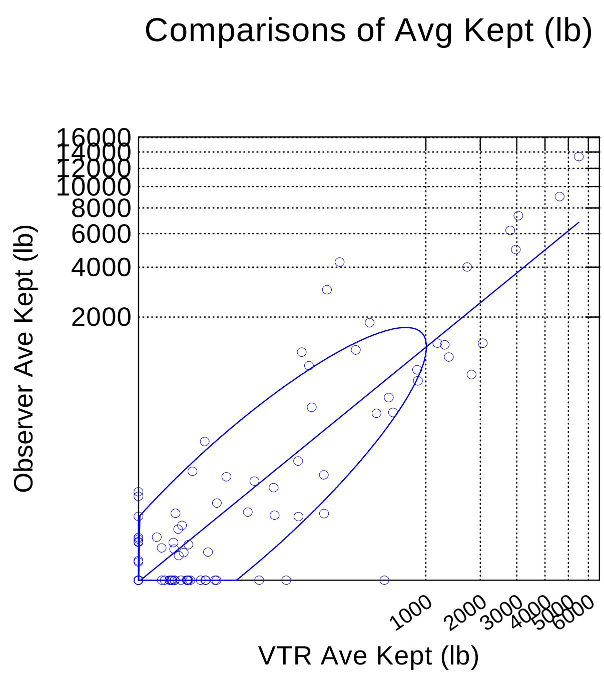
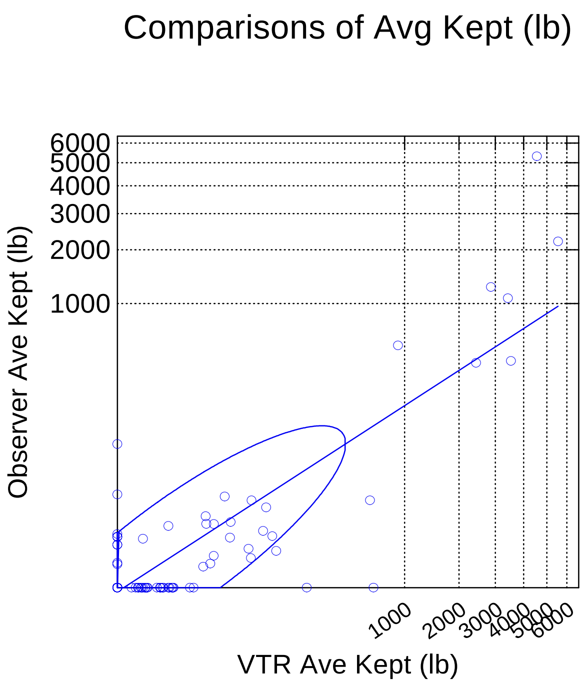
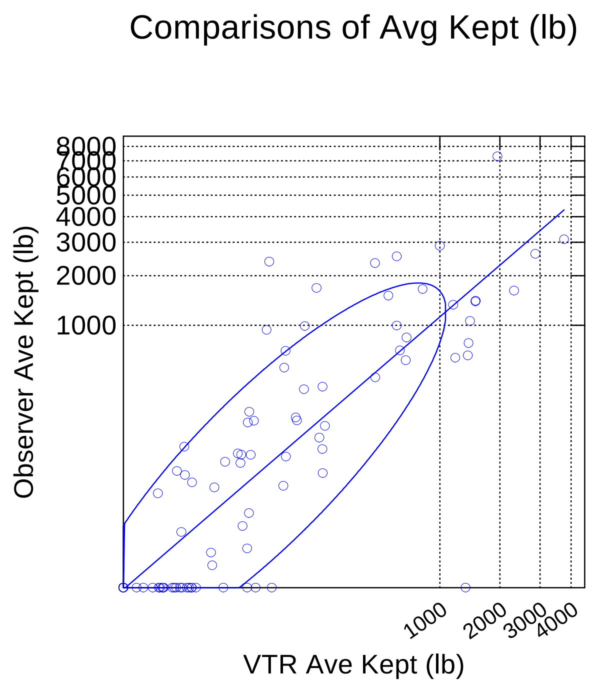


Figure B-7. Comparisons of average kept pounds (fourth root transformation used), by species group, in the Northeast Fisheries Observer Program and FVTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

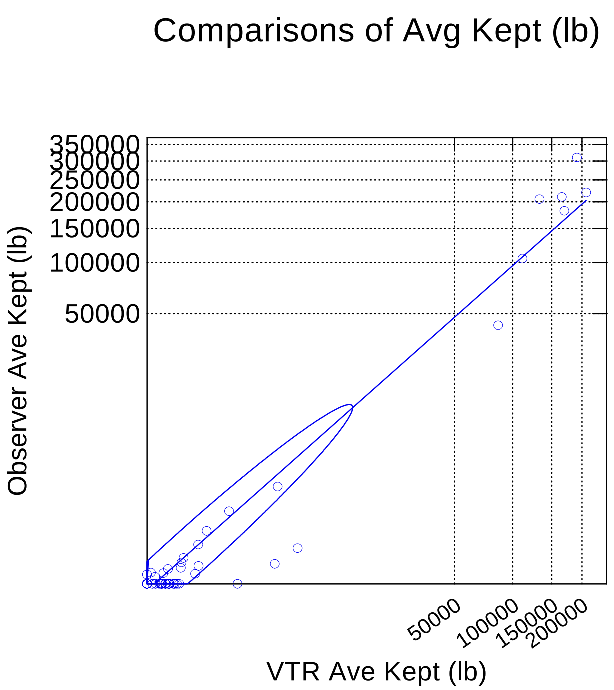
Northeast multispecies (Small-mesh)



Monkfish



Herring



Red Crab

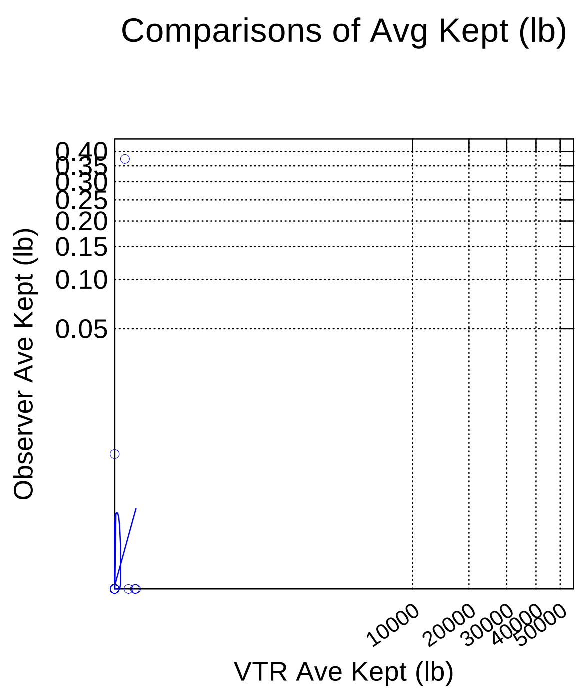
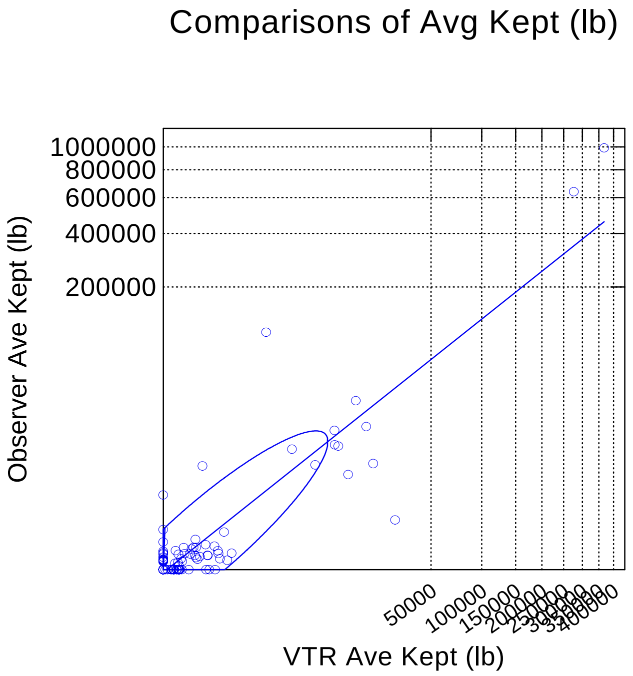
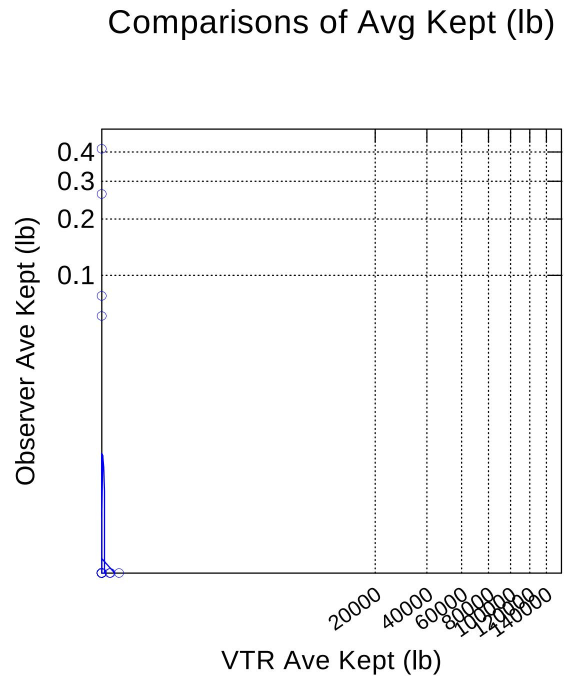


Figure B-7 continued. Comparisons of average kept pounds (fourth root transformation used), by species group, in the Northeast Fisheries Observer Program and FVTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

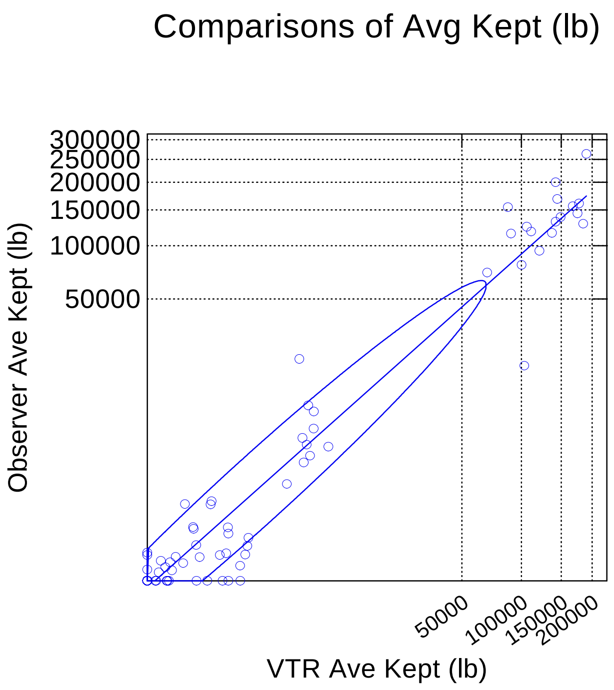
Mackerel-Squid-Butterfish



Surfclam – Ocean Quahog



Scallops



Skate Complex

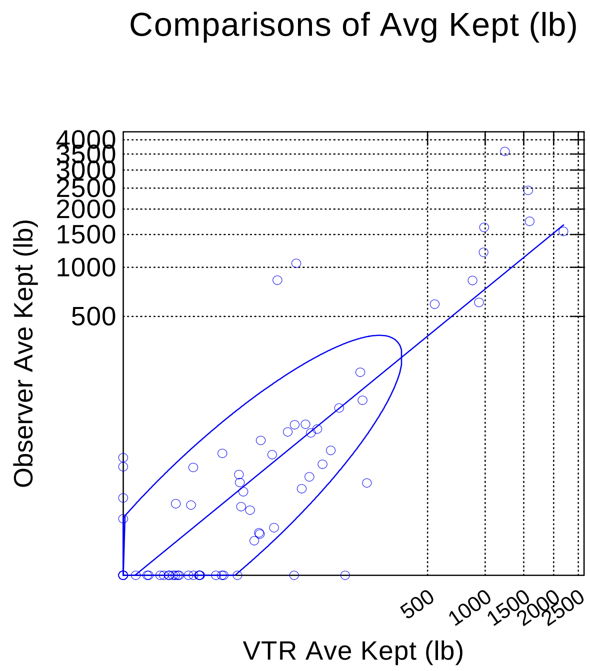
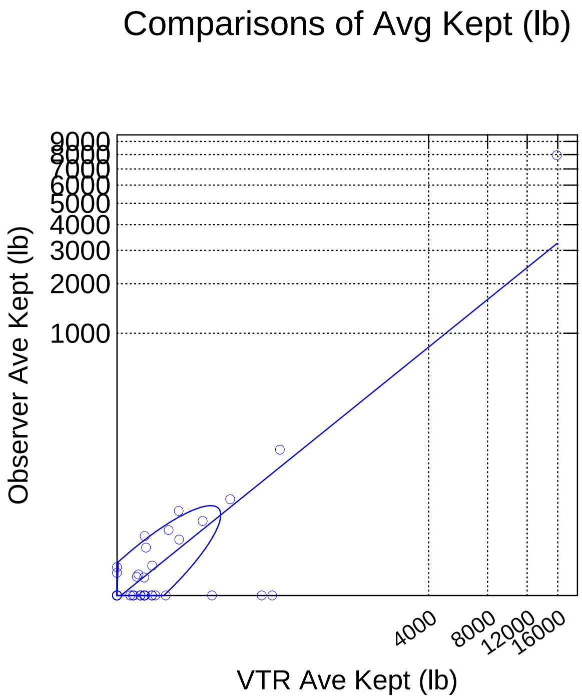


Figure B-7 continued. Comparisons of average kept pounds (fourth root transformation used), by species group, in the Northeast Fisheries Observer Program and FVTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

Tilefish



All Species

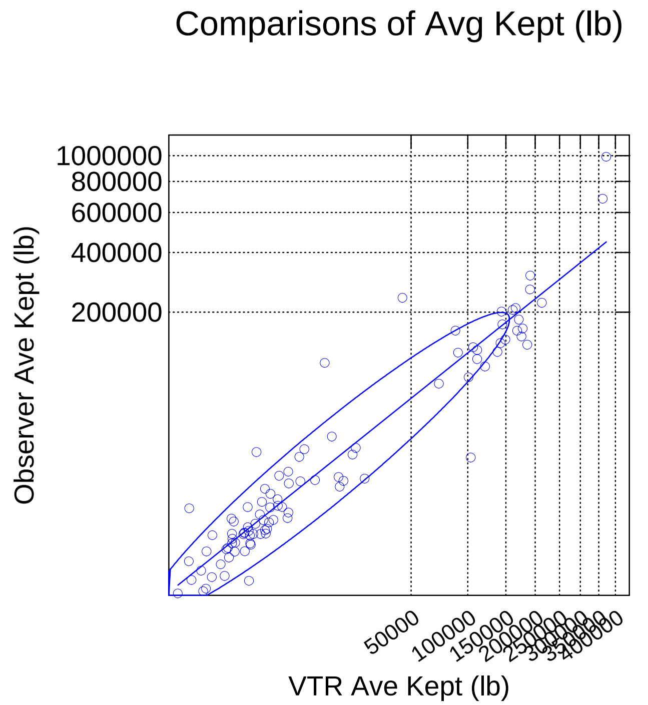
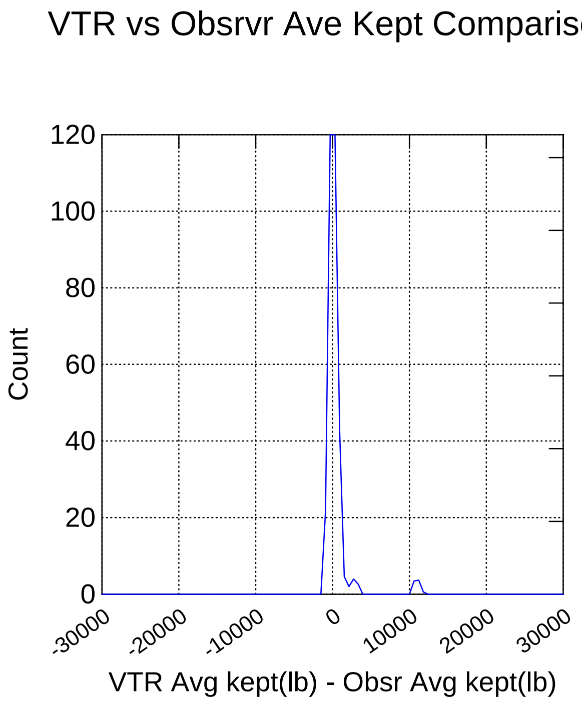
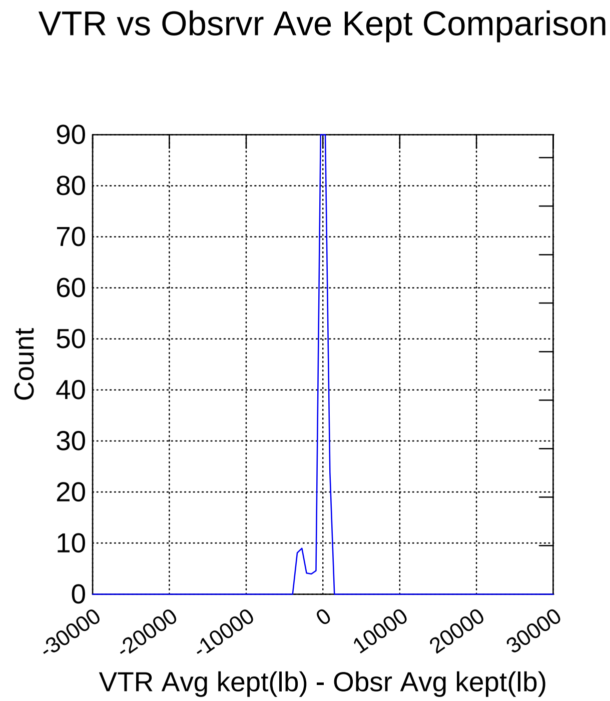


Figure B-7 continued. Comparisons of average kept pounds (fourth root transformation used), by species group, in the Northeast Fisheries Observer Program and FVTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

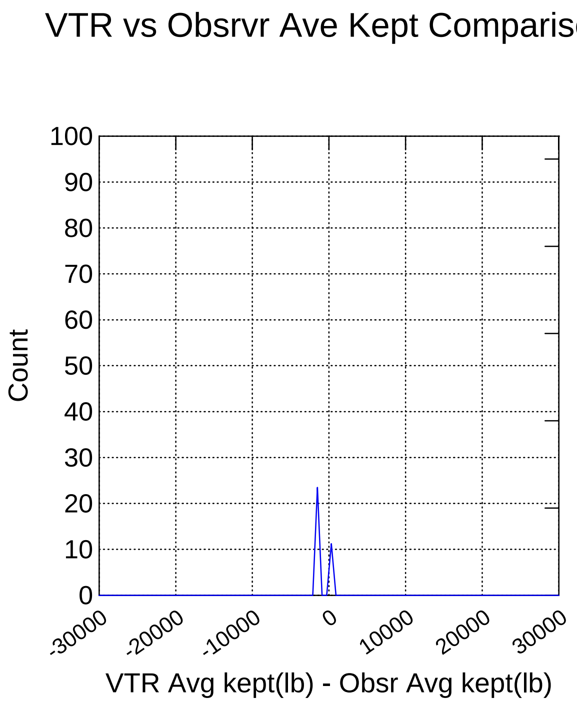
Bluefish



Fluke-Scup-Black Sea Bass



Spiny Dogfish



Northeast multispecies (Large-mesh)

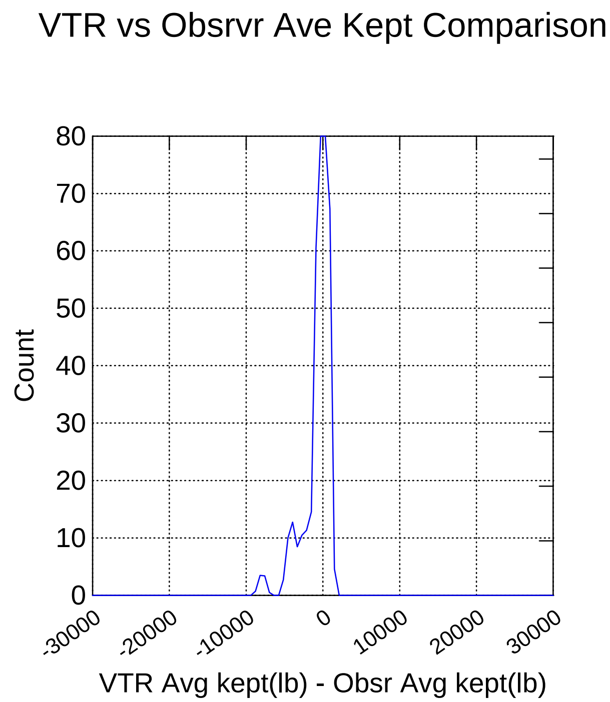
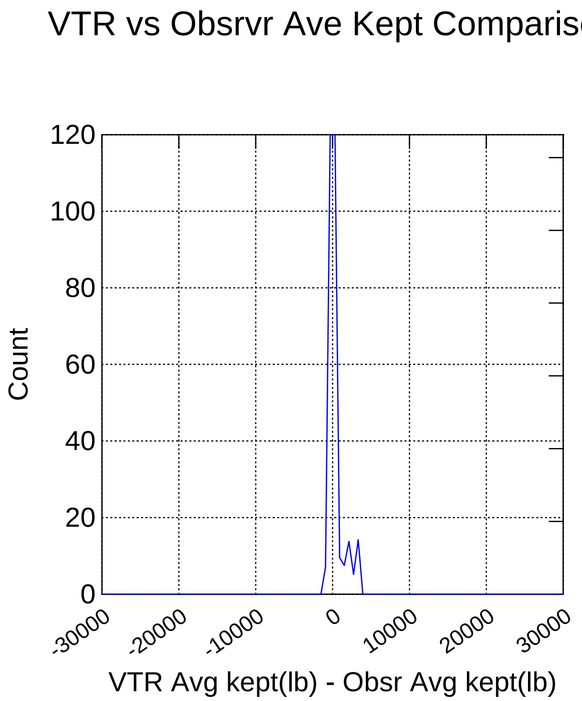
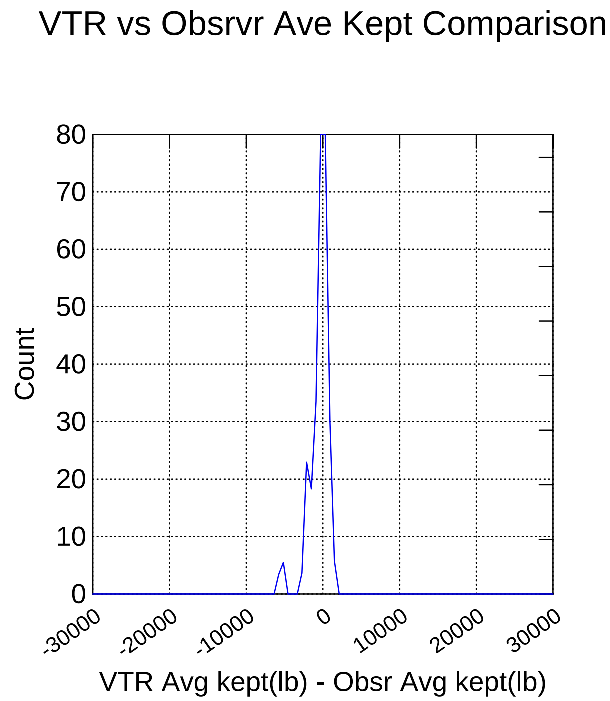


Figure B-8. The distribution of differences in the average kept pounds of species groups in the Northeast Fisheries Observer Program and the FVTR data for 2004.

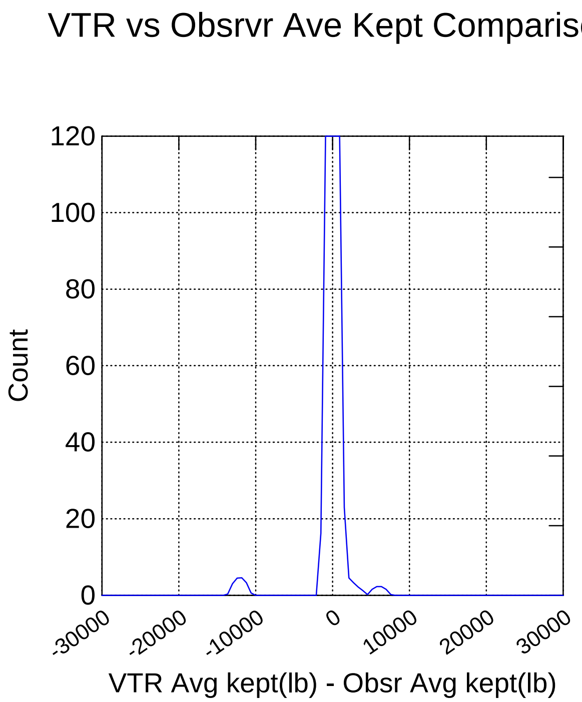
Northeast multispecies (Small-mesh)



Monkfish



Herring



Mackerel-Squid-Butterfish

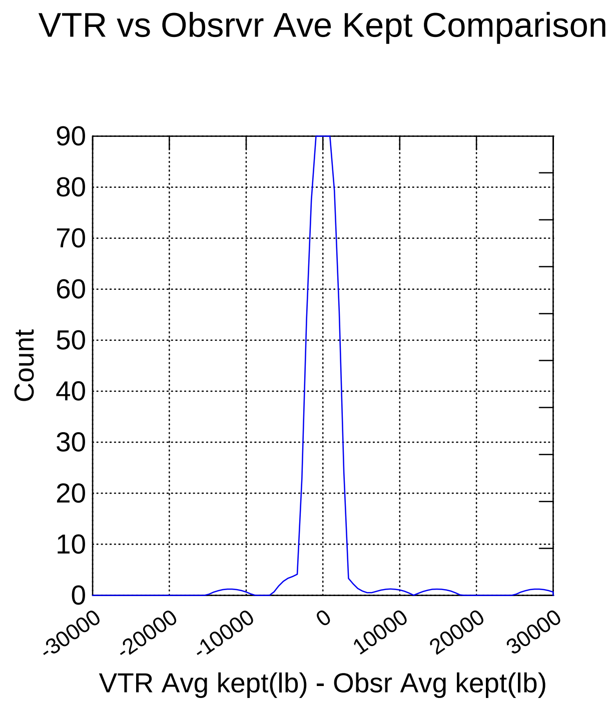
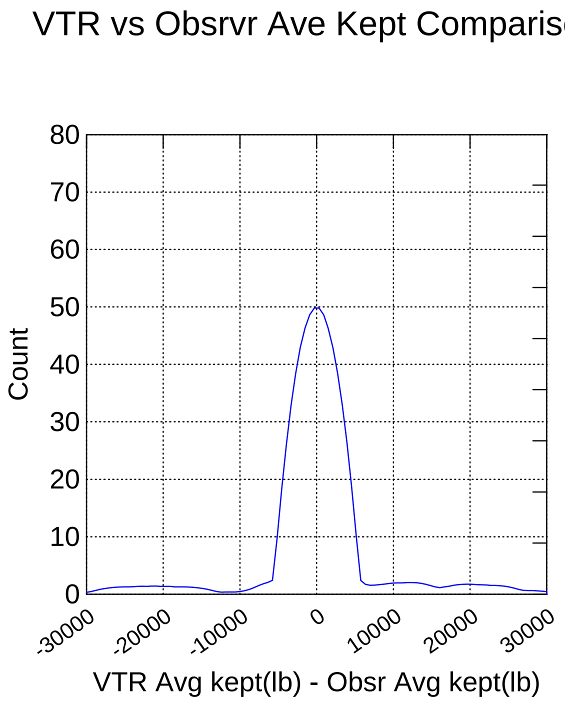
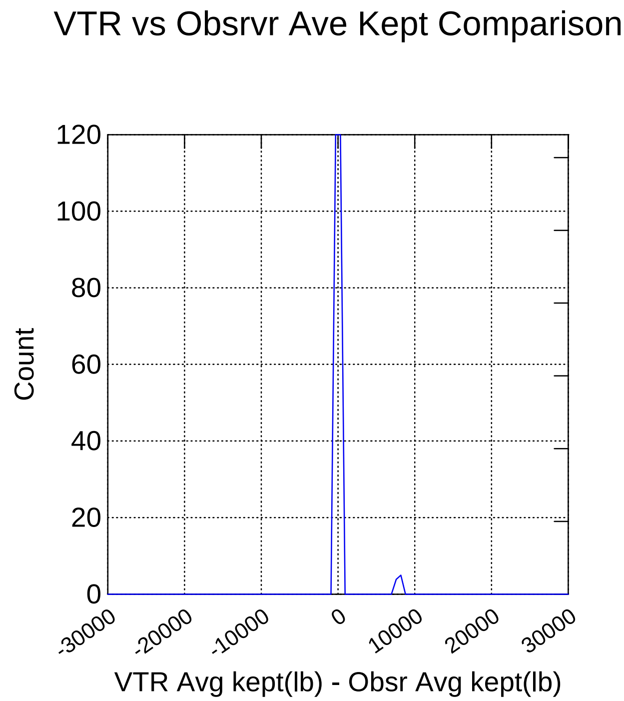


Figure B-8 continued. The distribution of differences in the average kept pounds of species groups in the Northeast Fisheries Observer Program and the FVTR data for 2004.

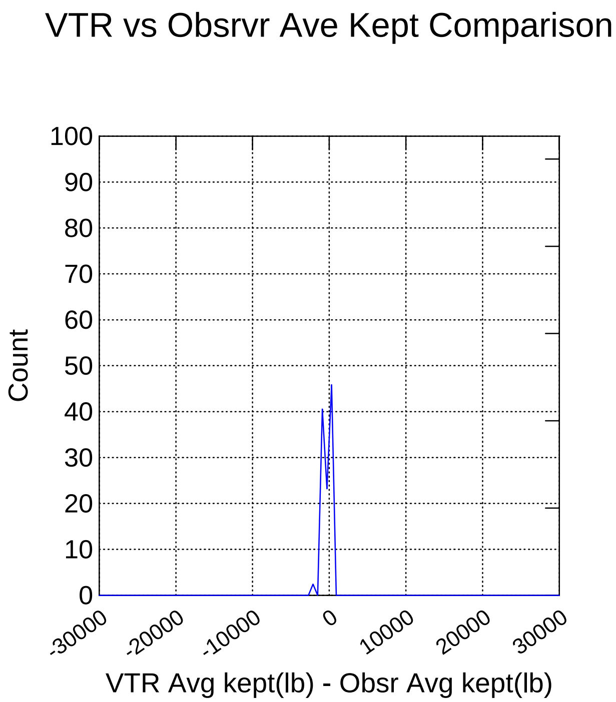
Scallops



Tilefish



Skate Complex



All species

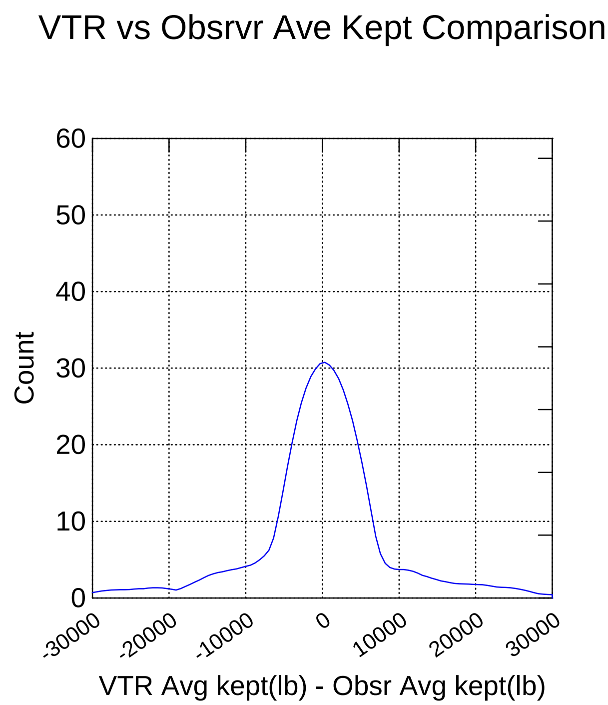
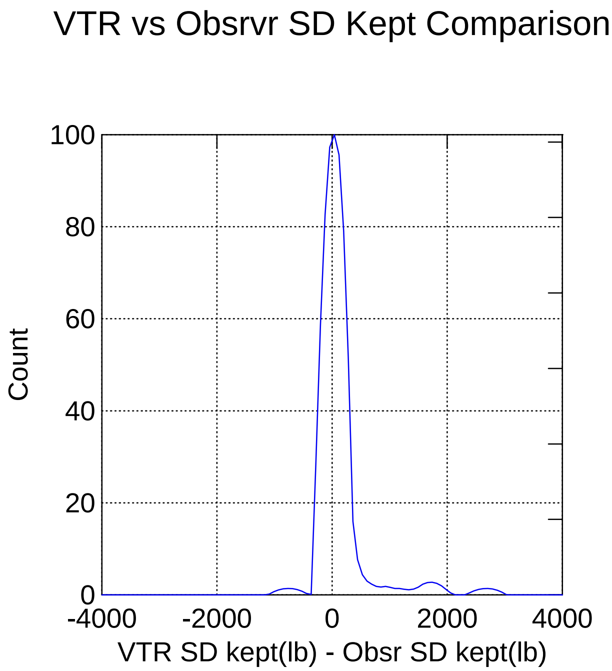
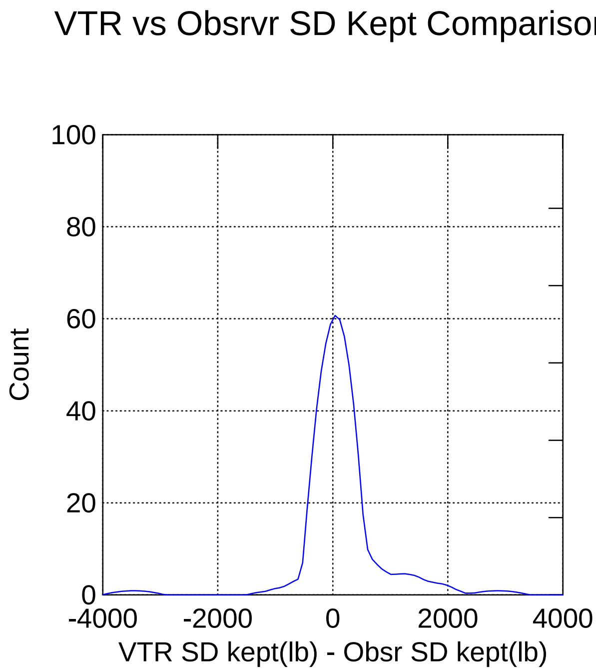


Figure B-8 continued. The distribution of differences in the average kept pounds of species groups in the Northeast Fisheries Observer Program and the FVTR data for 2004.

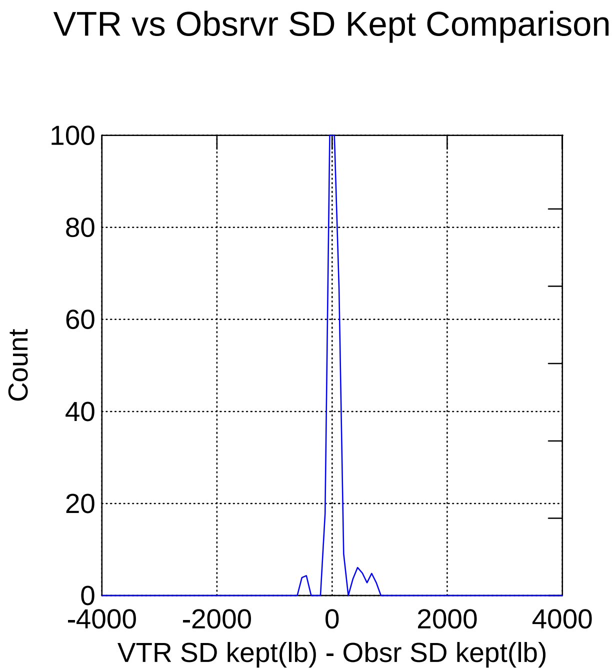
Bluefish



Fluke-Scup-Black Sea Bass



Spiny Dogfish



Northeast multispecies (Large-mesh)

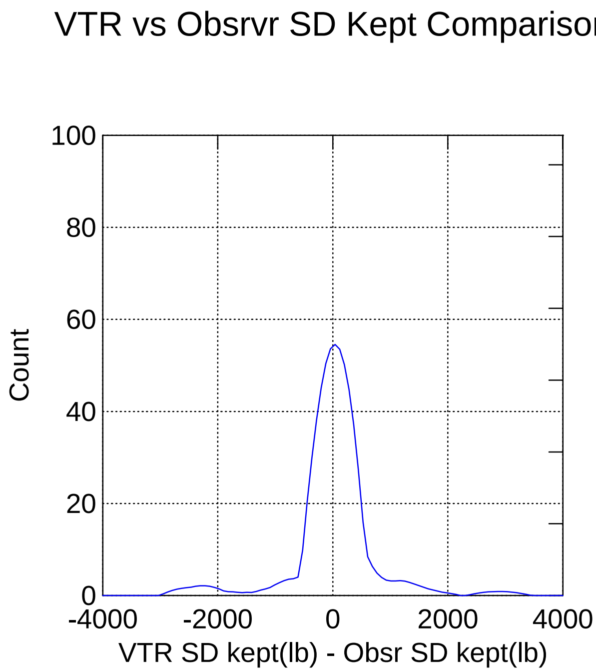
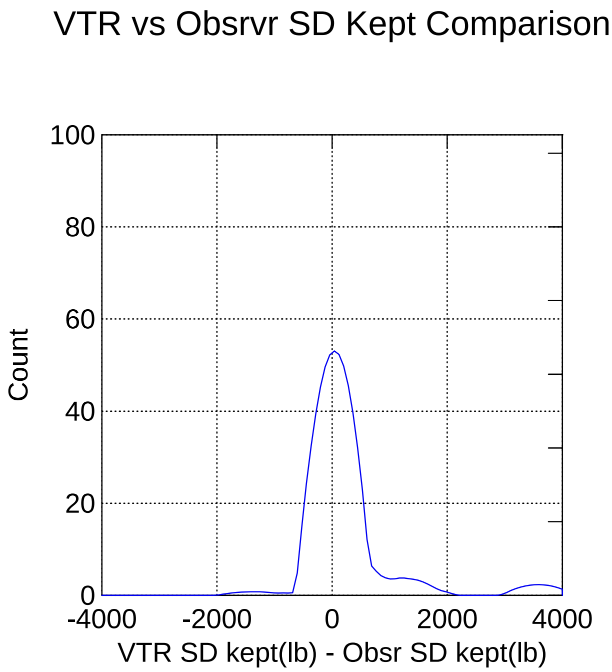
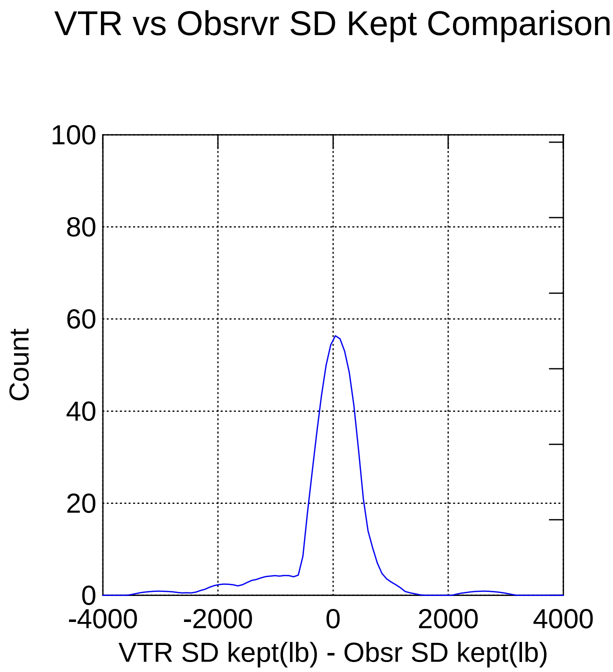


Figure B-9. The distribution of difference between the standard deviation of average kept pounds of species groups in the Northeast Fisheries Observer Program and the FVTR data for 2004.

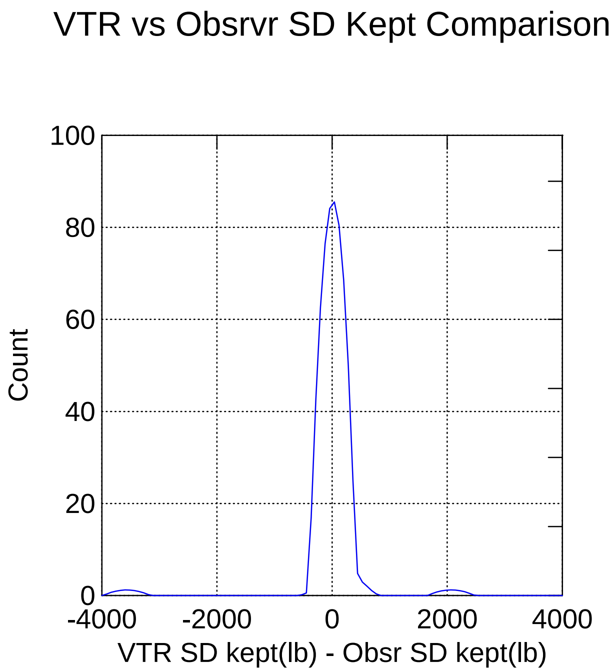
Northeast multispecies (small-mesh)



Monkfish



Herring



Mackerel-Squid-butterfish

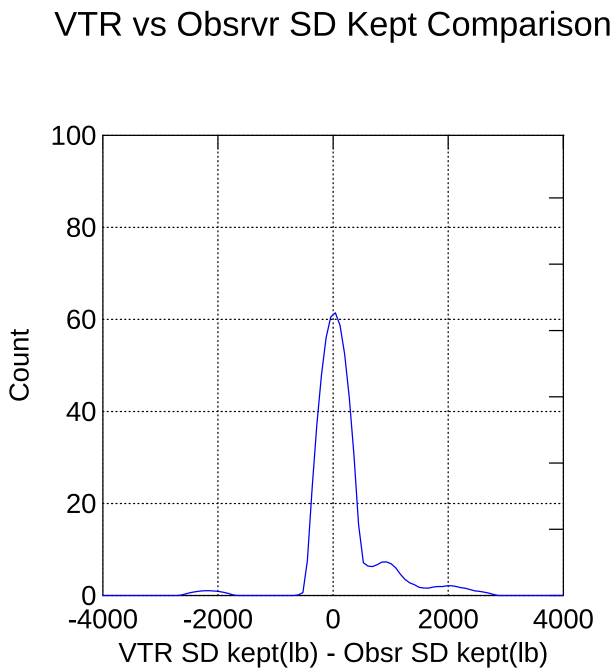
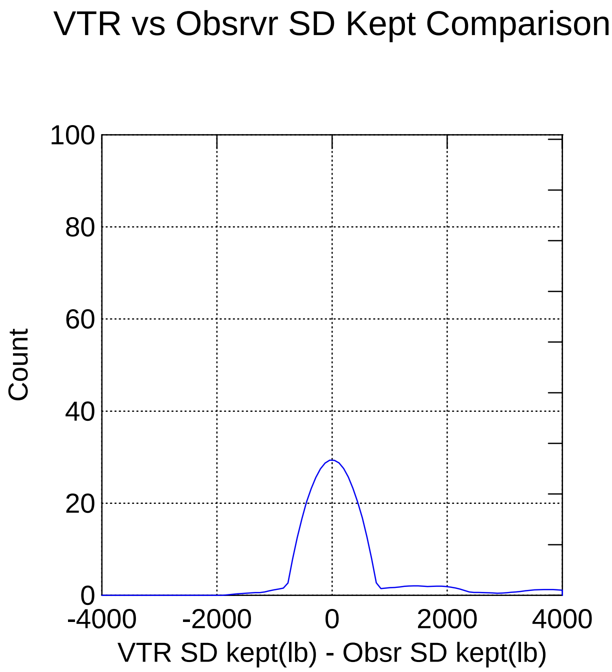
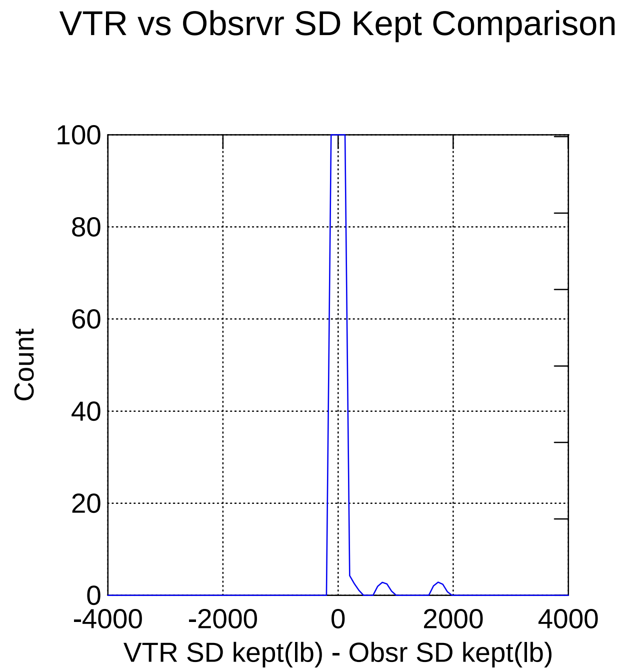


Figure B-9 continued. The distribution of difference between the standard deviation of average kept pounds of species groups in the Northeast Fisheries Observer Program and the FVTR data for 2004.

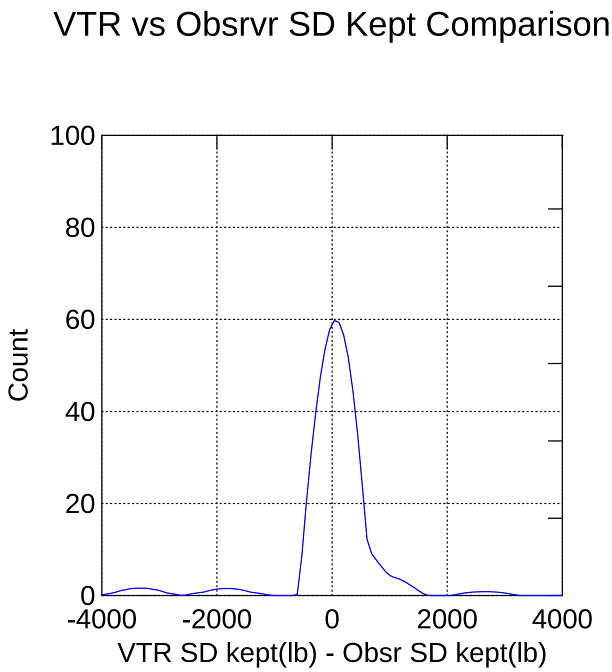
Scallop



Tilefish



Skate Complex



All Species

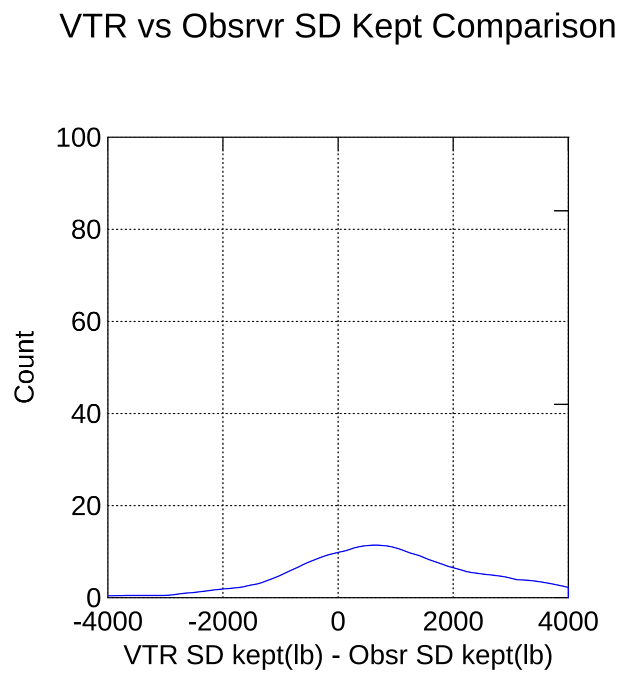


Figure B-9 continued. The distribution of difference between the standard deviation of average kept pounds of species groups in the Northeast Fisheries Observer Program and the FVTR data for 2004.

ALL TRIPS

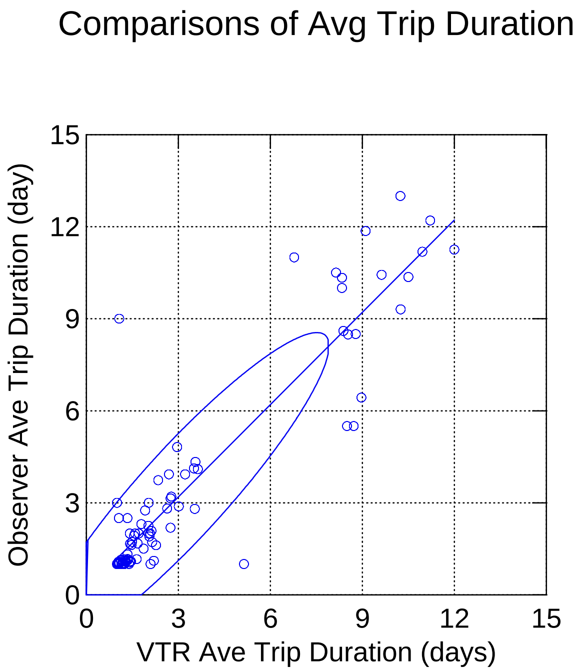
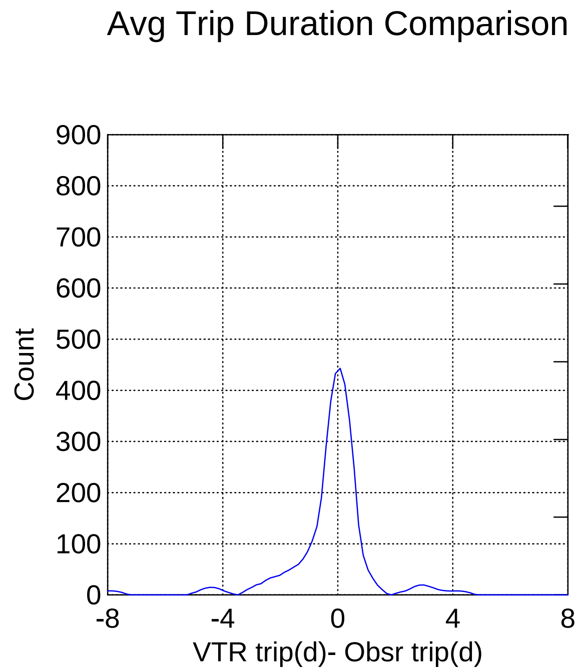


Figure B-10. Comparison of average trip duration (days) for all trips in the Northeast Fisheries Observer Program and FVTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

ALL TRIPS



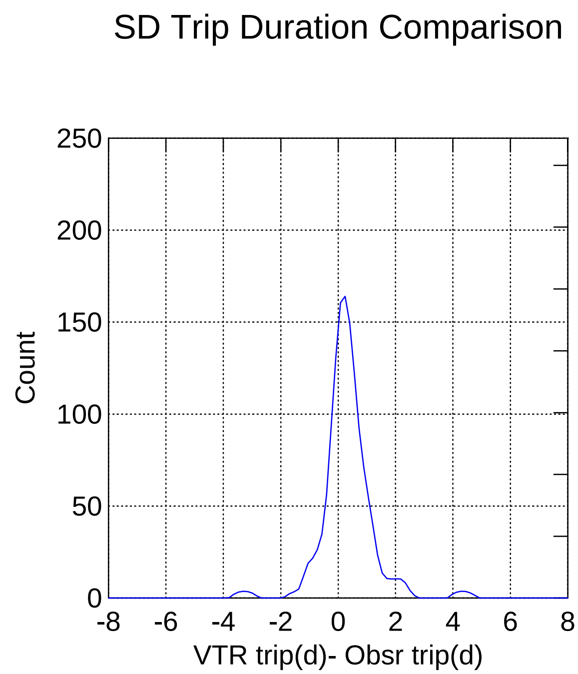


Figure B-11. The distribution of differences between the average trip duration (top), and standard deviation of average trip duration (bottom), for trips in the Northeast Fisheries Observer Program and the FVTR data for 2004

Table B-1. Precision (CV) of total discards, by species and fleet based on 2004 observer data .

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	BLUEFISH	HERRING	SALMON	RED CRAB	SCALLOP	MACK-/SQUID-/BUTTERFISH	Mackerel	Illex	Loligo	Butterfish	MONKFISH
Longline	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	*
Longline	all	all	MA	all											
Otter Trawl	all	all	NE	small	0.508	0.437	*	0.428	0.710	**0.227**	0.634	0.320	0.309	0.366	0.405
Otter Trawl	all	all	NE	large	2.474	1.313	*	**0.280**	0.350	0.572	0.520	1.097	0.610	0.756	**0.088**
Otter Trawl	all	all	MA	small	0.903	0.784	*	1.394	0.574	0.561	1.044	0.635	0.735	0.571	0.354
Otter Trawl	all	all	MA	large	1.906	0.775	*	*	0.444	0.390	0.489	0.710	0.456	0.502	**0.295**
Scallop Trawl	open	limited	MA	all	*	*	*	*	**0.000**	**0.000**	*	*	**0.000**	*	**0.000**
Scallop Trawl	open	general	MA	all	1.141	*	*	0.640	**0.224**	0.354	*	0.343	**0.252**	0.976	**0.194**
Shrimp Trawl	all	all	NE	all	*	0.479	*	*	0.965	0.981	*	*	*	0.981	**0.235**
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*
Sink, Anchor, Drift Gillnet	all	all	NE	small	*	*	*	*	*	**0.000**	**0.000**	*	*	*	*
Sink, Anchor, Drift Gillnet	all	all	NE	large	**0.220**	**0.229**	*	0.625	0.969	0.841	0.876	1.067	*	1.520	**0.210**
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	**0.181**	0.378	*	0.998	0.421	0.498	0.500	*	*	0.906	**0.174**
Sink, Anchor, Drift Gillnet	all	all	MA	small	*	*	*	*	*	**0.000**	*	*	*	**0.000**	*
Sink, Anchor, Drift Gillnet	all	all	MA	large	1.216	*	*	*	*	*	*	*	*	*	*
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	0.304	*	*	*	0.587	*	*	*	*	*	**0.273**
Scallop Dredge	open	limited	NE	all	*	*	*	0.842	**0.159**	0.689	*	0.490	1.112	1.662	0.319
Scallop Dredge	open	limited	MA	all	*	*	*	1.304	**0.200**	0.305	1.304	0.514	0.383	0.620	**0.174**
Scallop Dredge	open	general	NE	all	*	*	*	*	**0.094**	1.274	*	1.274	*	*	0.560
Scallop Dredge	open	general	MA	all	*	*	*	*	0.359	0.865	*	*	0.865	*	**0.202**
Scallop Dredge	closed	limited	NE	all	0.934	**0.160**	*	0.793	**0.170**	0.425	**0.160**	0.511	0.443	**0.195**	**0.252**
Scallop Dredge	closed	limited	MA	all	0.992	0.580	*	**0.295**	**0.202**	0.318	0.558	0.365	0.615	**0.295**	**0.262**
Scallop Dredge	closed	general	NE	all											
Scallop Dredge	closed	general	MA	all	*	*	*	*	**0.000**	*	*	*	*	*	**0.000**
Mid-water paired & single Trawl	all	all	NE	all	0.770	0.770	*	*	1.464	0.429	0.430	0.872	1.457	1.387	0.724
Mid-water paired & single Trawl	all	all	MA	all	0.539	0.982	*	*	*	0.546	0.540	0.547	0.539	0.539	1.108
Fish Pots/ Traps	all	all	NE	all											
Fish Pots/ Traps	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	0.408
Purse Seine	all	all	NE	all	*	0.981	*	*	*	0.935	*	0.935	*	*	*
Purse Seine	all	all	MA	all											
Hand Line	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	*
Hand Line	all	all	MA	all											
Scottish Seine	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	*
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, CV is null (*); Gray-shaded cells indicate unlikely species/gear combinations.

Table B-1 *continued.* Precision (CV) of total discards, by species and fleet based on 2004 observer data .

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	NE MULTI-SPP (LARGE-MESH)	Cod	Had-dock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Window-pane	Halibut	Ocean pout
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	**0.137**	0.443	0.366	**0.181**	0.740	**0.249**	**0.177**	*	*	0.456	0.306	**0.160**	0.414
Scallop Dredge	closed	limited	MA	all	0.631	*	*	1.044	**0.295**	0.356	1.053	*	*	0.624	0.726	*	1.023
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	0.742	*	*	*	*	1.166	*	*	*	0.542	*	*	*
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, CV is null (*); Gray-shaded cells indicate unlikely species/gear combinations.

Table B-1 *continued.* Precision (CV) of total discards, by species and fleet based on 2004 observer data .

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	NE MULTI-SPP (SMALL-MESH)	Silver hake	Offshore hake	Red hake	SKATE	DOGFISH	FLUKE/-SCUP/-BLK SEA BASS	Fluke	Scup	Black sea bass	SURF CLAM/-OCEAN QUAHOG	TILEFISH	
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	0.374	0.390	0.649	0.421	**0.134**	0.349	0.344	0.345	0.450	**0.160**	0.412	*	
Scallop Dredge	closed	limited	MA	all	**0.264**	0.321	*	**0.277**	**0.135**	0.364	0.311	0.312	0.921	0.365	**0.295**	*	
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**	1.172	1.164	*	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 = 0, CV is null (*); Gray-shaded cells indicate unlikely species/gear combinations.

Table B-1 *continued.* Precision (CV) of total discards, by species and fleet based on 2004 observer data .

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	TURTLES	TURTLE, GREEN	TURTLE, LEATHERBACK	TURTLE, LOGGERHEAD	TURTLE, KEMP'S RIDLEY	TURTLE, NK	SEALS	SEAL, HARP	SEAL, HOODED	SEAL, HARBOR	SEAL, GRAY	SEAL, NK	WHALES
Longline	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Longline	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Otter Trawl	all	all	NE	small	*	*	*	*	*	*	*	*	*	*	*	*	0.931
Otter Trawl	all	all	NE	large	*	*	*	*	*	*	*	*	*	*	*	*	1.089
Otter Trawl	all	all	MA	small	0.573	*	*	0.573	*	*	*	*	*	*	*	*	*
Otter Trawl	all	all	MA	large	*	*	*	*	*	*	*	*	*	*	*	*	*
Scallop Trawl	open	limited	MA	all	0.381	*	*	0.381	*	*	*	*	*	*	*	*	*
Scallop Trawl	open	general	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Shrimp Trawl	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Sink, Anchor, Drift Gillnet	all	all	NE	small	*	*	*	*	*	*	*	*	*	*	*	*	*
Sink, Anchor, Drift Gillnet	all	all	NE	large	*	*	*	*	*	*	**0.206**	**0.293**	*	**0.273**	0.520	*	*
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	*	*	*	*	*	*	**0.215**	0.435	0.751	0.320	**0.273**	*	*
Sink, Anchor, Drift Gillnet	all	all	MA	small	0.626	*	0.787	*	*	1.013	*	*	*	*	*	*	*
Sink, Anchor, Drift Gillnet	all	all	MA	large	1.052	1.479	*	1.478	*	*	*	*	*	*	*	*	*
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	0.495	*	0.730	0.656	*	*	0.692	*	*	1.023	0.924	*	*
Scallop Dredge	open	limited	NE	all	0.551	*	*	0.551	*	*	*	*	*	*	*	*	*
Scallop Dredge	open	limited	MA	all	0.770	*	*	0.770	*	*	*	*	*	*	*	*	*
Scallop Dredge	open	general	NE	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Scallop Dredge	open	general	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Scallop Dredge	closed	limited	NE	all	**0.157**	*	*	**0.157**	*	*	*	*	*	*	*	*	*
Scallop Dredge	closed	limited	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Scallop Dredge	closed	general	NE	all													
Scallop Dredge	closed	general	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Mid-water paired & single Trawl	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	*	*	1.114
Mid-water paired & single Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Fish Pots/ Traps	all	all	NE	all													
Fish Pots/ Traps	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Purse Seine	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Purse Seine	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Hand Line	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Hand Line	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Scottish Seine	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	*	*	*
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, CV is null (*); Gray-shaded cells indicate unlikely species/gear combinations.

Table B-1 *continued.* Precision (CV) of total discards, by species and fleet based on 2004 observer data.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	WHALE, PILOT, LONG-FIN	WHALE, MINKE	WHALE, NK	DOLPHINS/-PORPOISE	DOLPHIN WHITE-SIDED	DOLPHIN-COMMON	DOLPHIN-BOTTLE-NOSE	PORPOISE, HARBOR	PORPOISE/DOLPHIN, NK	SEA BIRDS (ALL)	ALL SPECIES	PILOT coverage
Longline	all	all	NE	all	*	*	*	*	*	*	*	*	*	0.425	0.489	
Longline	all	all	MA	all	*	*	*	*	*	*	*	*	*	*		pilot
Otter Trawl	all	all	NE	small	0.931	*	*	0.650	0.936	0.713	*	*	*	0.548	**0.193**	
Otter Trawl	all	all	NE	large	1.089	*	*	0.389	0.389	*	*	*	*	0.489	**0.124**	
Otter Trawl	all	all	MA	small	*	*	*	0.557	*	0.557	*	*	*	0.706	**0.247**	
Otter Trawl	all	all	MA	large	*	*	*	*	*	*	*	*	*	0.672	**0.185**	
Scallop Trawl	open	limited	MA	all	*	*	*	*	*	*	*	*	*	*	**0.000**	pilot
Scallop Trawl	open	general	MA	all	*	*	*	*	*	*	*	*	*	*	**0.243**	pilot
Shrimp Trawl	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	0.310	
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	**0.052**	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	small	*	*	*	*	*	*	*	*	*	*	**0.000**	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	large	*	*	*	0.359	0.977	*	*	0.384	*	0.342	**0.092**	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	*	*	*	**0.288**	*	*	0.751	0.300	*	0.602	**0.085**	
Sink, Anchor, Drift Gillnet	all	all	MA	small	*	*	*	*	*	*	*	*	*	0.582	**0.000**	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	*	*	*	*	*	*	*	*	*	0.618	1.078	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	*	*	*	0.924	*	*	*	0.924	*	0.693	**0.052**	pilot for fish
Scallop Dredge	open	limited	NE	all	*	*	*	*	*	*	*	*	*	0.896	**0.197**	
Scallop Dredge	open	limited	MA	all	*	*	*	*	*	*	*	*	*	*	**0.112**	
Scallop Dredge	open	general	NE	all	*	*	*	*	*	*	*	*	*	*	0.325	pilot
Scallop Dredge	open	general	MA	all	*	*	*	*	*	*	*	*	*	*	**0.184**	
Scallop Dredge	closed	limited	NE	all	*	*	*	*	*	*	*	*	*	**0.157**	**0.132**	
Scallop Dredge	closed	limited	MA	all	*	*	*	*	*	*	*	*	*	*	**0.118**	
Scallop Dredge	closed	general	NE	all												pilot
Scallop Dredge	closed	general	MA	all	*	*	*	*	*	*	*	*	*	*	**0.000**	pilot
Mid-water paired & single Trawl	all	all	NE	all	1.114	*	*	0.786	0.786	*	*	*	*	0.554	0.317	
Mid-water paired & single Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	0.412	
Fish Pots/ Traps	all	all	NE	all												pilot
Fish Pots/ Traps	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	**0.137**	pilot
Purse Seine	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	0.715	
Purse Seine	all	all	MA	all	*	*	*	*	*	*	*	*	*	*		pilot
Hand Line	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	4.030	pilot
Hand Line	all	all	MA	all	*	*	*	*	*	*	*	*	*	*		pilot
Scottish Seine	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	0.423	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

Note: when discard ratio = 0, 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.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	BLUEFISH	HERRING	SALMON	RED CRAB	SCALLOP	Mackerel	Illex	Loligo	Butterfish	MONKFISH
Longline	all	all	NE	all	8	8	*	8	8	8	8	8	8	8
Longline	all	all	MA	all										
Otter Trawl	all	all	NE	small	16	12	*	25	29	6	5	8	4	7
Otter Trawl	all	all	NE	large	22	23	*	12	20	29	27	31	30	3
Otter Trawl	all	all	MA	small	14	22	*	26	15	5	7	11	4	13
Otter Trawl	all	all	MA	large	16	24	*	26	6	21	20	12	15	8
Scallop Trawl	open	limited	MA	all	8	8	*	8	1	8	8	6	8	4
Scallop Trawl	open	general	MA	all	15	20	*	12	2	20	16	9	11	4
Shrimp Trawl	all	all	NE	all	20	1	*	20	17	20	20	20	19	14
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*
Sink, Anchor, Drift Gillnet	all	all	NE	small	3	3	*	3	3	2	3	3	3	3
Sink, Anchor, Drift Gillnet	all	all	NE	large	9	15	*	22	24	12	23	27	25	8
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	6	19	*	21	18	8	27	27	23	3
Sink, Anchor, Drift Gillnet	all	all	MA	small	4	4	*	4	4	4	4	4	2	4
Sink, Anchor, Drift Gillnet	all	all	MA	large	2	5	*	5	5	5	5	5	5	5
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	4	7	*	7	6	7	7	7	7	3
Scallop Dredge	open	limited	NE	all	26	26	*	24	1	26	17	16	18	3
Scallop Dredge	open	limited	MA	all	24	24	*	22	1	23	14	12	18	3
Scallop Dredge	open	general	NE	all	17	17	*	17	3	17	14	17	17	1
Scallop Dredge	open	general	MA	all	16	16	*	16	2	16	16	13	16	3
Scallop Dredge	closed	limited	NE	all	19	28	*	25	1	27	20	13	24	3
Scallop Dredge	closed	limited	MA	all	20	19	*	24	1	15	14	12	23	3
Scallop Dredge	closed	general	NE	all										
Scallop Dredge	closed	general	MA	all	5	5	*	5	1	5	5	5	5	3
Mid-water paired & single Trawl	all	all	NE	all	9	3	*	23	21	1	10	15	7	12
Mid-water paired & single Trawl	all	all	MA	all	11	10	*	15	15	14	2	7	9	3
Fish Pots/ Traps	all	all	NE	all										
Fish Pots/ Traps	all	all	MA	all	4	4	*	4	4	4	4	4	4	3
Purse Seine	all	all	NE	all	5	2	*	5	5	5	4	5	5	5
Purse Seine	all	all	MA	all										
Hand Line	all	all	NE	all	2	2	*	2	2	2	2	2	2	2
Hand Line	all	all	MA	all										
Scottish Seine	all	all	NE	all	13	13	*	13	13	13	13	13	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.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	Cod	Had-dock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Window-pane	Halibut	Ocean pout
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 Trawl	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.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	Silver hake	Offshore hake	Red hake	SKATE	DOGFISH	Fluke	Scup	Black sea bass	SURF CLAM/-OCEAN QUAHOG	TILEFISH	
Longline	all	all	NE	all	8	8	7	3	1	8	8	8	8	8	
Longline	all	all	MA	all											
Otter Trawl	all	all	NE	small	2	23	9	1	3	10	11	19	31	27	
Otter Trawl	all	all	NE	large	15	26	19	1	2	6	17	24	28	25	
Otter Trawl	all	all	MA	small	6	20	8	1	2	10	3	9	18	27	
Otter Trawl	all	all	MA	large	14	26	18	1	2	3	4	5	13	26	
Scallop Trawl	open	limited	MA	all	8	8	8	2	8	5	8	7	8	8	
Scallop Trawl	open	general	MA	all	7	20	14	1	3	6	10	19	20	20	
Shrimp Trawl	all	all	NE	all	2	20	10	4	18	20	20	20	20	20	
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	small	3	3	3	3	1	3	3	3	3	3	
Sink, Anchor, Drift Gillnet	all	all	NE	large	14	27	16	3	1	19	27	26	27	27	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	16	27	11	2	1	5	23	27	27	14	
Sink, Anchor, Drift Gillnet	all	all	MA	small	4	4	4	4	1	3	4	4	4	4	
Sink, Anchor, Drift Gillnet	all	all	MA	large	5	5	5	3	1	5	5	5	5	5	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	7	7	7	2	1	5	7	7	7	7	
Scallop Dredge	open	limited	NE	all	13	14	8	2	9	4	21	12	5	26	
Scallop Dredge	open	limited	MA	all	9	20	13	2	5	4	19	11	7	24	
Scallop Dredge	open	general	NE	all	16	17	9	2	6	7	17	17	11	17	
Scallop Dredge	open	general	MA	all	9	16	12	1	8	5	16	16	7	16	
Scallop Dredge	closed	limited	NE	all	12	22	7	2	8	5	23	17	18	29	
Scallop Dredge	closed	limited	MA	all	10	25	13	2	5	4	17	9	21	25	
Scallop Dredge	closed	general	NE	all											
Scallop Dredge	closed	general	MA	all	5	5	5	2	5	4	5	5	5	5	
Mid-water paired & single Trawl	all	all	NE	all	4	23	17	11	2	23	20	22	23	23	
Mid-water paired & single Trawl	all	all	MA	all	6	15	5	15	1	8	15	4	15	15	
Fish Pots/ Traps	all	all	NE	all											
Fish Pots/ Traps	all	all	MA	all	4	4	4	4	4	4	2	1	4	4	
Purse Seine	all	all	NE	all	5	5	5	5	1	5	5	5	5	5	
Purse Seine	all	all	MA	all											
Hand Line	all	all	NE	all	2	2	2	2	2	2	2	2	2	2	
Hand Line	all	all	MA	all											
Scottish Seine	all	all	NE	all	5	13	3	4	13	1	10	6	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.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	TURTLE, GREEN	TURTLE, LEATHERBACK	TURTLE, LOGGERHEAD	TURTLE, KEMP'S RIDLEY	TURTLE, NK	SEAL, HARP	SEAL, HOODED	SEAL, HARBOR	SEAL, GRAY	SEAL, NK	
Longline	all	all	NE	all	2	2	2	*	2	2	2	2	2	*	
Longline	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Otter Trawl	all	all	NE	small	5	5	5	*	5	5	5	5	5	*	
Otter Trawl	all	all	NE	large	4	4	4	*	4	4	4	4	4	*	
Otter Trawl	all	all	MA	small	4	4	2	*	4	4	4	4	4	*	
Otter Trawl	all	all	MA	large	2	2	2	*	2	2	2	2	2	*	
Scallop Trawl	open	limited	MA	all	2	2	1	*	2	2	2	2	2	*	
Scallop Trawl	open	general	MA	all	*	*	*	*	*	*	*	*	*	*	
Shrimp Trawl	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	small	*	*	*	*	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	large	7	7	7	*	7	2	7	3	4	*	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	8	8	8	*	8	4	6	1	3	*	
Sink, Anchor, Drift Gillnet	all	all	MA	small	4	2	4	*	3	4	4	4	4	*	
Sink, Anchor, Drift Gillnet	all	all	MA	large	2	4	2	*	4	4	4	4	4	*	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	7	4	1	*	7	7	7	6	5	*	
Scallop Dredge	open	limited	NE	all	3	3	1	*	3	3	3	3	3	*	
Scallop Dredge	open	limited	MA	all	2	2	1	*	2	2	2	2	2	*	
Scallop Dredge	open	general	NE	all	*	*	*	*	*	*	*	*	*	*	
Scallop Dredge	open	general	MA	all	*	*	*	*	*	*	*	*	*	*	
Scallop Dredge	closed	limited	NE	all	3	3	2	*	3	3	3	3	3	*	
Scallop Dredge	closed	limited	MA	all	*	*	*	*	*	*	*	*	*	*	
Scallop Dredge	closed	general	NE	all											
Scallop Dredge	closed	general	MA	all	*	*	*	*	*	*	*	*	*	*	
Mid-water paired & single Trawl	all	all	NE	all	4	4	4	*	4	4	4	4	4	*	
Mid-water paired & single Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Fish Pots/ Traps	all	all	NE	all											
Fish Pots/ Traps	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Purse Seine	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	
Purse Seine	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Hand Line	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	
Hand Line	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Scottish Seine	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	
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.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	WHALE, PILOT, LONG-FIN	WHALE, MINKE	WHALE, NK	DOLPHIN WHITE-SIDED	DOLPHIN-COMMON	DOLPHIN-BOTTLE-NOSE	PORPOISE, HARBOR	PORPOISE/DOLPHIN, NK	SEA BIRDS (ALL)	PILOT coverage
Longline	all	all	NE	all	2	*	*	2	2	2	2	*	1	
Longline	all	all	MA	all	*	*	*	*	*	*	*	*	*	pilot
Otter Trawl	all	all	NE	small	3	*	*	3	1	5	5	*	2	
Otter Trawl	all	all	NE	large	3	*	*	1	4	4	4	*	2	
Otter Trawl	all	all	MA	small	4	*	*	4	1	4	4	*	3	
Otter Trawl	all	all	MA	large	2	*	*	2	2	2	2	*	1	
Scallop Trawl	open	limited	MA	all	2	*	*	2	2	2	2	*	2	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	7	*	*	6	7	7	5	*	1	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	8	*	*	8	8	6	2	*	5	
Sink, Anchor, Drift Gillnet	all	all	MA	small	4	*	*	4	4	4	4	*	1	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	4	*	*	4	4	4	4	*	1	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	7	*	*	7	7	7	1	*	3	pilot for fish
Scallop Dredge	open	limited	NE	all	3	*	*	3	3	3	3	*	2	
Scallop Dredge	open	limited	MA	all	2	*	*	2	2	2	2	*	2	
Scallop Dredge	open	general	NE	all	*	*	*	*	*	*	*	*	*	pilot
Scallop Dredge	open	general	MA	all	*	*	*	*	*	*	*	*	*	
Scallop Dredge	closed	limited	NE	all	3	*	*	3	3	3	3	*	1	
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	4	4	4	*	1	
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-3. Ranking of total discards within species group (fish and protected species ranked separately) based on 2004 observer data.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	BLUEFISH	HERRING	SALMON	RED CRAB	SCALLOP	Mackerel	Illex	Loligo	Butterfish	MONKFISH	
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 (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	Cod	Had-dock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Window-pane	Halibut	Ocean pout
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 Trawl	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 Trawl	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.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	Silver hake	Offshore hake	Red hake	SKATE	DOGFISH	Fluke	Scup	Black sea bass	SURF CLAM/- OCEAN QUAHOG	TILEFISH	
Longline	all	all	NE	all	18	7	13	17	10	20	14	16	11	5	
Longline	all	all	MA	all											
Otter Trawl	all	all	NE	small	1	1	1	3	4	1	2	4	8	1	
Otter Trawl	all	all	NE	large	3	3	3	1	3	2	4	7	6	2	
Otter Trawl	all	all	MA	small	2	4	2	6	7	6	1	2	5	4	
Otter Trawl	all	all	MA	large	8	7	8	5	5	3	3	3	3	5	
Scallop Trawl	open	limited	MA	all	18	7	19	8	23	11	14	10	11	5	
Scallop Trawl	open	general	MA	all	11	7	16	10	13	16	5	14	11	5	
Shrimp Trawl	all	all	NE	all	4	7	10	18	22	20	14	16	11	5	
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	small	18	7	19	22	20	20	14	16	11	5	
Sink, Anchor, Drift Gillnet	all	all	NE	large	9	7	11	15	2	17	14	13	11	5	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	13	7	9	11	8	9	13	16	11	3	
Sink, Anchor, Drift Gillnet	all	all	MA	small	18	7	19	22	6	13	14	16	11	5	
Sink, Anchor, Drift Gillnet	all	all	MA	large	18	7	19	16	1	20	14	16	11	5	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	18	7	19	14	12	15	14	16	11	5	
Scallop Dredge	open	limited	NE	all	7	2	4	2	16	4	7	5	1	5	
Scallop Dredge	open	limited	MA	all	6	5	6	4	14	5	8	6	2	5	
Scallop Dredge	open	general	NE	all	17	7	7	13	19	14	14	16	7	5	
Scallop Dredge	open	general	MA	all	12	7	15	7	21	10	14	16	4	5	
Scallop Dredge	closed	limited	NE	all	10	6	5	9	17	7	12	12	9	5	
Scallop Dredge	closed	limited	MA	all	15	7	18	12	18	8	11	8	10	5	
Scallop Dredge	closed	general	NE	all											
Scallop Dredge	closed	general	MA	all	18	7	19	19	23	18	14	16	11	5	
Mid-water paired & single Trawl	all	all	NE	all	5	7	14	20	9	20	10	15	11	5	
Mid-water paired & single Trawl	all	all	MA	all	16	7	17	22	15	19	14	11	11	5	
Fish Pots/ Traps	all	all	NE	all											
Fish Pots/ Traps	all	all	MA	all	18	7	19	22	23	20	6	1	11	5	
Purse Seine	all	all	NE	all	18	7	19	22	11	20	14	16	11	5	
Purse Seine	all	all	MA	all											
Hand Line	all	all	NE	all	18	7	19	22	23	20	14	16	11	5	
Hand Line	all	all	MA	all											
Scottish Seine	all	all	NE	all	14	7	12	21	23	12	9	9	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											

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 (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	TURTLE, GREEN	TURTLE, LEATHERBACK	TURTLE, LOGGERHEAD	TURTLE, KEMP'S RIDLEY	TURTLE, NK	SEAL, HARP	SEAL, HOODED	SEAL, HARBOR	SEAL, GRAY	SEAL, NK	
Longline	all	all	NE	all	2	3	8	*	2	3	2	4	4	*	
Longline	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Otter Trawl	all	all	NE	small	2	3	8	*	2	3	2	4	4	*	
Otter Trawl	all	all	NE	large	2	3	8	*	2	3	2	4	4	*	
Otter Trawl	all	all	MA	small	2	3	4	*	2	3	2	4	4	*	
Otter Trawl	all	all	MA	large	2	3	8	*	2	3	2	4	4	*	
Scallop Trawl	open	limited	MA	all	2	3	1	*	2	3	2	4	4	*	
Scallop Trawl	open	general	MA	all	*	*	*	*	*	*	*	*	*	*	
Shrimp Trawl	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	small	*	*	*	*	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	large	2	3	8	*	2	1	2	2	2	*	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	2	3	8	*	2	2	1	1	1	*	
Sink, Anchor, Drift Gillnet	all	all	MA	small	2	2	8	*	1	3	2	4	4	*	
Sink, Anchor, Drift Gillnet	all	all	MA	large	1	3	6	*	2	3	2	4	4	*	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	2	1	5	*	2	3	2	3	3	*	
Scallop Dredge	open	limited	NE	all	2	3	2	*	2	3	2	4	4	*	
Scallop Dredge	open	limited	MA	all	2	3	3	*	2	3	2	4	4	*	
Scallop Dredge	open	general	NE	all	*	*	*	*	*	*	*	*	*	*	
Scallop Dredge	open	general	MA	all	*	*	*	*	*	*	*	*	*	*	
Scallop Dredge	closed	limited	NE	all	2	3	7	*	2	3	2	4	4	*	
Scallop Dredge	closed	limited	MA	all	*	*	*	*	*	*	*	*	*	*	
Scallop Dredge	closed	general	NE	all											
Scallop Dredge	closed	general	MA	all	*	*	*	*	*	*	*	*	*	*	
Mid-water paired & single Trawl	all	all	NE	all	2	3	8	*	2	3	2	4	4	*	
Mid-water paired & single Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Fish Pots/ Traps	all	all	NE	all											
Fish Pots/ Traps	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Purse Seine	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	
Purse Seine	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Hand Line	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	
Hand Line	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	
Scottish Seine	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	
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 (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	WHALE, PILOT, LONG-FIN	WHALE, MINKE	WHALE, NK	DOLPHIN WHITE-SIDED	DOLPHIN-COMMON	DOLPHIN-BOTTLE-NOSE	PORPOISE, HARBOR	PORPOISE/DOLPHIN, NK	SEA BIRDS (ALL)	PILOT coverage
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.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	BLUEFISH	HERRING	SALMON	RED CRAB	SCALLOP	MACK-/SQUID-/BUTTERFISH	Mackerel	Illex	Loligo	Butterfish	MONKFISH
Longline	all	all	NE	all	35	35	35	35	35	35	35	35	35	35	35
Longline	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76
Otter Trawl	all	all	NE	small	1879	2021	211	2769	2712	666	1522	1143	1594	1159	680
Otter Trawl	all	all	NE	large	5680	4817	730	2808	3439	1557	4339	5058	2916	3986	374
Otter Trawl	all	all	MA	small	1727	1781	196	685	2054	1875	2681	2471	2626	1926	1337
Otter Trawl	all	all	MA	large	437	892	342	342	726	537	516	785	699	745	392
Scallop Trawl	open	limited	MA	all	95	95	95	95	95	95	95	95	95	95	95
Scallop Trawl	open	general	MA	all	103	51	51	404	100	132	51	225	150	223	89
Shrimp Trawl	all	all	NE	all	42	101	42	42	388	400	42	42	42	400	25
Shrimp Trawl	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76
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	1342	754	141	2808	414	2096	1693	650	141	2037	1156
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	576	1065	144	1208	1314	2244	2246	144	144	758	425
Sink, Anchor, Drift Gillnet	all	all	MA	small	62	62	62	62	62	62	62	62	62	62	62
Sink, Anchor, Drift Gillnet	all	all	MA	large	103	29	29	29	29	29	29	29	29	29	29
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	113	68	68	68	246	68	68	68	68	68	92
Scallop Dredge	open	limited	NE	all	269	269	269	1268	896	1839	269	1852	1974	978	685
Scallop Dredge	open	limited	MA	all	329	329	329	706	589	1129	706	2320	1907	2029	462
Scallop Dredge	open	general	NE	all	92	92	92	92	180	157	92	157	92	92	110
Scallop Dredge	open	general	MA	all	96	96	96	96	257	268	96	96	268	96	81
Scallop Dredge	closed	limited	NE	all	1583	3147	139	3810	475	1393	2764	3618	2419	3953	439
Scallop Dredge	closed	limited	MA	all	477	1722	108	1470	497	766	1713	1804	1281	1762	164
Scallop Dredge	closed	general	NE	all	24	24	24	24	24	24	24	24	24	24	24
Scallop Dredge	closed	general	MA	all	21	21	21	21	21	21	21	21	21	21	21
Mid-water paired & single Trawl	all	all	NE	all	420	749	56	56	467	752	728	712	458	852	484
Mid-water paired & single Trawl	all	all	MA	all	66	235	35	35	35	51	158	56	34	52	335
Fish Pots/ Traps	all	all	NE	all	20	20	20	20	20	20	20	20	20	20	20
Fish Pots/ Traps	all	all	MA	all	40	40	40	40	40	40	40	40	40	40	100
Purse Seine	all	all	NE	all	19	169	19	19	19	157	19	157	19	19	19
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9
Hand Line	all	all	NE	all	72	72	72	72	72	72	72	72	72	72	72
Hand Line	all	all	MA	all	133	133	133	133	133	133	133	133	133	133	133
Scottish Seine	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12
Clam Quahog Dredge	all	all	NE	all	50	50	50	50	50	50	50	50	50	50	50
Clam Quahog Dredge	all	all	MA	all	84	84	84	84	84	84	84	84	84	84	84
Crab Pots	all	all	NE	all	101	101	101	101	101	101	101	101	101	101	101
Crab Pots	all	all	MA	all	28	28	28	28	28	28	28	28	28	28	28
Lobster Pots	all	all	NE	all	439	439	439	439	439	439	439	439	439	439	439
Lobster Pots	all	all	MA	all	89	89	89	89	89	89	89	89	89	89	89
Total Sea Days					16,828	19,864	4,573	20,193	16,314	17,592	21,210	22,866	18,338	22,642	8,916
Total Sea Days excluding shaded cells					12,727	12,914	4,573	11,488	12,209	15,957	19,666	20,394	16,270	18,436	7,906

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.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	NE MULTI-SPP (LARGE-MESH)	Cod	Had-dock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Window-pane	Halibut	Ocean pout
Longline	all	all	NE	all	54	71	41	35	35	35	35	82	35	35	35	35	101
Longline	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76	76	76
Otter Trawl	all	all	NE	small	864	1499	2851	1927	1287	1178	1116	3136	1875	2523	1649	1798	2123
Otter Trawl	all	all	NE	large	501	1520	1687	2457	838	769	1230	7417	1365	1666	1968	2146	805
Otter Trawl	all	all	MA	small	1005	196	196	2448	1353	1775	1335	196	1908	3489	1598	196	2035
Otter Trawl	all	all	MA	large	386	676	342	1217	342	593	851	676	1215	705	847	342	934
Scallop Trawl	open	limited	MA	all	95	95	95	95	95	95	95	95	95	95	95	95	95
Scallop Trawl	open	general	MA	all	82	51	51	457	51	260	419	51	51	404	135	51	51
Shrimp Trawl	all	all	NE	all	22	55	188	133	41	360	32	98	62	24	19	42	384
Shrimp Trawl	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76	76	76
Sink, Anchor, Drift Gillnet	all	all	NE	small	12	12	12	12	12	12	12	12	12	12	12	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	281	486	719	940	749	1331	1121	862	1818	1728	1933	2439	2045
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	504	646	894	1930	1254	1226	2379	1403	909	1587	1873	1953	964
Sink, Anchor, Drift Gillnet	all	all	MA	small	62	62	62	62	62	62	62	62	62	62	62	62	62
Sink, Anchor, Drift Gillnet	all	all	MA	large	19	29	29	29	29	29	29	29	29	29	19	29	29
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	68	68	68	68	68	68	68	68	68	68	68	68	68
Scallop Dredge	open	limited	NE	all	1468	1805	1333	2489	1333	1977	1700	1333	269	1599	1811	269	2726
Scallop Dredge	open	limited	MA	all	1142	329	329	1749	3230	2246	3017	329	329	3210	1784	329	2502
Scallop Dredge	open	general	NE	all	81	112	92	84	104	133	89	92	92	92	87	92	169
Scallop Dredge	open	general	MA	all	198	96	96	268	260	176	96	96	96	179	204	96	96
Scallop Dredge	closed	limited	NE	all	415	730	566	5219	3333	581	4393	139	139	3584	2623	1149	4634
Scallop Dredge	closed	limited	MA	all	612	108	108	3429	1210	557	506	108	108	2590	3306	108	492
Scallop Dredge	closed	general	NE	all	24	24	24	24	24	24	24	24	24	24	24	24	24
Scallop Dredge	closed	general	MA	all	21	21	21	21	21	21	21	21	21	21	21	21	21
Mid-water paired & single Trawl	all	all	NE	all	531	714	478	56	684	776	414	749	515	739	56	56	56
Mid-water paired & single Trawl	all	all	MA	all	379	35	35	35	35	319	35	35	35	158	35	35	35
Fish Pots/ Traps	all	all	NE	all	20	20	20	20	20	20	20	20	20	20	20	20	20
Fish Pots/ Traps	all	all	MA	all	40	40	40	40	40	40	40	40	40	40	40	40	40
Purse Seine	all	all	NE	all	164	19	19	19	19	19	19	19	164	19	19	19	19
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	131	131	72	72	72	72	72	72	72	72	72	72	72
Hand Line	all	all	MA	all	133	133	133	133	133	133	133	133	133	133	133	133	133
Scottish Seine	all	all	NE	all	14	12	12	12	12	12	19	12	12	12	15	12	12
Clam Quahog Dredge	all	all	NE	all	50	50	50	50	50	50	50	50	50	50	50	50	50
Clam Quahog Dredge	all	all	MA	all	84	84	84	84	84	84	84	84	84	84	84	84	84
Crab Pots	all	all	NE	all	101	101	101	101	101	101	101	101	101	101	101	101	101
Crab Pots	all	all	MA	all	28	28	28	28	28	28	28	28	28	28	28	28	28
Lobster Pots	all	all	NE	all	439	439	439	439	439	439	439	439	439	439	439	439	439
Lobster Pots	all	all	MA	all	89	89	89	89	89	89	89	89	89	89	89	89	89
Total Sea Days					10,282	10,747	11,563	26,430	17,697	15,851	20,335	18,360	12,523	25,870	21,514	12,694	21,707
Total Sea Days excluding shaded cells					10,020	9,949	7,536	25,186	9,724	11,441	19,407	13,917	6,903	18,240	20,349	10,070	20,859

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.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	NE MULTI-SPP (SMALL-MESH)	Silver hake	Offshore hake	Red hake	SKATE	DOGFISH	FLUKE/-SCUP/-BLK SEA BASS	Fluke	Scup	Black sea bass	SURF CLAM/-OCEAN QUAHOG	TILEFISH
Longline	all	all	NE	all	55	35	35	55	84	187	35	35	35	35	35	35
Longline	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76	76
Otter Trawl	all	all	NE	small	1001	1024	2397	2587	1157	1093	1431	999	2354	2155	1634	1678
Otter Trawl	all	all	NE	large	890	1504	5314	2249	906	1017	3726	4053	4456	6944	6058	3827
Otter Trawl	all	all	MA	small	1307	1825	993	1901	794	1231	974	909	1511	1815	3316	929
Otter Trawl	all	all	MA	large	702	738	342	565	203	710	395	292	1072	946	831	342
Scallop Trawl	open	limited	MA	all	95	95	95	95	95	95	95	95	95	95	95	95
Scallop Trawl	open	general	MA	all	280	283	51	103	78	430	404	61	75	401	51	51
Shrimp Trawl	all	all	NE	all	136	141	42	126	272	384	42	42	42	42	42	42
Shrimp Trawl	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76	76
Sink, Anchor, Drift Gillnet	all	all	NE	small	12	12	12	12	12	12	12	12	12	12	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	1011	1200	141	1378	772	408	2022	2057	141	672	141	141
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	1890	1275	144	1655	274	419	1245	1245	753	144	144	384
Sink, Anchor, Drift Gillnet	all	all	MA	small	62	62	62	62	62	62	62	62	62	62	62	62
Sink, Anchor, Drift Gillnet	all	all	MA	large	29	29	29	29	97	93	29	29	29	29	29	29
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	68	68	68	68	53	55	105	105	68	68	68	68
Scallop Dredge	open	limited	NE	all	1191	1627	2649	1376	337	1540	1331	1453	1474	1963	1817	269
Scallop Dredge	open	limited	MA	all	2949	3358	2964	2679	305	2421	606	1025	2311	1235	2446	329
Scallop Dredge	open	general	NE	all	125	180	92	135	112	112	92	92	92	92	169	92
Scallop Dredge	open	general	MA	all	118	114	96	260	77	136	270	270	96	96	235	96
Scallop Dredge	closed	limited	NE	all	1332	1608	2759	1618	198	2841	1149	1448	4746	2768	4242	139
Scallop Dredge	closed	limited	MA	all	994	1896	108	954	337	1778	996	1149	795	1834	2662	108
Scallop Dredge	closed	general	NE	all	24	24	24	24	24	24	24	24	24	24	24	24
Scallop Dredge	closed	general	MA	all	21	21	21	21	21	21	21	21	21	21	21	21
Mid-water paired & single Trawl	all	all	NE	all	924	927	56	495	764	280	544	56	235	365	56	56
Mid-water paired & single Trawl	all	all	MA	all	82	82	35	66	35	49	319	319	35	288	35	35
Fish Pots/ Traps	all	all	NE	all	20	20	20	20	20	20	20	20	20	20	20	20
Fish Pots/ Traps	all	all	MA	all	40	40	40	40	40	40	40	40	71	40	40	40
Purse Seine	all	all	NE	all	19	19	19	19	19	176	19	19	19	19	19	19
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9	9
Hand Line	all	all	NE	all	72	72	72	72	72	72	72	72	72	72	72	72
Hand Line	all	all	MA	all	133	133	133	133	133	133	133	133	133	133	133	133
Scottish Seine	all	all	NE	all	12	12	12	12	12	12	30	30	30	30	12	12
Clam Quahog Dredge	all	all	NE	all	50	50	50	50	50	50	50	50	50	50	50	50
Clam Quahog Dredge	all	all	MA	all	84	84	84	84	84	84	84	84	84	84	84	84
Crab Pots	all	all	NE	all	101	101	101	101	101	101	101	101	101	101	101	101
Crab Pots	all	all	MA	all	28	28	28	28	28	28	28	28	28	28	28	28
Lobster Pots	all	all	NE	all	439	439	439	439	439	439	439	439	439	439	439	439
Lobster Pots	all	all	MA	all	89	89	89	89	89	89	89	89	89	89	89	89
Total Sea Days					16,544	19,374	19,777	19,761	8,316	16,802	17,193	17,117	21,831	23,372	25,472	10,109
Total Sea Days excluding shaded cells					15,314	18,109	7,800	18,333	6,522	15,359	15,235	15,647	9,842	12,604	133	6,946

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.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	TURTLES	TURTLE, GREEN	TURTLE, LEATHERBACK	TURTLE, LOGGERHEAD	TURTLE, KEMP'S RIDLEY	TURTLE, NK	SEALS	SEAL, HARP	SEAL, HOODED	SEAL, HARBOR	SEAL, GRAY	SEAL, NK
Longline	all	all	NE	all	35	35	35	35	35	35	35	35	35	35	35	35
Longline	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76	76
Otter Trawl	all	all	NE	small	211	211	211	211	211	211	211	211	211	211	211	211
Otter Trawl	all	all	NE	large	730	730	730	730	730	730	730	730	730	730	730	730
Otter Trawl	all	all	MA	small	1886	196	196	1886	196	196	196	196	196	196	196	196
Otter Trawl	all	all	MA	large	342	342	342	342	342	342	342	342	342	342	342	342
Scallop Trawl	open	limited	MA	all	95	95	95	95	95	95	95	95	95	95	95	95
Scallop Trawl	open	general	MA	all	51	51	51	51	51	51	51	51	51	51	51	51
Shrimp Trawl	all	all	NE	all	42	42	42	42	42	42	42	42	42	42	42	42
Shrimp Trawl	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76	76
Sink, Anchor, Drift Gillnet	all	all	NE	small	12	12	12	12	12	12	12	12	12	12	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	141	141	141	141	141	141	971	339	141	1357	2388	141
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	144	144	144	144	144	144	1249	306	1030	1640	1525	144
Sink, Anchor, Drift Gillnet	all	all	MA	small	1025	62	583	62	62	503	62	62	62	62	62	62
Sink, Anchor, Drift Gillnet	all	all	MA	large	107	143	29	143	29	29	29	29	29	29	29	29
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	557	68	336	289	68	68	849	68	68	472	445	68
Scallop Dredge	open	limited	NE	all	2718	269	269	2718	269	269	269	269	269	269	269	269
Scallop Dredge	open	limited	MA	all	3470	329	329	3470	329	329	329	329	329	329	329	329
Scallop Dredge	open	general	NE	all	92	92	92	92	92	92	92	92	92	92	92	92
Scallop Dredge	open	general	MA	all	96	96	96	96	96	96	96	96	96	96	96	96
Scallop Dredge	closed	limited	NE	all	2431	139	139	2431	139	139	139	139	139	139	139	139
Scallop Dredge	closed	limited	MA	all	108	108	108	108	108	108	108	108	108	108	108	108
Scallop Dredge	closed	general	NE	all	24	24	24	24	24	24	24	24	24	24	24	24
Scallop Dredge	closed	general	MA	all	21	21	21	21	21	21	21	21	21	21	21	21
Mid-water paired & single Trawl	all	all	NE	all	56	56	56	56	56	56	56	56	56	56	56	56
Mid-water paired & single Trawl	all	all	MA	all	35	35	35	35	35	35	35	35	35	35	35	35
Fish Pots/ Traps	all	all	NE	all	20	20	20	20	20	20	20	20	20	20	20	20
Fish Pots/ Traps	all	all	MA	all	40	40	40	40	40	40	40	40	40	40	40	40
Purse Seine	all	all	NE	all	19	19	19	19	19	19	19	19	19	19	19	19
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9	9
Hand Line	all	all	NE	all	72	72	72	72	72	72	72	72	72	72	72	72
Hand Line	all	all	MA	all	133	133	133	133	133	133	133	133	133	133	133	133
Scottish Seine	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12	12
Clam Quahog Dredge	all	all	NE	all	50	50	50	50	50	50	50	50	50	50	50	50
Clam Quahog Dredge	all	all	MA	all	84	84	84	84	84	84	84	84	84	84	84	84
Crab Pots	all	all	NE	all	101	101	101	101	101	101	101	101	101	101	101	101
Crab Pots	all	all	MA	all	28	28	28	28	28	28	28	28	28	28	28	28
Lobster Pots	all	all	NE	all	439	439	439	439	439	439	439	439	439	439	439	439
Lobster Pots	all	all	MA	all	89	89	89	89	89	89	89	89	89	89	89	89
Total Sea Days					15,676	4,687	5,363	14,480	4,573	5,015	7,289	4,934	5,460	7,689	8,578	4,573
Total Sea Days excluding shaded cells					15,676	2,312	4,421	14,480	3,632	5,015	6,006	3,650	2,538	5,868	6,757	3,290

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.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	WHALES	WHALE, PILOT, LONG-FIN	WHALE, MINKE	WHALE, NK	DOLPHINS/-PORPOISE	DOLPHIN WHITE-SIDED	DOLPHIN-COMMON	DOLPHIN- BOTTLE-NOSE	PORPOISE, HARBOR	PORPOISE/DOLPHIN, NK	SEA BIRDS (ALL)	ALL SPECIES	PILOT coverage
Longline	all	all	NE	all	35	35	35	35	35	35	35	35	35	35	250	107	
Longline	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76	76	pilot
Otter Trawl	all	all	NE	small	1464	1464	211	211	1432	1499	1631	211	211	211	2157	484	
Otter Trawl	all	all	NE	large	5591	5591	730	730	3001	3001	730	730	730	730	6776	537	
Otter Trawl	all	all	MA	small	196	196	196	196	1661	196	1661	196	196	196	1014	561	
Otter Trawl	all	all	MA	large	342	342	342	342	342	342	342	342	342	342	481	137	
Scallop Trawl	open	limited	MA	all	95	95	95	95	95	95	95	95	95	95	95	95	pilot
Scallop Trawl	open	general	MA	all	51	51	51	51	51	51	51	51	51	51	51	35	pilot
Shrimp Trawl	all	all	NE	all	42	42	42	42	42	42	42	42	42	42	42	43	
Shrimp Trawl	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76	55	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	small	12	12	12	12	12	12	12	12	12	12	12	12	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	large	141	141	141	141	1081	987	141	141	1160	141	2831	209	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	144	144	144	144	1322	144	144	1032	1359	144	2644	162	
Sink, Anchor, Drift Gillnet	all	all	MA	small	62	62	62	62	62	62	62	62	62	62	411	62	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	29	29	29	29	29	29	29	29	29	29	161	93	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	68	68	68	68	445	68	68	68	445	68	852	50	pilot for fish
Scallop Dredge	open	limited	NE	all	269	269	269	269	269	269	269	269	269	269	1054	323	
Scallop Dredge	open	limited	MA	all	329	329	329	329	329	329	329	329	329	329	329	218	
Scallop Dredge	open	general	NE	all	92	92	92	92	92	92	92	92	92	92	92	86	pilot
Scallop Dredge	open	general	MA	all	96	96	96	96	96	96	96	96	96	96	96	20	
Scallop Dredge	closed	limited	NE	all	139	139	139	139	139	139	139	139	139	139	2444	241	
Scallop Dredge	closed	limited	MA	all	108	108	108	108	108	108	108	108	108	108	108	223	
Scallop Dredge	closed	general	NE	all	24	24	24	24	24	24	24	24	24	24	24	24	pilot
Scallop Dredge	closed	general	MA	all	21	21	21	21	21	21	21	21	21	21	21	21	pilot
Mid-water paired & single Trawl	all	all	NE	all	548	548	56	56	367	367	56	56	56	56	567	322	
Mid-water paired & single Trawl	all	all	MA	all	35	35	35	35	35	35	35	35	35	35	35	95	
Fish Pots/ Traps	all	all	NE	all	20	20	20	20	20	20	20	20	20	20	20	20	pilot
Fish Pots/ Traps	all	all	MA	all	40	40	40	40	40	40	40	40	40	40	40	36	pilot
Purse Seine	all	all	NE	all	19	19	19	19	19	19	19	19	19	19	19	123	
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9	9	pilot
Hand Line	all	all	NE	all	72	72	72	72	72	72	72	72	72	72	72	131	pilot
Hand Line	all	all	MA	all	133	133	133	133	133	133	133	133	133	133	133	133	pilot
Scottish Seine	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12	21	pilot
Clam Quahog Dredge	all	all	NE	all	50	50	50	50	50	50	50	50	50	50	50	50	pilot
Clam Quahog Dredge	all	all	MA	all	84	84	84	84	84	84	84	84	84	84	84	84	pilot
Crab Pots	all	all	NE	all	101	101	101	101	101	101	101	101	101	101	101	101	pilot
Crab Pots	all	all	MA	all	28	28	28	28	28	28	28	28	28	28	28	28	pilot
Lobster Pots	all	all	NE	all	439	439	439	439	439	439	439	439	439	439	439	439	pilot
Lobster Pots	all	all	MA	all	89	89	89	89	89	89	89	89	89	89	89	89	pilot
Total Sea Days					11,180	11,180	4,573	4,573	12,335	9,289	7,458	5,462	7,185	4,573	23,792	5,554	
Total Sea Days excluding shaded cells					10,103	10,103	2,593	3,497	12,335	9,289	7,458	4,924	7,094	4,573	23,792	5,554	

Gray-shaded cells indicate unlikely combinations of species/gear.

Table B-5. Number of trips needed to achieve a CV of 30 percent.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	BLUEFISH	HERRING	SALMON	RED CRAB	SCALLOP	MACK-/SQUID-/BUTTERFISH	Mackerel	Illex	Loligo	Butterfish	MONKFISH
Longline	all	all	NE	all	26	26	26	26	26	26	26	26	26	26	26
Longline	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12
Otter Trawl	all	all	NE	small	677	615	70	900	859	217	496	343	523	387	268
Otter Trawl	all	all	NE	large	1917	1671	304	1378	1269	483	1319	1344	999	1240	151
Otter Trawl	all	all	MA	small	706	664	104	392	877	749	1126	1072	1127	766	595
Otter Trawl	all	all	MA	large	249	305	177	177	384	294	214	279	364	396	203
Scallop Trawl	open	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12
Scallop Trawl	open	general	MA	all	73	25	25	201	58	87	25	136	97	133	56
Shrimp Trawl	all	all	NE	all	42	101	42	42	388	400	42	42	42	400	25
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	1160	634	104	2503	365	1875	1448	620	104	1751	1040
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	479	937	94	1043	1122	1809	1810	94	94	587	324
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	101	27	27	27	27	27	27	27	27	27	27
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	96	51	51	51	216	51	51	51	51	51	77
Scallop Dredge	open	limited	NE	all	25	25	25	98	68	141	25	140	144	79	52
Scallop Dredge	open	limited	MA	all	36	36	36	98	65	134	98	244	217	219	53
Scallop Dredge	open	general	NE	all	71	71	71	71	150	131	71	131	71	71	90
Scallop Dredge	open	general	MA	all	69	69	69	69	183	184	69	69	184	69	46
Scallop Dredge	closed	limited	NE	all	182	326	15	405	49	147	292	378	246	420	48
Scallop Dredge	closed	limited	MA	all	42	167	12	143	47	71	166	169	120	171	15
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	166	244	21	21	160	305	271	325	157	367	199
Mid-water paired & single Trawl	all	all	MA	all	20	86	12	12	12	14	50	16	10	15	118
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	98
Purse Seine	all	all	NE	all	10	85	10	10	10	79	10	79	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					7,160	7,175	2,306	8,679	7,348	8,236	8,648	6,597	5,624	8,196	4,495
Total Trips excluding shaded cells					5,826	5,580	2,306	3,386	4,200	7,000	7,551	4,571	4,059	4,785	3,699

Gray-shaded cells indicate unlikely combinations of species/gear.

Table B-5 *continued*. Number of trips needed to achieve a CV of 30 percent.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	NE MULTI-SPP (LARGE-MESH)	Cod	Had-dock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Window-pane	Halibut	Ocean pout
Longline	all	all	NE	all	54	71	41	26	26	26	26	75	26	26	26	26	100
Longline	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	12	12
Otter Trawl	all	all	NE	small	288	461	886	564	390	445	359	939	600	791	464	627	659
Otter Trawl	all	all	NE	large	168	562	662	774	334	331	514	2917	517	708	579	960	293
Otter Trawl	all	all	MA	small	399	104	104	875	394	815	667	104	663	1468	566	104	689
Otter Trawl	all	all	MA	large	182	398	177	590	177	348	336	398	382	416	325	177	401
Scallop Trawl	open	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12	12	12
Scallop Trawl	open	general	MA	all	43	25	25	251	25	129	213	25	25	201	83	25	25
Shrimp Trawl	all	all	NE	all	22	55	188	133	41	360	32	98	62	24	19	42	384
Shrimp Trawl	all	all	MA	all	13	13	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	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	246	422	632	814	658	1162	984	786	1628	1586	1699	2166	1796
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	356	447	747	1556	884	1059	1865	1170	594	1343	1656	1699	797
Sink, Anchor, Drift Gillnet	all	all	MA	small	58	58	58	58	58	58	58	58	58	58	58	58	58
Sink, Anchor, Drift Gillnet	all	all	MA	large	17	27	27	27	27	27	27	27	27	27	17	27	27
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	51	51	51	51	51	51	51	51	51	51	51	51	51
Scallop Dredge	open	limited	NE	all	109	139	103	185	103	147	128	103	25	125	130	25	205
Scallop Dredge	open	limited	MA	all	130	36	36	221	381	259	351	36	36	352	192	36	310
Scallop Dredge	open	general	NE	all	64	92	71	67	84	110	71	71	71	71	70	71	141
Scallop Dredge	open	general	MA	all	139	69	69	184	179	122	67	69	69	123	143	69	69
Scallop Dredge	closed	limited	NE	all	41	83	64	537	359	62	448	15	15	385	267	105	477
Scallop Dredge	closed	limited	MA	all	55	12	12	326	118	51	45	12	12	246	316	12	44
Scallop Dredge	closed	general	NE	all	12	12	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	15	15
Mid-water paired & single Trawl	all	all	NE	all	254	279	195	21	270	302	142	337	214	290	21	21	21
Mid-water paired & single Trawl	all	all	MA	all	132	12	12	12	12	113	12	12	12	50	12	12	12
Fish Pots/ Traps	all	all	NE	all	19	19	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	37	37	37
Purse Seine	all	all	NE	all	82	10	10	10	10	10	10	10	82	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	130	130	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	126	126
Scottish Seine	all	all	NE	all	14	12	12	12	12	12	19	12	12	12	15	12	12
Clam Quahog Dredge	all	all	NE	all	69	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	69
Crab Pots	all	all	NE	all	12	12	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	27	27
Lobster Pots	all	all	NE	all	353	353	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	75	75
Total Trips					3,908	4,428	5,122	8,235	5,535	6,941	7,366	8,266	6,123	9,305	7,660	7,277	7,521
Total Trips excluding shaded cells					3,731	3,999	3,757	7,281	3,181	5,442	6,644	6,455	3,856	7,442	6,767	5,788	6,965

Gray-shaded cells indicate unlikely combinations of species/gear.

Table B-5 *continued*. Number of trips needed to achieve a CV of 30 percent.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	NE MULTI-SPP (SMALL-MESH)	Silver hake	Offshore hake	Red hake	SKATE	DOGFISH	FLUKE/-SCUP/-BLK SEA BASS	Fluke	Scup	Black sea bass	SURF CLAM/-OCEAN QUAHOG	TILEFISH
Longline	all	all	NE	all	47	26	26	47	84	187	26	26	26	26	26	26
Longline	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	12
Otter Trawl	all	all	NE	small	317	332	779	756	391	371	453	326	734	754	608	565
Otter Trawl	all	all	NE	large	343	537	1696	965	296	355	1050	1168	1847	2063	2231	897
Otter Trawl	all	all	MA	small	556	779	504	805	326	513	424	374	672	825	1364	287
Otter Trawl	all	all	MA	large	342	364	177	323	110	272	158	164	437	372	488	177
Scallop Trawl	open	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12	12
Scallop Trawl	open	general	MA	all	147	149	25	73	40	222	206	36	49	200	25	25
Shrimp Trawl	all	all	NE	all	136	141	42	126	272	384	42	42	42	42	42	42
Shrimp Trawl	all	all	MA	all	13	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	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	914	1082	104	1254	673	375	1736	1768	104	602	104	104
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	1497	950	94	1460	197	314	1052	1052	583	94	94	263
Sink, Anchor, Drift Gillnet	all	all	MA	small	58	58	58	58	58	58	58	58	58	58	58	58
Sink, Anchor, Drift Gillnet	all	all	MA	large	27	27	27	27	95	91	27	27	27	27	27	27
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	51	51	51	51	43	45	89	89	51	51	51	51
Scallop Dredge	open	limited	NE	all	92	127	190	106	25	111	96	103	111	143	138	25
Scallop Dredge	open	limited	MA	all	347	386	319	309	35	283	67	116	263	135	288	36
Scallop Dredge	open	general	NE	all	102	150	71	111	92	92	71	71	71	71	141	71
Scallop Dredge	open	general	MA	all	82	79	69	179	55	94	180	180	69	69	162	69
Scallop Dredge	closed	limited	NE	all	139	169	301	168	21	291	123	154	492	274	458	15
Scallop Dredge	closed	limited	MA	all	92	179	12	87	32	170	95	110	73	175	258	12
Scallop Dredge	closed	general	NE	all	12	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	15
Mid-water paired & single Trawl	all	all	NE	all	350	351	21	207	298	114	198	21	56	163	21	21
Mid-water paired & single Trawl	all	all	MA	all	25	25	12	20	12	18	113	113	12	105	12	12
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	37	37	37	37	37	37	37	69	37	37	37
Purse Seine	all	all	NE	all	10	10	10	10	10	87	10	10	10	10	10	10
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	68
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	12	12	12	12	12	30	30	30	30	12	12
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	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	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	75	75	75	75	75	75
Total Trips					6,626	6,924	5,540	8,099	4,117	5,400	7,245	6,979	6,789	7,231	7,559	3,746
Total Trips excluding shaded cells					5,679	5,951	2,550	7,066	3,008	4,216	6,113	6,023	3,958	4,403	139	2,021

Gray-shaded cells indicate unlikely combinations of species/gear.

Table B-5 *continued*. Number of trips needed to achieve a CV of 30 percent.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	TURTLES	TURTLE, GREEN	TURTLE, LEATHERBACK	TURTLE, LOGGERHEAD	TURTLE, KEMP'S RIDLEY	TURTLE, NK	SEALS	SEAL, HARP	SEAL, HOODED	SEAL, HARBOR	SEAL, GRAY	SEAL, NK
Longline	all	all	NE	all	26	26	26	26	26	26	26	26	26	26	26	26
Longline	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	12
Otter Trawl	all	all	NE	small	70	70	70	70	70	70	70	70	70	70	70	70
Otter Trawl	all	all	NE	large	304	304	304	304	304	304	304	304	304	304	304	304
Otter Trawl	all	all	MA	small	901	104	104	901	104	104	104	104	104	104	104	104
Otter Trawl	all	all	MA	large	177	177	177	177	177	177	177	177	177	177	177	177
Scallop Trawl	open	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12	12
Scallop Trawl	open	general	MA	all	25	25	25	25	25	25	25	25	25	25	25	25
Shrimp Trawl	all	all	NE	all	42	42	42	42	42	42	42	42	42	42	42	42
Shrimp Trawl	all	all	MA	all	13	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	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	104	104	104	104	104	104	844	293	104	1212	2088	104
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	94	94	94	94	94	94	995	180	689	1281	1124	94
Sink, Anchor, Drift Gillnet	all	all	MA	small	977	58	548	58	58	487	58	58	58	58	58	58
Sink, Anchor, Drift Gillnet	all	all	MA	large	105	141	27	140	27	27	27	27	27	27	27	27
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	519	51	302	268	51	51	793	51	51	427	418	51
Scallop Dredge	open	limited	NE	all	206	25	25	206	25	25	25	25	25	25	25	25
Scallop Dredge	open	limited	MA	all	378	36	36	378	36	36	36	36	36	36	36	36
Scallop Dredge	open	general	NE	all	71	71	71	71	71	71	71	71	71	71	71	71
Scallop Dredge	open	general	MA	all	69	69	69	69	69	69	69	69	69	69	69	69
Scallop Dredge	closed	limited	NE	all	243	15	15	243	15	15	15	15	15	15	15	15
Scallop Dredge	closed	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12	12
Scallop Dredge	closed	general	NE	all	12	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	15
Mid-water paired & single Trawl	all	all	NE	all	21	21	21	21	21	21	21	21	21	21	21	21
Mid-water paired & single Trawl	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	12
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	37	37	37	37	37	37	37	37	37	37	37
Purse Seine	all	all	NE	all	10	10	10	10	10	10	10	10	10	10	10	10
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	68
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	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	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	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	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	75	75	75	75	75	75
Total Trips					5,318	2,420	3,046	4,185	2,306	2,735	4,689	2,581	2,901	4,977	5,686	2,306
Total Trips excluding shaded cells					5,318	1,391	2,673	4,185	1,933	2,735	4,352	2,244	1,772	4,358	5,067	1,969

Gray-shaded cells indicate unlikely combinations of species/gear.

Table B-5 *continued*. Number of trips needed to achieve a CV of 30 percent.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	WHALES	WHALE, PILOT, LONG-FIN	WHALE, MINKE	WHALE, NK	DOLPHINS/-PORPOISE	DOLPHIN WHITE-SIDED	DOLPHIN-COMMON	DOLPHIN- BOTTLE-NOSE	PORPOISE, HARBOR	PORPOISE/DOLPHIN, NK	SEA BIRDS (ALL)	ALL SPECIES	PILOT coverage
Longline	all	all	NE	all	26	26	26	26	26	26	26	26	26	26	215	107	
Longline	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	12	pilot
Otter Trawl	all	all	NE	small	505	505	70	70	557	517	626	70	70	70	677	157	
Otter Trawl	all	all	NE	large	1577	1577	304	304	777	777	304	304	304	304	1973	177	
Otter Trawl	all	all	MA	small	104	104	104	104	799	104	799	104	104	104	522	222	
Otter Trawl	all	all	MA	large	177	177	177	177	177	177	177	177	177	177	251	65	
Scallop Trawl	open	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12	12	pilot
Scallop Trawl	open	general	MA	all	25	25	25	25	25	25	25	25	25	25	25	19	pilot
Shrimp Trawl	all	all	NE	all	42	42	42	42	42	42	42	42	42	42	42	43	
Shrimp Trawl	all	all	MA	all	13	13	13	13	13	13	13	13	13	13	13	9	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	small	12	12	12	12	12	12	12	12	12	12	12	12	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	large	104	104	104	104	966	858	104	104	1036	104	2510	182	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	94	94	94	94	973	94	94	691	998	94	2176	118	
Sink, Anchor, Drift Gillnet	all	all	MA	small	58	58	58	58	58	58	58	58	58	58	395	58	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	27	27	27	27	27	27	27	27	27	27	144	91	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	51	51	51	51	418	51	51	51	418	51	796	39	pilot for fish
Scallop Dredge	open	limited	NE	all	25	25	25	25	25	25	25	25	25	25	72	24	
Scallop Dredge	open	limited	MA	all	36	36	36	36	36	36	36	36	36	36	36	25	
Scallop Dredge	open	general	NE	all	71	71	71	71	71	71	71	71	71	71	71	69	pilot
Scallop Dredge	open	general	MA	all	69	69	69	69	69	69	69	69	69	69	69	13	
Scallop Dredge	closed	limited	NE	all	15	15	15	15	15	15	15	15	15	15	263	25	
Scallop Dredge	closed	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12	21	
Scallop Dredge	closed	general	NE	all	12	12	12	12	12	12	12	12	12	12	12	12	pilot
Scallop Dredge	closed	general	MA	all	15	15	15	15	15	15	15	15	15	15	15	15	pilot
Mid-water paired & single Trawl	all	all	NE	all	196	196	21	21	92	92	21	21	21	21	218	124	
Mid-water paired & single Trawl	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	33	
Fish Pots/ Traps	all	all	NE	all	19	19	19	19	19	19	19	19	19	19	19	19	pilot
Fish Pots/ Traps	all	all	MA	all	37	37	37	37	37	37	37	37	37	37	37	34	pilot
Purse Seine	all	all	NE	all	10	10	10	10	10	10	10	10	10	10	10	61	
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9	9	pilot
Hand Line	all	all	NE	all	68	68	68	68	68	68	68	68	68	68	68	130	pilot
Hand Line	all	all	MA	all	126	126	126	126	126	126	126	126	126	126	126	126	pilot
Scottish Seine	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12	21	pilot
Clam Quahog Dredge	all	all	NE	all	69	69	69	69	69	69	69	69	69	69	69	69	pilot
Clam Quahog Dredge	all	all	MA	all	69	69	69	69	69	69	69	69	69	69	69	69	pilot
Crab Pots	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12	12	pilot
Crab Pots	all	all	MA	all	27	27	27	27	27	27	27	27	27	27	27	27	pilot
Lobster Pots	all	all	NE	all	353	353	353	353	353	353	353	353	353	353	353	353	pilot
Lobster Pots	all	all	MA	all	75	75	75	75	75	75	75	75	75	75	75	75	pilot
Total Trips					4,189	4,189	2,306	2,306	6,139	4,052	3,557	2,902	4,509	2,306	11,444	2,689	
Total Trips excluding shaded cells					3,934	3,934	1,550	2,051	6,139	4,052	3,557	2,621	4,475	2,306	11,444	2,689	

Gray-shaded cells indicate unlikely combinations of species/gear.

Appendix C
Importance Filter Worksheets for All Fishing Modes

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Northeast Region SBRM Importance Filter Worksheet
New England Clam Dredge

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
0	0	3,466	0%	Fish
0	0	3,466	0%	Protected Species

Top Species:	scallop	monkfish	surfclam quahog										sea turtles
Projected observer days needed:	***50***	***50***	***50***										***50***
Average trip length (days):	0.70												
Estimated % coverage level required:	2%	2%	2%										2%
Realized CV for 2004:	N/A	N/A	N/A										N/A
Percent of trips w/ zero discard:	N/A	N/A	N/A										N/A
Encounter rate:	N/A	N/A	N/A										N/A
Rank of total discards (out of 13):	N/A	N/A	N/A										N/A
Observed discards (lb):	N/A	N/A	N/A										N/A
Obs. discard percent of all obs. discards:	N/A	N/A	N/A										N/A
2004 commercial landings (lb, all gears):	64,506,000	23,036,000	101,717,000										N/A
2004 recreational landings (lb, all gears):	0	0	0										N/A
Obs. discards as % of comm landings:	N/A	N/A	N/A										N/A
Discards as % of comm landings:	N/A	N/A	N/A										N/A
Discards as % ot total landings:	N/A	N/A	N/A										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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Clam Dredge

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
0	0	3,461	0%	Fish
0	0	3,461	0%	Protected Species

Top Species:	scallop	monkfish	surfclam quahog	sea turtles
Projected observer days needed:	***84***	***84***	***84***	***84***
Average trip length (days):	1.20			
Estimated % coverage level required:	2%	2%	2%	2%
Realized CV for 2004:	N/A	N/A	N/A	N/A
Percent of trips w/ zero discard:	N/A	N/A	N/A	N/A
Encounter rate:	N/A	N/A	N/A	N/A
Rank of total discards (out of 13):	N/A	N/A	N/A	N/A
Observed discards (lb):	N/A	N/A	N/A	N/A
Obs. discard percent of all obs. discards:	N/A	N/A	N/A	N/A
2004 commercial landings (lb, all gears):	64,506,000	23,036,000	101,717,000	N/A
2004 recreational landings (lb, all gears):	0	0	0	N/A
Obs. discards as % of comm landings:	N/A	N/A	N/A	N/A
Discards as % of comm landings:	N/A	N/A	N/A	N/A
Discards as % ot total landings:	N/A	N/A	N/A	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.

Northeast Region SBRM Importance Filter Worksheet
New England Crab Pots

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
0	0	103	0%	Fish
0	0	103	0%	Protected Species

Top Species:	red crab	sea turtles
Projected observer days needed:	***101***	***101***
Average trip length (days):	6.00	
Estimated % coverage level required:	16%	16%
Realized CV for 2004:	N/A	N/A
Percent of trips w/ zero discard:	N/A	N/A
Encounter rate:	N/A	N/A
Rank of total discards (out of 13):	N/A	N/A
Observed discards (lb):	N/A	N/A
Obs. discard percent of all obs. discards:	N/A	N/A
2004 commercial landings (lb, all gears):	3,952,000	N/A
2004 recreational landings (lb, all gears):	0	N/A
Obs. discards as % of comm landings:	N/A	N/A
Discards as % of comm landings:	N/A	N/A
Discards as % ot total landings:	N/A	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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Crab Pots

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
0	0	1,133	0%	Fish
0	0	1,133	0%	Protected Species

Top Species:	red crab														sea turtles
Projected observer days needed:	***28***														***28***
Average trip length (days):	0.30														
Estimated % coverage level required:	8%														8%
Realized CV for 2004:	N/A														N/A
Percent of trips w/ zero discard:	N/A														N/A
Encounter rate:	N/A														N/A
Rank of total discards (out of 13):	N/A														N/A
Observed discards (lb):	N/A														N/A
Obs. discard percent of all obs. discards:	N/A														N/A
2004 commercial landings (lb, all gears):	3,952,000														N/A
2004 recreational landings (lb, all gears):	0														N/A
Obs. discards as % of comm landings:	N/A														N/A
Discards as % of comm landings:	N/A														N/A
Discards as % ot total landings:	N/A														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.

Northeast Region SBRM Importance Filter Worksheet
New England Fish Pots/Traps

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
0	0	973	0%	Fish
0	0	973	0%	Protected Species

Top Species:	herring	red crab	large-mesh mults	small-mesh mults	skates	SF/S/BSB	tilefish	sea turtles
Projected observer days needed:	***20***	***20***	***20***	***20***	***20***	***20***	***20***	***20***
Average trip length (days):	0.40							
Estimated % coverage level required:	5%	5%	5%	5%	5%	5%	5%	5%
Realized CV for 2004:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Percent of trips w/ zero discard:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Encounter rate:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rank of total discards (out of 13):	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Observed discards (lb):	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Obs. discard percent of all obs. discards:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2004 commercial landings (lb, all gears):	187,387,000	3,952,000	83,523,000	19,387,000	20,388,000	30,616,000	2,316,000	N/A
2004 recreational landings (lb, all gears):	27,000	0	5,383,000	35,000	0	17,982,000	0	N/A
Obs. discards as % of comm landings:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Discards as % of comm landings:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Discards as % ot total landings:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Fish Pots/Traps

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
6	6	1,750	0%	Fish
9	8	1,750	0%	Protected Species

Top Species:	herring	red crab	large-mesh mults	small-mesh mults	skate	SF/S/BSB	tilefish						sea turtles
Projected observer days needed:	***40***	***40***	***40***	***40***	***40***	***40***	***40***						***40***
Average trip length (days):	0.60												
Estimated % coverage level required:	4%	4%	4%	4%	4%	4%	4%						4%
Realized CV for 2004:	*	*	*	*	*	16.1%	*						*
Percent of trips w/ zero discard:	100%	100%	100%	100%	100%	0%	100%						100%
Encounter rate:	0%	0%	0%	0%	0%	100%	0%						0%
Rank of total discards (out of 13):	3	3	3	3	3	1	3						N/A
Observed discards (lb):	0	0	0	0	0	7,031	0						0
Obs. discard percent of all obs. discards:	0.00%	0.00%	0.00%	0.00%	0.00%	90.47%	0.00%						N/A
2004 commercial landings (lb, all gears):	187,387,000	3,952,000	83,523,000	19,387,000	20,388,000	30,616,000	2,316,000						N/A
2004 recreational landings (lb, all gears):	27,000	0	5,383,000	35,000	0	17,982,000	0						N/A
Obs. discards as % of comm landings:	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%						N/A
Discards as % of comm landings:	0.00%	0.00%	0.00%	0.00%	0.00%	5.39%	0.00%						N/A
Discards as % ot total landings:	0.00%	0.00%	0.00%	0.00%	0.00%	3.40%	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.

Northeast Region SBRM Importance Filter Worksheet

New England Small-Mesh Gillnet

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
1	1	42	2%	Fish
1	1	42	2%	Protected Species

Top Species:	bluefish	herring	M/S/B	monkfish	large-mesh mults	small-mesh mults	skates	dogfish	SF/S/BSB				sea turtles
Projected observer days needed:	***12***	***12***	***12***	***12***	***12***	***12***	***12***	***12***	***12***				***12***
Average trip length (days):	0.80												
Estimated % coverage level required:	36%	36%	36%	36%	36%	36%	36%	36%	36%				36%
Realized CV for 2004:	*	*	0.0%	*	*	*	*	0.0%	*				*
Percent of trips w/ zero discard:	100%	100%	0%	100%	100%	100%	100%	0%	100%				100%
Encounter rate:	0%	0%	100%	0%	0%	0%	0%	100%	0%				0%
Rank of total discards (out of 13):	3	3	2	3	3	3	3	1	3				N/A
Observed discards (lb):	0	0	47	0	0	0	0	97	0				0
Obs. discard percent of all obs. discards:	0.00%	0.00%	27.73%	0.00%	0.00%	0.00%	0.00%	57.23%	0.00%				N/A
2004 commercial landings (lb, all gears):	7,512,000	187,387,000	212,528,000	23,036,000	83,523,000	19,387,000	20,388,000	1,965,000	30,616,000				N/A
2004 recreational landings (lb, all gears):	15,146,000	27,000	1,134,000	0	5,383,000	35,000	0	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%				N/A
Discards as % of comm landings:	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.28%	0.00%				N/A
Discards as % ot total landings:	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.28%	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.

Northeast Region SBRM Importance Filter Worksheet

New England Large-Mesh Gillnet

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
657	577	5,189	11%	Fish
876	772	5,189	15%	Protected Species

Top Species:	S/M/B	SF/S/BSB	bluefish	monkfish	small-mesh mults	skates	herring	dogfish	large-mesh mults				sea turtles
Projected observer days needed:	2,096	2,022	1,342	1,156	1,011	772	754	408	281				141
Average trip length (days):	0.90												
Estimated % coverage level required:	45%	43%	29%	25%	22%	17%	16%	9%	6%				3%
Realized CV for 2004:	84.1%	84.5%	22.0%	21.0%	18.3%	22.8%	22.9%	10.6%	9.2%				*
Percent of trips w/ zero discard:	95%	98%	93%	81%	81%	44%	93%	28%	22%				100%
Encounter rate:	5%	2%	7%	19%	19%	56%	7%	72%	78%				0%
Rank of total discards (out of 13):	7	9	5	4	6	3	8	1	2				N/A
Observed discards (lb):	346	50	849	878	495	11,989	208	460,442	41,669				0
Obs. discard percent of all obs. discards:	0.06%	0.01%	0.15%	0.16%	0.09%	2.16%	0.04%	82.83%	7.50%				N/A
2004 commercial landings (lb, all gears):	212,528,000	30,616,000	7,512,000	23,036,000	19,387,000	20,388,000	187,387,000	1,965,000	83,523,000				N/A
2004 recreational landings (lb, all gears):	1,134,000	17,982,000	15,146,000	0	35,000	0	27,000	0	5,383,000				N/A
Obs. discards as % of comm landings:	0.00%	0.00%	0.01%	0.00%	0.00%	0.06%	0.00%	23.43%	0.05%				N/A
Discards as % of comm landings:	0.00%	0.00%	0.14%	0.05%	0.03%	0.73%	0.00%	265.91%	0.63%				N/A
Discards as % ot total landings:	0.00%	0.00%	0.05%	0.05%	0.03%	0.73%	0.00%	265.91%	0.60%				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.

Northeast Region SBRM Importance Filter Worksheet

New England Extra-Large-Mesh Gillnet

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
533	445	4,712	9%	Fish
701	569	4,712	12%	Protected Species

Top Species:	M/S/B	small-mesh mults	SF/S/BSB	herring	bluefish	large-mesh mults	monkfish	dogfish	skates				sea turtles
Projected observer days needed:	2,244	1,890	1,245	1,065	576	504	425	419	274				144
Average trip length (days):	0.40												
Estimated % coverage level required:	119%	100%	66%	57%	31%	27%	23%	22%	15%				8%
Realized CV for 2004:	49.8%	62.4%	23.3%	37.8%	18.1%	15.9%	17.4%	16.2%	11.7%				*
Percent of trips w/ zero discard:	95%	88%	92%	96%	85%	48%	57%	29%	30%				100%
Encounter rate:	5%	12%	8%	4%	15%	52%	43%	71%	70%				0%
Rank of total discards (out of 13):	7	8	5	11	6	4	3	1	2				N/A
Observed discards (lb):	393	373	2,417	46	1,935	16,705	29,933	100,388	36,016				0
Obs. discard percent of all obs. discards:	0.16%	0.15%	1.00%	0.02%	0.80%	6.91%	12.39%	41.55%	14.91%				N/A
2004 commercial landings (lb, all gears):	212,528,000	19,387,000	30,616,000	187,387,000	7,512,000	83,523,000	23,036,000	1,965,000	20,388,000				N/A
2004 recreational landings (lb, all gears):	1,134,000	35,000	17,982,000	27,000	15,146,000	5,383,000	0	0	0				N/A
Obs. discards as % of comm landings:	0.00%	0.00%	0.01%	0.00%	0.03%	0.02%	0.13%	5.11%	0.18%				N/A
Discards as % of comm landings:	0.00%	0.02%	0.24%	0.00%	0.32%	0.27%	2.76%	64.66%	3.34%				N/A
Discards as % ot total landings:	0.00%	0.02%	0.15%	0.00%	0.10%	0.26%	2.76%	64.66%	3.34%				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.

Northeast Region SBRM Importance Filter Worksheet
Mid-Atlantic Small-Mesh Gillnet

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
3	3	2,924	0%	Fish
375	358	2,924	12%	Protected Species

Top Species:	bluefish	herring	M/S/B	monkfish	large-mesh mults	skates	dogfish	SF/S/BSB					sea turtles
Projected observer days needed:	***62***	***62***	***62***	***62***	***62***	***62***	***62***	***62***					1,025
Average trip length (days):	1.10												
Estimated % coverage level required:	2%	2%	2%	2%	2%	2%	2%	2%					32%
Realized CV for 2004:	*	*	0.0%	*	*	*	0.0%	0.0%					62.6%
Percent of trips w/ zero discard:	100%	100%	67%	100%	100%	100%	33%	67%					99%
Encounter rate:	0%	0%	33%	0%	0%	0%	67%	33%					1%
Rank of total discards (out of 13):	4	4	2	4	4	4	1	3					N/A
Observed discards (lb):	0	0	1	0	0	0	64	0					Yes
Obs. discard percent of all obs. discards:	0.00%	0.00%	0.24%	0.00%	0.00%	0.00%	31.25%	0.15%					N/A
2004 commercial landings (lb, all gears):	7,512,000	187,387,000	212,528,000	23,036,000	83,523,000	20,388,000	1,965,000	30,616,000					N/A
2004 recreational landings (lb, all gears):	15,146,000	27,000	1,134,000	0	5,383,000	0	0	17,982,000					N/A
Obs. discards as % of comm landings:	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%					N/A
Discards as % of comm landings:	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	99.70%	0.03%					N/A
Discards as % ot total landings:	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	99.70%	0.02%					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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Large-Mesh Gillnet

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
4	4	1,293	0%	Fish
85	81	1,293	6%	Protected Species

Top Species:	bluefish	skate	dogfish	herring	M/S/B	monkfish	SF/S/BSB	large-mesh mults					sea turtles
Projected observer days needed:	103	97	93	***29***	***29***	***29***	***29***	19					107
Average trip length (days):	0.40												
Estimated % coverage level required:	20%	19%	18%	6%	6%	6%	6%	4%					21%
Realized CV for 2004:	121.6%	111.8%	108.3%	*	*	*	*	86.8%					105.2%
Percent of trips w/ zero discard:	75%	50%	25%	100%	100%	100%	100%	75%					98%
Encounter rate:	25%	50%	75%	0%	0%	0%	0%	25%					3%
Rank of total discards (out of 13):	2	3	1	5	5	5	5	4					N/A
Observed discards (lb):	102	11	2,302	0	0	0	0	6					Yes
Obs. discard percent of all obs. discards:	4.02%	0.43%	90.65%	0.00%	0.00%	0.00%	0.00%	0.24%					N/A
2004 commercial landings (lb, all gears):	7,512,000	20,388,000	1,965,000	187,387,000	212,528,000	23,036,000	30,616,000	83,523,000					N/A
2004 recreational landings (lb, all gears):	15,146,000	0	0	27,000	1,134,000	0	17,982,000	5,383,000					N/A
Obs. discards as % of comm landings:	0.00%	0.00%	0.12%	0.00%	0.00%	0.00%	0.00%	0.00%					N/A
Discards as % of comm landings:	8.93%	0.35%	770.42%	0.00%	0.00%	0.00%	0.00%	0.05%					N/A
Discards as % ot total landings:	2.96%	0.35%	770.42%	0.00%	0.00%	0.00%	0.00%	0.04%					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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Extra-Large-Mesh Gillnet

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
30	27	2,568	1%	Fish
152	142	2,568	6%	Protected Species

Top Species:	bluefish	SF/S/BSB	monkfish	herring	M/S/B	large-mesh mults	dogfish	skates					sea turtles
Projected observer days needed:	113	105	92	***68***	***68***	***68***	55	53					557
Average trip length (days):	0.60												
Estimated % coverage level required:	7%	7%	6%	4%	4%	4%	4%	3%					36%
Realized CV for 2004:	30.4%	30.3%	27.3%	*	*	*	12.9%	11.5%					49.5%
Percent of trips w/ zero discard:	56%	74%	37%	100%	100%	100%	11%	4%					97%
Encounter rate:	44%	26%	63%	0%	0%	0%	89%	96%					3%
Rank of total discards (out of 13):	4	5	3	7	7	7	1	2					N/A
Observed discards (lb):	328	113	1,712	0	0	0	3,620	2,500					Yes
Obs. discard percent of all obs. discards:	2.45%	0.84%	12.79%	0.00%	0.00%	0.00%	27.05%	18.68%					N/A
2004 commercial landings (lb, all gears):	7,512,000	30,616,000	23,036,000	187,387,000	212,528,000	83,523,000	1,965,000	20,388,000					N/A
2004 recreational landings (lb, all gears):	15,146,000	17,982,000	0	27,000	1,134,000	5,383,000	0	0					N/A
Obs. discards as % of comm landings:	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.18%	0.01%					N/A
Discards as % of comm landings:	0.26%	0.02%	0.45%	0.00%	0.00%	0.00%	11.19%	0.74%					N/A
Discards as % ot total landings:	0.09%	0.01%	0.45%	0.00%	0.00%	0.00%	11.19%	0.74%					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.

Northeast Region SBRM Importance Filter Worksheet

New England Handline

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
6	6	3,378	0%	Fish
18	9	3,378	0%	Protected Species

Top Species:	large-mesh mults	bluefish	dogfish	SF/S/BSB								sea turtles
Projected observer days needed:	131	***72***	***72***	***72***								***72***
Average trip length (days):	0.40											
Estimated % coverage level required:	10%	5%	5%	5%								5%
Realized CV for 2004:	403.0%	*	*	*								*
Percent of trips w/ zero discard:	67%	100%	100%	100%								100%
Encounter rate:	33%	0%	0%	0%								0%
Rank of total discards (out of 13):	1	2	2	2								N/A
Observed discards (lb):	8	0	0	0								0
Obs. discard percent of all obs. discards:	100.00%	0.00%	0.00%	0.00%								N/A
2004 commercial landings (lb, all gears):	83,523,000	7,512,000	1,965,000	30,616,000								N/A
2004 recreational landings (lb, all gears):	5,383,000	15,416,000	0	17,982,000								N/A
Obs. discards as % of comm landings:	0.00%	0.00%	0.00%	0.00%								N/A
Discards as % of comm landings:	0.01%	0.00%	0.00%	0.00%								N/A
Discards as % ot total landings:	0.01%	0.00%	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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Handline

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
0	0	6,283	0%	Fish
11	3	6,283	0%	Protected Species

Top Species:	large-mesh mults	sea turtles
Projected observer days needed:	***133***	72
Average trip length (days):	0.30	
Estimated % coverage level required:	7%	4%
Realized CV for 2004:	N/A	*
Percent of trips w/ zero discard:	N/A	100%
Encounter rate:	N/A	0%
Rank of total discards (out of 13):	N/A	N/A
Observed discards (lb):	N/A	0
Obs. discard percent of all obs. discards:	N/A	N/A
2004 commercial landings (lb, all gears):	83,523,000	N/A
2004 recreational landings (lb, all gears):	5,383,000	N/A
Obs. discards as % of comm landings:	N/A	N/A
Discards as % of comm landings:	N/A	N/A
Discards as % ot total landings:	N/A	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.

Northeast Region SBRM Importance Filter Worksheet

New England Lobster Pots

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
0	0	34,101	0%	Fish
3	3	34,101	0%	Protected Species

Top Species:	red crab	large-mesh mults	sea turtles
Projected observer days needed:	***439***	***439***	***439***
Average trip length (days):	0.60		
Estimated % coverage level required:	2%	2%	2%
Realized CV for 2004:	N/A	N/A	*
Percent of trips w/ zero discard:	N/A	N/A	100%
Encounter rate:	N/A	N/A	0%
Rank of total discards (out of 13):	N/A	N/A	N/A
Observed discards (lb):	N/A	N/A	0
Obs. discard percent of all obs. discards:	N/A	N/A	N/A
2004 commercial landings (lb, all gears):	3,952,000	83,523,000	N/A
2004 recreational landings (lb, all gears):	0	5,383,000	N/A
Obs. discards as % of comm landings:	N/A	N/A	N/A
Discards as % of comm landings:	0.00%	0.00%	N/A
Discards as % ot total landings:	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.

Northeast Region SBRM Importance Filter Worksheet
Mid-Atlantic Lobster Pots

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
0	0	3,750	0%	Fish
0	0	3,750	0%	Protected Species

Top Species:	red crab	large-mesh mults	sea turtles
Projected observer days needed:	***89***	***89***	***89***
Average trip length (days):	0.60		
Estimated % coverage level required:	4%	4%	4%
Realized CV for 2004:	N/A	N/A	N/A
Percent of trips w/ zero discard:	N/A	N/A	N/A
Encounter rate:	N/A	N/A	N/A
Rank of total discards (out of 13):	N/A	N/A	N/A
Observed discards (lb):	N/A	N/A	0
Obs. discard percent of all obs. discards:	N/A	N/A	N/A
2004 commercial landings (lb, all gears):	3,952,000	83,523,000	N/A
2004 recreational landings (lb, all gears):	0	5,383,000	N/A
Obs. discards as % of comm landings:	N/A	N/A	N/A
Discards as % of comm landings:	N/A	N/A	N/A
Discards as % ot total landings:	N/A	N/A	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.

Northeast Region SBRM Importance Filter Worksheet

New England Longline

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
12	12	1,234	1%	Fish
133	119	1,234	10%	Protected Species

Top Species:	dogfish	skates	small-mesh mults	large-mesh mults	monkfish	tilefish							sea turtles
Projected observer days needed:	187	84	55	54	35	35							35
Average trip length (days):	0.80												
Estimated % coverage level required:	19%	9%	6%	5%	4%	4%							4%
Realized CV for 2004:	65.4%	61.4%	91.0%	33.5%	*	*							*
Percent of trips w/ zero discard:	33%	25%	92%	0%	100%	100%							100%
Encounter rate:	67%	75%	8%	100%	0%	0%							0%
Rank of total discards (out of 13):	1	3	4	2	5	5							N/A
Observed discards (lb):	8,270	455	7	1,667	0	0							0
Obs. discard percent of all obs. discards:	77.04%	4.24%	0.07%	15.53%	0.00%	0.00%							N/A
2004 commercial landings (lb, all gears):	1,965,000	20,388,000	19,387,000	83,523,000	23,036,000	2,316,000							N/A
2004 recreational landings (lb, all gears):	0	0	35,000	5,383,000	0	0							N/A
Obs. discards as % of comm landings:	0.42%	0.00%	0.00%	0.00%	0.00%	0.00%							N/A
Discards as % of comm landings:	42.71%	0.35%	0.00%	0.28%	0.00%	0.00%							N/A
Discards as % ot total landings:	42.71%	0.35%	0.00%	0.27%	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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Longline

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
0	0	205	0%	Fish
11	2	205	1%	Protected Species

Top Species:	monkfish	large-mesh mults	skate	dogfish	tilefish	sea turtles
Projected observer days needed:	***76***	***76***	***76***	***76***	***76***	***76***
Average trip length (days):	5.40					
Estimated % coverage level required:	7%	7%	7%	7%	7%	7%
Realized CV for 2004:	N/A	N/A	N/A	N/A	N/A	*
Percent of trips w/ zero discard:	N/A	N/A	N/A	N/A	N/A	100%
Encounter rate:	N/A	N/A	N/A	N/A	N/A	0%
Rank of total discards (out of 13):	N/A	N/A	N/A	N/A	N/A	N/A
Observed discards (lb):	N/A	N/A	N/A	N/A	N/A	0
Obs. discard percent of all obs. discards:	N/A	N/A	N/A	N/A	N/A	N/A
2004 commercial landings (lb, all gears):	23,036,000	83,523,000	20,388,000	1,965,000	2,316,000	N/A
2004 recreational landings (lb, all gears):	0	5,383,000	0	0	0	N/A
Obs. discards as % of comm landings:	N/A	N/A	N/A	N/A	N/A	N/A
Discards as % of comm landings:	N/A	N/A	N/A	N/A	N/A	N/A
Discards as % ot total landings:	N/A	N/A	N/A	N/A	N/A	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.

Northeast Region SBRM Importance Filter Worksheet

New England Mid-Water Trawl

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
165	66	1,061	6%	Fish
242	99	1,061	9%	Protected Species

Top Species:	small-mesh mults	M/S/B	herring	large-mesh mults	monkfish	bluefish	dogfish	sea turtles
Projected observer days needed:	924	752	749	531	484	420	280	56
Average trip length (days):	1.50							
Estimated % coverage level required:	58%	47%	47%	33%	30%	26%	18%	4%
Realized CV for 2004:	99.4%	42.9%	77.0%	66.9%	72.4%	77.0%	41.8%	*
Percent of trips w/ zero discard:	79%	62%	86%	73%	85%	89%	30%	100%
Encounter rate:	21%	38%	14%	27%	15%	11%	70%	0%
Rank of total discards (out of 11):	5	1	3	4	8	6	2	N/A
Observed discards (lb):	4,080	157,591	97,352	5,642	269	611	131,699	0
Obs. discard percent of all obs. discards:	1.01%	39.17%	24.20%	1.40%	0.07%	0.15%	32.74%	N/A
2004 commercial landings (lb, all gears):	19,387,000	212,528,000	187,387,000	83,523,000	23,036,000	7,512,000	1,965,000	0
2004 recreational landings (lb, all gears):	35,000	1,134,000	27,000	5,383,000	0	15,146,000	266,657	N/A
Obs. discards as % of comm landings:	0.02%	0.07%	0.05%	0.01%	0.00%	0.01%	6.70%	N/A
Discards as % of comm landings:	0.23%	2.43%	0.37%	0.06%	0.01%	0.05%	58.04%	N/A
Discards as % ot total landings:	0.23%	2.41%	0.37%	0.06%	0.01%	0.02%	51.10%	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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Mid-Water Trawl

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
39	13	121	11%	Fish
42	14	121	12%	Protected Species

Top Species:	large-mesh mults	monkfish	herring	small-mesh mults	bluefish	M/S/B	dogfish						sea turtles
Projected observer days needed:	379	335	235	82	66	51	49						35
Average trip length (days):	2.60												
Estimated % coverage level required:	120%	106%	75%	26%	21%	16%	16%						11%
Realized CV for 2004:	74.2%	110.8%	98.2%	53.9%	53.9%	54.6%	24.6%						*
Percent of trips w/ zero discard:	38%	77%	92%	77%	92%	69%	54%						100%
Encounter rate:	62%	23%	8%	23%	8%	31%	46%						0%
Rank of total discards (out of 13):	7	3	6	5	8	2	1						N/A
Observed discards (lb):	43	94	5	1,024	100	11,794	2,716						0
Obs. discard percent of all obs. discards:	0.23%	0.50%	0.03%	5.49%	0.54%	63.28%	14.57%						N/A
2004 commercial landings (lb, all gears):	83,523,000	23,036,000	187,387,000	19,387,000	7,512,000	212,528,000	1,965,000						N/A
2004 recreational landings (lb, all gears):	5,383,000	0	27,000	35,000	15,146,000	1,134,000	0						N/A
Obs. discards as % of comm landings:	0.00%	0.00%	0.00%	0.01%	0.00%	0.01%	0.14%						N/A
Discards as % of comm landings:	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.18%						N/A
Discards as % ot total landings:	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.18%						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.

Northeast Region SBRM Importance Filter Worksheet
New England Small-Mesh Otter Trawl

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
449	142	3,484	4%	Fish
577	200	3,484	6%	Protected Species

Top Species:	red crab	scallop	herring	bluefish	tilefish	SF/S/BSB	skates	dogfish	small-mesh mults	large-mesh mults	monkfish	M/S/B	sea turtles
Projected observer days needed:	2,769	2,712	2,021	1,879	1,678	1,431	1,157	1,093	1,001	864	680	666	211
Average trip length (days):	1.90												
Estimated % coverage level required:	42%	41%	31%	28%	25%	22%	17%	17%	15%	13%	10%	10%	3%
Realized CV for 2004:	42.8%	71.0%	43.7%	50.8%	30.4%	30.9%	69.1%	32.2%	23.5%	23.3%	40.5%	22.7%	*
Percent of trips w/ zero discard:	90%	89%	74%	85%	87%	41%	14%	21%	34%	4%	36%	35%	100%
Encounter rate:	10%	11%	26%	15%	13%	59%	86%	79%	66%	96%	64%	65%	0%
Rank of total discards (out of 13):	10	12	8	9	11	5	2	4	3	6	7	1	N/A
Observed discards (lb):	1,143	180	13,687	7,934	316	37,034	178,362	93,129	148,897	41,122	26,577	229,443	0
Obs. discard percent of all obs. discards:	0.10%	0.02%	1.24%	0.72%	0.03%	3.34%	16.10%	8.40%	13.44%	3.71%	2.40%	20.71%	N/A
2004 commercial landings (lb, all gears):	3,952,000	64,506,000	187,387,000	7,512,000	2,316,000	30,616,000	20,388,000	1,965,000	19,387,000	83,523,000	23,036,000	212,528,000	0
2004 recreational landings (lb, all gears):	0	0	27,000	15,146,000	0	17,982,000	35,405	266,657	35,000	5,383,000	0	1,134,000	N/A
Obs. discards as % of comm landings:	0.03%	0.00%	0.01%	0.11%	0.01%	0.12%	0.87%	4.74%	0.77%	0.05%	0.12%	0.11%	N/A
Discards as % of comm landings:	1.14%	0.01%	0.28%	2.56%	0.81%	5.54%	38.71%	160.90%	26.55%	1.81%	4.93%	4.28%	N/A
Discards as % ot total landings:	1.14%	0.01%	0.28%	0.85%	0.81%	3.49%	38.64%	141.67%	26.50%	1.70%	4.93%	4.25%	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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Small-Mesh Otter Trawl

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
471	194	5,222	4%	Fish
499	205	5,222	4%	Protected Species

Top Species:	scallop	M/S/B	herring	bluefish	monkfish	small-mesh mults	dogfish	large-mesh mults	SF/S/BSB	tilefish	skate		sea turtles
Projected observer days needed:	2,054	1,875	1,781	1,727	1,337	1,307	1,231	1,005	974	929	794		1,886
Average trip length (days):	0.90												
Estimated % coverage level required:	44%	40%	38%	37%	28%	28%	26%	21%	21%	20%	17%		40%
Realized CV for 2004:	57.4%	56.1%	78.4%	90.3%	35.4%	50.8%	36.7%	32.6%	38.6%	115.5%	22.2%		57.3%
Percent of trips w/ zero discard:	90%	55%	96%	90%	67%	73%	37%	44%	28%	99%	23%		99%
Encounter rate:	10%	45%	4%	10%	33%	27%	63%	56%	72%	1%	77%		2%
Rank of total discards (out of 13):	9	2	11	8	7	5	3	6	4	13	1		N/A
Observed discards (lb):	6,303	119,995	144	6,645	7,744	75,491	94,574	7,560	91,616	6	110,445		Yes
Obs. discard percent of all obs. discards:	0.81%	15.45%	0.02%	0.86%	1.00%	9.72%	12.18%	0.97%	11.80%	0.00%	14.22%		N/A
2004 commercial landings (lb, all gears):	64,506,000	212,528,000	187,387,000	7,512,000	23,036,000	19,387,000	1,965,000	83,523,000	30,616,000	2,316,000	20,388,000		N/A
2004 recreational landings (lb, all gears):	0	1,134,000	27,000	15,146,000	0	35,000	0	5,383,000	17,982,000	0	0		NA
Obs. discards as % of comm landings:	7.56%	6.22%	0.00%	7.82%	7.02%	7.48%	6.20%	3.98%	6.56%	7.25%	5.29%		N/A
Discards as % of comm landings:	0.13%	0.91%	0.00%	1.13%	0.48%	5.20%	77.63%	0.23%	4.56%	0.00%	10.24%		N/A
Discards as % ot total landings:	0.13%	0.90%	0.00%	0.38%	0.48%	5.19%	77.63%	0.21%	2.87%	0.00%	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.

Northeast Region SBRM Importance Filter Worksheet
New England Large-Mesh Otter Trawl

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
1,076	386	16,156	2%	Fish
1,947	539	16,156	3%	Protected Species

Top Species:	bluefish	herring	tilefish	SF/S/BSB	scallop	red crab	M/S/B	dogfish	skates	small-mesh mults	large-mesh mults	monkfish	sea turtles
Projected observer days needed:	5,680	4,817	3,827	3,726	3,439	2,808	1,557	1,017	906	890	501	374	730
Average trip length (days):	1.90												
Estimated % coverage level required:	19%	16%	12%	12%	11%	9%	5%	3%	3%	3%	2%	1%	2%
Realized CV for 2004:	247.4%	131.3%	52.9%	31.9%	35.0%	28.0%	57.2%	24.5%	17.5%	18.2%	10.1%	8.8%	*
Percent of trips w/ zero discard:	98%	90%	99%	72%	88%	82%	70%	28%	6%	53%	5%	49%	100%
Encounter rate:	2%	10%	1%	28%	12%	18%	30%	72%	94%	47%	95%	51%	0%
Rank of total discards (out of 13):	9	10	12	5	8	6	11	2	1	7	3	4	N/A
Observed discards (lb):	854	563	285	21,854	1,191	6,660	357	149,701	1,008,436	5,141	124,760	41,061	0
Obs. discard percent of all obs. discards:	0.06%	0.04%	0.02%	1.41%	0.08%	0.43%	0.02%	9.69%	65.24%	0.33%	8.07%	2.66%	N/A
2004 commercial landings (lb, all gears):	7,512,000	187,387,000	2,316,000	30,616,000	64,506,000	3,952,000	212,528,000	1,965,000	20,388,000	19,387,000	83,523,000	23,036,000	0
2004 recreational landings (lb, all gears):	15,146,000	27,000	0	17,982,000	0	0	1,134,000	266,657	35,405	35,000	5,383,000	0	N/A
Obs. discards as % of comm landings:	0.01%	0.00%	0.01%	0.07%	0.00%	0.17%	0.00%	7.62%	4.95%	0.03%	0.15%	0.18%	N/A
Discards as % of comm landings:	0.42%	0.01%	0.38%	2.35%	0.06%	5.58%	0.01%	244.01%	167.01%	0.90%	4.79%	5.70%	N/A
Discards as % ot total landings:	0.14%	0.01%	0.38%	1.48%	0.06%	5.58%	0.01%	214.85%	166.72%	0.90%	4.50%	5.70%	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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Large-Mesh Otter Trawl

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
183	75	8,850	1%	Fish
186	76	8,850	1%	Protected Species

Top Species:	herring	scallop	dogfish	small-mesh mults	M/S/B	bluefish	SF/S/BSB	monkfish	large-mesh mults	tilefish	skate		sea turtles
Projected observer days needed:	892	726	710	702	537	437	395	392	386	342	203		342
Average trip length (days):	0.90												
Estimated % coverage level required:	11%	9%	9%	9%	7%	5%	5%	5%	5%	4%	3%		4%
Realized CV for 2004:	77.5%	44.4%	55.7%	82.7%	39.0%	190.6%	24.6%	29.5%	25.1%	*	20.9%		*
Percent of trips w/ zero discard:	96%	80%	31%	77%	59%	92%	20%	44%	35%	100%	5%		100%
Encounter rate:	4%	20%	69%	23%	41%	8%	80%	56%	65%	0%	95%		0%
Rank of total discards (out of 13):	11	5	2	8	7	10	3	6	4	12	1		N/A
Observed discards (lb):	5	7,202	44,140	217	407	102	18,118	3,629	3,523	0	88,540		0
Obs. discard percent of all obs. discards:	0.00%	3.46%	21.21%	0.10%	0.20%	0.05%	8.70%	1.74%	1.69%	0.00%	42.54%		N/A
2004 commercial landings (lb, all gears):	187,387,000	64,506,000	1,965,000	19,387,000	212,528,000	7,512,000	30,616,000	23,036,000	83,523,000	2,316,000	20,388,000		N/A
2004 recreational landings (lb, all gears):	27,000	0	0	35,000	1,134,000	15,146,000	17,982,000	0	5,385,000	0	0		N/A
Obs. discards as % of comm landings:	0.00%	0.01%	2.25%	0.00%	0.00%	0.00%	0.06%	0.02%	0.00%	0.00%	0.43%		N/A
Discards as % of comm landings:	0.00%	0.46%	106.69%	0.05%	0.01%	0.06%	3.76%	0.72%	0.37%	0.00%	29.24%		N/A
Discards as % ot total landings:	0.00%	0.46%	106.69%	0.05%	0.01%	0.02%	2.37%	0.72%	0.35%	0.00%	29.24%		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.

Northeast Region SBRM Importance Filter Worksheet

New England Purse Seine

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
33	16	264	6%	Fish
53	26	264	10%	Protected Species

Top Species:	dogfish	herring	large-mesh mults	M/S/B	bluefish	small-mesh mults	skates	sea turtles
Projected observer days needed:	176	169	164	157	19	19	19	19
Average trip length (days):	0.80							
Estimated % coverage level required:	83%	80%	78%	74%	9%	9%	9%	9%
Realized CV for 2004:	97.2%	98.1%	97.3%	93.5%	*	*	*	*
Percent of trips w/ zero discard:	44%	88%	94%	88%	100%	100%	100%	100%
Encounter rate:	56%	12%	6%	12%	0%	0%	0%	0%
Rank of total discards (out of 13):	1	2	3	4	5	5	5	N/A
Observed discards (lb):	11,817	5,200	20	14	0	0	0	0
Obs. discard percent of all obs. discards:	67.15%	29.55%	0.11%	0.08%	0.00%	0.00%	0.00%	N/A
2004 commercial landings (lb, all gears):	1,965,000	187,387,000	83,523,000	212,528,000	7,512,000	35,000	20,388,000	N/A
2004 recreational landings (lb, all gears):	0	27,000	5,383,000	1,134,000	15,146,000	19,387,000	0	N/A
Obs. discards as % of comm landings:	0.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	N/A
Discards as % of comm landings:	13.86%	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%	N/A
Discards as % ot total landings:	13.86%	0.06%	0.00%	0.00%	0.00%	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.

Northeast Region SBRM Importance Filter Worksheet
Mid-Atlantic Purse Seine

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
0	0	76	0%	Fish
2	2	76	3%	Protected Species

Top Species:	bluefish	herring	M/S/B	large-mesh mults	small-mesh mults	skates	dogfish	SF/S/BSB					sea turtles
Projected observer days needed:	***9***	***9***	***9***	***9***	***9***	***9***	***9***	***9***					***9***
Average trip length (days):	0.40												
Estimated % coverage level required:	30%	30%	30%	30%	30%	30%	30%	30%					30%
Realized CV for 2004:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					*
Percent of trips w/ zero discard:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					100%
Encounter rate:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					0%
Rank of total discards (out of 13):	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					N/A
Observed discards (lb):	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					0
Obs. discard percent of all obs. discards:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					N/A
2004 commercial landings (lb, all gears):	7,512,000	187,387,000	212,528,000	83,523,000	19,387,000	20,388,000	1,965,000	30,616,000					N/A
2004 recreational landings (lb, all gears):	15,146,000	27,000	1,134,000	5,383,000	35,000	0	0	17,982,000					N/A
Obs. discards as % of comm landings:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					N/A
Discards as % of comm landings:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					N/A
Discards as % ot total landings:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					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.

Northeast Region SBRM Importance Filter Worksheet

New England Scallop Dredge, Open Access Area, Limited Trip Category

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
344	26	1,229	2%	Fish
457	36	1,229	3%	Protected Species

Top Species:	M/S/B	dogfish	large-mesh mults	SF/S/BSB	red crab	small mesh mults	scallop	monkfish	skate				sea turtles
Projected observer days needed:	1,839	1,540	1,468	1,331	1,268	1,191	896	685	337				2,718
Average trip length (days):	10.90												
Estimated % coverage level required:	14%	11%	11%	10%	9%	9%	7%	5%	3%				20%
Realized CV for 2004:	68.9%	51.5%	48.0%	45.8%	84.2%	41.4%	15.9%	31.9%	23.6%				55.1%
Percent of trips w/ zero discard:	50%	46%	0%	35%	96%	38%	19%	8%	0%				89%
Encounter rate:	50%	54%	100%	65%	4%	62%	81%	92%	100%				11%
Rank of total discards (out of 13):	9	8	5	4	10	7	1	3	2				N/A
Observed discards (lb):	285	871	4,146	12,725	3	817	270,249	37,877	218,592				Yes
Obs. discard percent of all obs. discards:	0.04%	0.11%	0.51%	1.58%	0.00%	0.10%	33.50%	4.69%	27.09%				N/A
2004 commercial landings (lb, all gears):	212,528,000	1,965,000	83,823,000	30,616,000	3,952,000	19,387,000	64,506,000	23,036,000	20,388,000				N/A
2004 recreational landings (lb, all gears):	1,134,000	0	5,383,000	17,982,000	0	35,000	0	0	0				N/A
Obs. discards as % of comm landings:	0.00%	0.04%	0.00%	0.04%	0.00%	0.00%	0.42%	0.16%	1.07%				N/A
Discards as % of comm landings:	0.01%	1.66%	0.27%	1.57%	0.00%	0.32%	28.58%	12.58%	64.85%				N/A
Discards as % ot total landings:	0.01%	1.66%	0.25%	0.99%	0.00%	0.32%	28.58%	12.58%	64.85%				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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Scallop Dredge, Open Area Access, Limited Trip Category

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
591	69	1,822	4%	Fish
675	78	1,822	4%	Protected Species

Top Species:	small-mesh mults	dogfish	large-mesh mults	M/S/B	SF/S/BSB	scallop	monkfish	skates							sea turtles
Projected observer days needed:	2,949	2,421	1,142	1,129	606	589	462	305							3,470
Average trip length (days):	9.00														
Estimated % coverage level required:	18%	15%	7%	7%	4%	4%	3%	2%							21%
Realized CV for 2004:	75.8%	23.0%	24.2%	30.5%	25.8%	20.0%	17.4%	12.6%							77.0%
Percent of trips w/ zero discard:	57%	62%	25%	42%	33%	26%	1%	0%							97%
Encounter rate:	43%	38%	75%	58%	67%	74%	99%	100%							3%
Rank of total discards (out of 11):	8	2	5	9	4	1	3	2							N/A
Observed discards (lb):	869	2,037	2,927	278	10,280	367,166	45,211	156,844							Yes
Obs. discard percent of all obs. discards:	0.11%	0.26%	0.37%	0.04%	1.31%	46.65%	5.74%	19.93%							N/A
2004 commercial landings (lb, all gears):	19,387,000	1,965,000	83,523,000	212,528,000	30,616,000	64,506,000	23,036,000	20,388,000							0
2004 recreational landings (lb, all gears):	35,000	266,657	5,383,000	1,134,000	17,982,000	0	0	35,405							N/A
Obs. discards as % of comm landings:	0.00%	0.10%	0.004%	0.00%	0.03%	0.57%	0.20%	0.77%							N/A
Discards as % of comm landings:	0.15%	4.68%	0.12%	0.00%	1.42%	29.66%	8.80%	31.32%							N/A
Discards as % ot total landings:	0.15%	4.12%	0.12%	0.00%	0.90%	29.66%	8.80%	31.27%							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.

Northeast Region SBRM Importance Filter Worksheet

New England Scallop Dredge, Closed Area Access, Limited Trip Category

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
805	86	292	29%	Fish
805	86	292	29%	Protected Species

Top Species:	red crab	dogfish	M/S/B	small-mesh mults	SF/S/BSB	scallop	monkfish	large-mesh mults	skates				sea turtles
Projected observer days needed:	3,810	2,841	1,393	1,332	1,149	475	439	415	198				2,431
Average trip length (days):	9.70												
Estimated % coverage level required:	135%	100%	49%	47%	41%	17%	15%	15%	7%				86%
Realized CV for 2004:	79.3%	34.9%	42.5%	37.4%	34.4%	17.0%	25.2%	13.7%	13.4%				15.7%
Percent of trips w/ zero discard:	98%	51%	43%	16%	26%	20%	5%	1%	0%				99%
Encounter rate:	2%	49%	57%	84%	74%	80%	95%	99%	100%				1%
Rank of total discards (out of 13):	11	7	8	6	5	1	3	4	2				N/A
Observed discards (lb):	5	3,948	460	3,547	36,678	706,435	123,827	19,724	331,549				Yes
Obs. discard percent of all obs. discards:	0.00%	0.27%	0.03%	0.24%	2.48%	47.81%	8.38%	1.33%	22.44%				N/A
2004 commercial landings (lb, all gears):	3,952,000	1,965,000	212,528,000	19,387,000	30,616,000	64,506,000	23,036,000	83,523,000	20,388,000				N/A
2004 recreational landings (lb, all gears):	0	266,657	1,134,000	35,000	17,982,000	0	0	5,383,000	35,405				N/A
Obs. discards as % of comm landings:	0.00%	0.20%	0.00%	0.02%	0.12%	1.10%	0.54%	0.02%	1.63%				N/A
Discards as % of comm landings:	0.00%	0.77%	0.00%	0.12%	0.33%	2.09%	1.64%	0.26%	6.16%				N/A
Discards as % ot total landings:	0.00%	0.68%	0.00%	0.12%	0.21%	2.09%	1.64%	0.24%	6.15%				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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Scallop Dredge, Closed Area Access, Limited Trip Category

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
373	35	78	45%	Fish
373	35	78	45%	Protected Species

Top Species:	dogfish	SF/S/BSB	small-mesh mults	M/S/B	large-mesh mults	scallop	skates	monkfish					sea turtles
Projected observer days needed:	1,778	996	994	766	612	497	337	164					108
Average trip length (days):	9.00												
Estimated % coverage level required:	253%	142%	142%	109%	87%	71%	48%	23%					15%
Realized CV for 2004:	36.4%	31.1%	26.4%	31.8%	63.1%	20.2%	13.5%	26.2%					*
Percent of trips w/ zero discard:	46%	29%	23%	26%	9%	17%	0%	0%					100%
Encounter rate:	54%	71%	77%	74%	91%	83%	100%	100%					0%
Rank of total discards (out of 13):	5	4	7	8	6	1	2	3					N/A
Observed discards (lb):	2,019	9,418	317	164	1,213	631,764	159,899	67,163					0
Obs. discard percent of all obs. discards:	0.21%	0.98%	0.03%	0.02%	0.13%	65.77%	16.65%	6.99%					N/A
2004 commercial landings (lb, all gears):	1,965,000	30,616,000	19,387,000	212,528,000	83,523,000	64,506,000	20,388,000	23,036,000					N/A
2004 recreational landings (lb, all gears):	0	17,982,000	35,000	1,134,000	5,383,000	0	0	0					N/A
Obs. discards as % of comm landings:	0.10%	0.03%	0.00%	0.00%	0.00%	0.98%	0.78%	0.29%					N/A
Discards as % of comm landings:	0.66%	0.24%	0.00%	0.00%	0.01%	1.88%	2.74%	1.07%					N/A
Discards as % ot total landings:	0.66%	0.15%	0.00%	0.00%	0.01%	1.88%	2.74%	1.07%					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.

Northeast Region SBRM Importance Filter Worksheet

New England Scallop Dredge, Open Area Access, General Trip Category

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
11	9	3,566	0%	Fish
24	20	3,566	1%	Protected Species

Top Species:	scallop	small-mesh mults	skate	dogfish	monkfish	red crab	SF/S/BSB	large-mesh mults					sea turtles
Projected observer days needed:	180	125	112	112	110	***92***	***92***	81					***92***
Average trip length (days):	1.30												
Estimated % coverage level required:	4%	3%	2%	2%	2%	2%	2%	2%					2%
Realized CV for 2004:	9.4%	10.4%	17.7%	31.8%	56.0%	*	9.2%	35.8%					*
Percent of trips w/ zero discard:	67%	56%	11%	78%	33%	100%	89%	0%					100%
Encounter rate:	33%	44%	89%	22%	67%	0%	11%	100%					0%
Rank of total discards (out of 13):	3	7	2	5	1	10	6	4					N/A
Observed discards (lb):	114	6	1,123	33	3,330	0	4	225					0
Obs. discard percent of all obs. discards:	1.15%	0.06%	11.32%	0.33%	33.57%	0.00%	0.04%	2.27%					N/A
2004 commercial landings (lb, all gears):	64,506,000	19,387,000	20,388,000	1,965,000	23,036,000	3,952,000	30,616,000	83,523,000					N/A
2004 recreational landings (lb, all gears):	0	35,000	0	0	0	0	17,982,000	5,383,000					N/A
Obs. discards as % of comm landings:	0.00%	0.00%	0.01%	0.00%	0.01%	0.00%	0.00%	0.00%					N/A
Discards as % of comm landings:	0.22%	0.02%	1.80%	0.50%	1.75%	0.00%	0.02%	0.04%					N/A
Discards as % ot total landings:	0.22%	0.02%	1.80%	0.50%	1.75%	0.00%	0.01%	0.04%					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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Scallop Dredge, Open Access Area, General Trip Category

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
33	22	3,433	1%	Fish
55	39	3,433	1%	Protected Species

Top Species:	SF/S/BSB	scallop	large-mesh mults	dogfish	small-mesh mults	monkfish	skates	sea turtles
Projected observer days needed:	270	257	198	136	118	81	77	96
Average trip length (days):	1.40							
Estimated % coverage level required:	6%	5%	4%	3%	2%	2%	2%	2%
Realized CV for 2004:	46.1%	35.9%	31.1%	55.0%	48.2%	20.2%	20.2%	*
Percent of trips w/ zero discard:	73%	41%	41%	86%	77%	18%	9%	100%
Encounter rate:	27%	59%	59%	14%	23%	82%	91%	0%
Rank of total discards (out of 13):	5	2	4	7	8	3	1	N/A
Observed discards (lb):	97	6,039	293	18	15	1,307	10,040	0
Obs. discard percent of all obs. discards:	0.29%	18.08%	0.88%	0.05%	0.04%	3.91%	30.06%	N/A
2004 commercial landings (lb, all gears):	30,616,000	64,506,000	83,523,000	1,965,000	19,387,000	23,036,000	20,388,000	N/A
2004 recreational landings (lb, all gears):	17,982,000	0	5,383,000	0	35,000	0	0	N/A
Obs. discards as % of comm landings:	0.00%	0.01%	0.00%	0.00%	0.00%	0.01%	0.05%	N/A
Discards as % of comm landings:	0.08%	1.30%	0.05%	0.12%	0.01%	0.91%	8.30%	N/A
Discards as % ot total landings:	0.05%	1.30%	0.05%	0.12%	0.01%	0.91%	8.30%	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.

Northeast Region SBRM Importance Filter Worksheet
New England Scallop Dredge, Closed Area Access, General Trip Category

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
0	0	50	0%	Fish
0	0	50	0%	Protected Species

Top Species:	red crab	scallop	monkfish	large-mesh mults	small-mesh mults	skate	dogfish	SF/S/BSB					sea turtles
Projected observer days needed:	***24***	***24***	***24***	***24***	***24***	***24***	***24***	***24***					***24***
Average trip length (days):	2.00												
Estimated % coverage level required:	24%	24%	24%	24%	24%	24%	24%	24%					24%
Realized CV for 2004:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					N/A
Percent of trips w/ zero discard:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					N/A
Encounter rate:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					N/A
Rank of total discards (out of 13):	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					N/A
Observed discards (lb):	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					N/A
Obs. discard percent of all obs. discards:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					N/A
2004 commercial landings (lb, all gears):	3,952,000	64,506,000	23,036,000	83,523,000	19,387,000	20,388,000	1,965,000	30,616,000					N/A
2004 recreational landings (lb, all gears):	0	0	0	5,383,000	35,000	0	0	17,982,000					N/A
Obs. discards as % of comm landings:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					N/A
Discards as % of comm landings:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					N/A
Discards as % ot total landings:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Scallop Dredge, Closed Area Access, General Trip Category

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
2	1	546	0%	Fish
2	1	546	0%	Protected Species

Top Species:	scallop	monkfish	large-mesh mults	small-mesh mults	skate	dogfish	SF/S/BSB						sea turtles
Projected observer days needed:	***21***	***21***	***21***	***21***	***21***	***21***	***21***						***21***
Average trip length (days):	1.30												
Estimated % coverage level required:	3%	3%	3%	3%	3%	3%	3%						3%
Realized CV for 2004:	0.0%	0.0%	*	*	0.0%	*	0.0%						*
Percent of trips w/ zero discard:	0%	0%	100%	100%	0%	100%	0%						100%
Encounter rate:	100%	100%	0%	0%	100%	0%	100%						0%
Rank of total discards (out of 13):	1	3	5	5	2	5	4						N/A
Observed discards (lb):	70	11	0	0	21	0	1						0
Obs. discard percent of all obs. discards:	17.77%	2.79%	0.00%	0.00%	5.33%	0.00%	0.25%						N/A
2004 commercial landings (lb, all gears):	64,506,000	23,036,000	83,523,000	19,387,000	20,388,000	1,965,000	30,616,000						N/A
2004 recreational landings (lb, all gears):	0	0	5,383,000	35,000	0	0	17,982,000						N/A
Obs. discards as % of comm landings:	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%						N/A
Discards as % of comm landings:	0.06%	0.03%	0.00%	0.00%	0.06%	0.00%	0.00%						N/A
Discards as % ot total landings:	0.06%	0.03%	0.00%	0.00%	0.06%	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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Scallop Trawl, Open Area Access, Limited Trip Category

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
11	1	198	1%	Fish
22	3	198	2%	Protected Species

Top Species:	bluefish	scallop	M/S/B	monkfish	large-mesh mults	small-mesh mults	skates	dogfish	SF/S/BSB				sea turtles
Projected observer days needed:	***95***	***95***	***95***	***95***	***95***	***95***	***95***	***95***	***95***				***95***
Average trip length (days):	7.90												
Estimated % coverage level required:	6%	6%	6%	6%	6%	6%	6%	6%	6%				6%
Realized CV for 2004:	*	0.0%	0.0%	0.0%	0.0%	*	0.0%	*	0.0%				38.1%
Percent of trips w/ zero discard:	100%	0%	0%	0%	0%	100%	0%	100%	0%				67%
Encounter rate:	0%	100%	100%	100%	100%	0%	100%	0%	100%				33%
Rank of total discards (out of 13):	7	1	6	4	3	7	2	7	5				N/A
Observed discards (lb):	0	7,280	9	275	979	0	5,790	0	82				Yes
Obs. discard percent of all obs. discards:	0.00%	45.45%	0.06%	1.72%	6.11%	0.00%	36.14%	0.00%	0.51%				N/A
2004 commercial landings (lb, all gears):	7,512,000	64,506,000	212,528,000	23,036,000	83,523,000	19,387,000	20,388,000	1,965,000	30,616,000				N/A
2004 recreational landings (lb, all gears):	15,146,000	0	1,134,000	0	5,383,000	35,000	0	0	17,982,000				N/A
Obs. discards as % of comm landings:	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%				N/A
Discards as % of comm landings:	0.00%	3.12%	0.00%	0.33%	0.32%	0.00%	7.86%	0.00%	0.07%				N/A
Discards as % ot total landings:	0.00%	3.12%	0.00%	0.33%	0.30%	0.00%	7.86%	0.00%	0.05%				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.

Northeast Region SBRM Importance Filter Worksheet

Mid-Atlantic Scallop Trawl, Open Area Access, General Trip Category

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
56	31	1,088	3%	Fish
71	39	1,088	4%	Protected Species

Top Species:	dogfish	SF/S/BSB	small-mesh mults	M/S/B	bluefish	scallop	monkfish	large-mesh mults	skates				sea turtles
Projected observer days needed:	430	404	280	132	103	100	89	82	78				51
Average trip length (days):	2.10												
Estimated % coverage level required:	19%	18%	12%	6%	5%	4%	4%	4%	3%				2%
Realized CV for 2004:	67.5%	50.5%	49.6%	35.4%	114.1%	22.4%	19.4%	17.0%	34.7%				*
Percent of trips w/ zero discard:	77%	74%	77%	58%	97%	35%	29%	32%	3%				100%
Encounter rate:	23%	26%	23%	42%	3%	65%	71%	68%	97%				0%
Rank of total discards (out of 13):	3	6	7	8	10	2	4	5	1				N/A
Observed discards (lb):	3,201	106	64	30	2	4,672	585	160	17,773				0
Obs. discard percent of all obs. discards:	8.45%	0.28%	0.17%	0.08%	0.01%	12.33%	1.54%	0.42%	46.90%				N/A
2004 commercial landings (lb, all gears):	1,965,000	30,616,000	19,387,000	212,528,000	7,512,000	64,506,000	23,036,000	83,523,000	20,388,000				N/A
2004 recreational landings (lb, all gears):	0	17,982,000	35,000	1,134,000	15,146,000	0	0	5,383,000	0				N/A
Obs. discards as % of comm landings:	0.16%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.09%				N/A
Discards as % of comm landings:	7.52%	0.02%	0.02%	0.00%	0.00%	0.35%	0.12%	0.01%	4.06%				N/A
Discards as % ot total landings:	7.52%	0.01%	0.02%	0.00%	0.00%	0.35%	0.12%	0.01%	4.06%				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.

Northeast Region SBRM Importance Filter Worksheet

Scottish Seine

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
5	5	95	5%	Fish
8	8	95	8%	Protected Species

Top Species:	SF/S/BSB	large-mesh mults	bluefish	herring	scallop	M/S/B	monkfish	small-mesh mults	skates	dogfish			sea turtles
Projected observer days needed:	30	14	***12***	***12***	***12***	***12***	***12***	***12***	***12***	***12***			***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:	60%	0%	100%	100%	100%	100%	100%	80%	40%	100%			100%
Encounter rate:	40%	100%	0%	0%	0%	0%	0%	20%	60%	0%			0%
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.

Northeast Region SBRM Importance Filter Worksheet

New England Shrimp Trawl

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
12	12	1,968	1%	Fish
12	12	1,968	1%	Protected Species

Top Species:	M/S/B	skate	small-mesh mults	herring	monkfish	large-mesh mults	sea turtles
Projected observer days needed:	400	272	136	101	25	22	42
Average trip length (days):	1.00						
Estimated % coverage level required:	20%	14%	7%	5%	1%	1%	2%
Realized CV for 2004:	98.1%	79.9%	55.7%	47.9%	23.5%	22.4%	*
Percent of trips w/ zero discard:	92%	50%	50%	0%	17%	0%	100%
Encounter rate:	8%	50%	50%	100%	83%	100%	0%
Rank of total discards (out of 13):	8	4	3	1	5	2	N/A
Observed discards (lb):	0	84	285	1,072	2	299	0
Obs. discard percent of all obs. discards:	0.01%	3.85%	13.10%	49.28%	0.10%	13.73%	N/A
2004 commercial landings (lb, all gears):	212,528,000	20,388,000	19,387,000	187,387,000	23,036,000	83,523,000	N/A
2004 recreational landings (lb, all gears):	1,134,000	0	35,000	27,000	0	5,383,000	N/A
Obs. discards as % of comm landings:	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	N/A
Discards as % of comm landings:	0.00%	0.08%	0.29%	0.11%	0.00%	0.07%	N/A
Discards as % ot total landings:	0.00%	0.08%	0.29%	0.11%	0.00%	0.07%	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.

Northeast Region SBRM Importance Filter Worksheet
Mid-Atlantic Shrimp Trawl

2004 Observed Sea Days	2004 Observed Trips	2004 FVTR Trips	Percent Covered	
2	2	334	1%	Fish
2	2	334	1%	Protected Species

Top Species:	herring	M/S/B	monkfish	large-mesh mults	small-mesh mults	skates	SF/S/BSB	sea turtles
Projected observer days needed:	***76***	***76***	***76***	***76***	***76***	***76***	***76***	***76***
Average trip length (days):	5.80							
Estimated % coverage level required:	4%	4%	4%	4%	4%	4%	4%	4%
Realized CV for 2004:	*	*	*	*	*	*	*	*
Percent of trips w/ zero discard:	100%	100%	100%	100%	100%	100%	100%	100%
Encounter rate:	0%	0%	0%	0%	0%	0%	0%	0%
Rank of total discards (out of 13):	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Observed discards (lb):	0	0	0	0	0	0	0	N/A
Obs. discard percent of all obs. discards:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2004 commercial landings (lb, all gears):	187,387,000	212,528,000	23,036,000	83,523,000	19,387,000	20,388,000	30,616,000	N/A
2004 recreational landings (lb, all gears):	27,000	1,134,000	0	5,383,000	35,000	0	17,982,000	N/A
Obs. discards as % of comm landings:	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	N/A
Discards as % of comm landings:	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	N/A
Discards as % ot total landings:	0.00%	0.00%	0.00%	0.00%	0.00%	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.

Fishing Mode	Baseline Levels (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	100	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	1,025	1,025	1,025	1,025	1,025	1,025	1,025	1,025	1,025
NE Large-mesh Gillnet	2,808	2,096	2,096	772	772	408	772	408	408
MA Large-mesh Gillnet	107	107	107	107	107	107	107	107	107
NE X-Large-mesh Gillnet	2,244	2,244	2,244	1,245	504	504	425	425	419
MA X-Large-mesh Gillnet	557	557	557	557	557	557	557	557	557
NE Handline	131	131	131	131	131	131	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	187	187	187	187	187	187	187	187	187
MA Longline	76	76	76	76	76	76	76	76	76
NE Mid-Water Trawl	924	924	924	924	924	752	752	752	280
MA Mid-Water Trawl	379	379	379	335	82	82	49	49	35
NE Small-mesh Trawl	2,769	2,769	2,769	2,021	2,021	1,431	1,879	1,431	1,431
MA Small-mesh Trawl	3,316	2,054	2,054	2,054	1,886	1,886	1,886	1,886	1,886
NE Large-mesh Trawl	6,058	5,680	5,680	3,726	3,726	1,017	3,726	3,726	1,017
MA Large-mesh Trawl	892	892	892	726	726	726	710	710	710
NE Purse Seine	176	176	176	176	176	176	176	176	176
MA Purse Seine	9	9	9	9	9	9	9	9	9
NE Scallop Dredge OL	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718	2,718
MA Scallop Dredge OL	3,470	3,470	3,470	3,470	3,470	3,470	3,470	3,470	3,470
NE Scallop Dredge CL	4,242	3,810	3,810	2,431	2,431	2,431	2,431	2,431	2,431
MA Scallop Dredge CL	2,662	1,778	1,778	996	497	497	497	497	108
NE Scallop Dredge OG	180	180	112	110	110	110	110	110	92
MA Scallop Dredge OG	270	270	270	257	257	257	257	257	96
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	430	430	430	430	430	430	430	430	430
NE Scottish Seine	30	30	12	12	12	12	12	12	12
NE Shrimp Trawl	400	400	400	272	272	272	42	42	42
MA Shrimp Trawl	76	76	76	76	76	76	76	76	76
Total Sea Days Needed:	**37,332**	**33,604**	**33,518**	**25,979**	**24,318**	**20,483**	**23,587**	**22,775**	**19,006**

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.

Appendix D
Northeast Region Fishery 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. The flow of data can be very complex as it migrates from various sources before it is loaded to the main database. Since 1989, the Northeast Fisheries Observer Program has deployed an average of 35 observers a year in various commercial fisheries. These observers completed an average of 2300 days at sea annually. Due to new regulations, the observer program now deploys an average of 100 observers on about 12,000 days at sea annually. This, in turn, has increased the number of trips received on a daily basis by the observer program. The Fisheries Sampling Branch now receive an average of 40 trips per day, up from eight trips per day in the recent past. Trips can range from 1 to 15 days. The trips consist of data logs containing a variety of information including but not limited to:

- Trip information (target species, dates, primary species landed, etc…..)
- Economic information (insurance costs, repair costs, engine type, etc…)
- Haul information (times, dates, 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, weights, etc…)
- Safety information (EPRB on board, Coast Guard Doc sticker, etc…..)

Not every trip includes all of the above mentioned information, however, a typical trip does include most of these variables. The outline below describes what happens to these data once an observer returns to port from an observed trip.

1. OBSERVER COMPLETES DATA – The observer verifies that the data sheets are filled out completely and accurately, calls in the data to the OBSCON system, and sends the data sheets to NEFSC.

2. OBSCON – This program consists of a total of 44 crucial fields (port, dates, target species, incidental takes, etc.) that provide users with real-time data. The data in OBSCON are called in by the observer working with the area coordinator and entered into an ORACLE-based table.

3. DATA LOGS – Before the data are entered, they go through a series of review and editing steps. There are three separate reviews conducted by data analysts and data editors once the data are appropriately logged in. These: (1) Verify the correct program code has been recorded for each trip and calculate the average mesh size of each trip; (2) review each individual trip against OBSCON and

verify all fields called in to OBSCON match up with actual data logs; and (3) verify all logs are as complete and accurate as possible, all errors are corrected throughout the trip, all age structures for that trip have been logged in, and no new errors have occurred.

4. AUDIT CHECKS – Before the data are loaded into the database, they go through a series of audit checks to verify certain fields or values are entered properly. Preliminary audit is handed over to staff fishery biologists who review audit or pass on to data editors for review. The audit continues until it is as clean as possible before the data are uploaded to entry tables. A second round of audits is performed and fishery biologist/data editor verifies all errors and has entry staff make corrections as necessary. Once complete, the fishery biologist signs off on audit as "Approved to Load." Data are loaded to the main database and confirmation is sent that data have been uploaded to main database. Once all gear types for a month have been loaded to the main database, the appropriate personnel are notified that an entire month has been loaded to the database.

***** At this point the data have been loaded in the database and are accessible to end users*****

5. FINAL CHECK – Once data have gone through the final audit process they go through a series of data checks one last time before being filed.

6. DATA ERROR REPORTS – If errors are found after data has been loaded to the main database, error reports are generated, and the appropriate changes are made directly to the main database.

7. DATA ARCHIVING PROJECT – All data collected from the Fisheries Sampling Branch are scanned in order to alleviate space and enable observer data to be viewed on a computer screen by end users. To identify logs, a uniquely identified bar code is attached to every single sheet that is scanned.

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 for how the data are reviewed, edited, and processed. More detail is available in the "Fisheries Observer Program Manual."***

Appendix E
Example SBRM Report and Data Queries

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EXAMPLE – EXAMPLE – EXAMPLE – EXAMPLE – EXAMPLE

Northeast Region SBRM Report

[*Note: This is an* *example* *report to illustrate one possible structure for presenting information relevant for reviewing and evaluating the Northeast Region SBRM. This information should be considered preliminary and is not intended for Council action.*]

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 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 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 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	2004 Monkfish Landings (lb) (FVTR)	Percent of Total 2004 Monkfish Landings	Cumulative Percentage of 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 Discards (lb)	Percent of Total Observed Discards	Cumulative Percent of 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.

Fishing Mode	Observed Monkfish Discards (lb)	Observed Discards, All Species (lb)	Ratio of Monkfish to Total Discards	Estimate of Total Monkfish Discards (lb)	Percent of Total Monkfish Discards	Cumulative Percent of 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	33,400	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	7,771	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	NE large-mesh otter trawl	NE extra-large-mesh gillnet	MA extra-large-mesh gillnet
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 Discards
NE Scallop Dredge OL	32%
MA Scallop Dredge OL	**17%**
NE Large-mesh Otter Trawl	**9%**
NE Small-mesh Otter Trawl	40%
NE X-Large-mesh Gillnet	**17%**
NE Scallop Dredge OG	56%
NE Scallop Dredge CL	**25%**
MA Scallop Dredge CL	**26%**
MA Scallop Dredge OG	**20%**
MA Large-mesh Otter Trawl	**29%**
MA Small-mesh Otter Trawl	35%
MA X-Large-mesh Gillnet	**27%**

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	2004 CV	Observed Discards (lb)	Estimated Total Discards (lb)	Discards as Percent of Total Landings
NE Large-mesh Otter Trawl	Atlantic bluefish	247%	854	31,518	0.14%
	Atlantic herring	131%	563	18,710	0.01%
	Sea scallop	35%	1,191	39,996	0.06%
	Mackerel, squid, butterfish	57%	357	12,498	0.01%
	Summer flounder, scup, black sea bass	32%	21,854	720,531	1.48%
	Tilefish	53%	285	8,798	0.38%
NE X-Large-mesh Gillnet	Atlantic herring	38%	46	531	0.00%
	Mackerel, squid, butterfish	50%	393	9,736	0.00%
	Small-mesh multispecies	62%	373	4,414	0.02%
MA X-Large-mesh Gillnet	Sea turtles	49%	Yes	N/A	N/A

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	2004 CV (Monkfish)	Observed Discards (lb)	Estimated Total Discards (lb)	Discards as Percent of Total 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 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 ½ 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 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).

Individual Species	2004 CV	Observed Discards (lb)	Estimated Total Discards (lb)	Discards as Percent of Total Landings
Summer flounder	33%	19,723	650,271	2.23%
Scup	92%	1,879	61,951	0.45%
Black sea bass	83%	253	8,341	0.15%

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 Discards, All 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 Discards (lb)	Observed Discards, All Species (lb)	Ratio of Discards to All Discards	Cumulative Percent 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 (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 (lb)	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 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								
	2001			2002			2003		
Quarter	Both	561	562	Both	561	562	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)

Species	SA 561		SA 562		Grand Total
	Discarded	Kept	Discarded	Kept	
ANGLER	955	17,246	479	4,008	22,688
COD	631	27,181	136	20,526	48,473
FLOUNDER, AM. PLAICE	150	5,486	3	13	5,652
FLOUNDER, SUMMER	66	192	4,633	2,399	7,289
FLOUNDER, WINTER	2	30,208	1,695	287,302	319,207
FLOUNDER, YELLOWTAIL	378	25,468	165	41,184	67,194
HADDOCK	292	15,966	758	18,163	35,179
HAKE, WHITE	77	4,823	9	34	4,943
LOBSTER	1,752	5,980	2,272	6,246	16,250
SCALLOP, SEA	261	8	6,514	3,490	10,273
SEA RAVEN	2,021	10	2,150	10	4,191
SKATE, LITTLE	14,428	1,352	111,140		126,920
SKATE, THORNY	2,779		1,883		4,662
SKATE, WINTER(BIG)	12,761	7,228	72,358	13,287	105,634
SKATES	5,980	70	35,401	2,303	43,754
Grand Total	42,532	141,218	239,594	398,962	822,307

Table 57 – Top fifteen species caught by otter trawls on observed tows in SAs 561 and 562, 2002 (pounds) (NMFS OBDBS)

Species	SA 561		SA 562		Grand 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 lbs.), haddock (156,378 lbs.), sea scallops (88,634 lbs.), monkfish (68,417 lbs.), and winter skates (47,517 lbs.) were the top five kept species on these observed trips. The top discarded species were skates (704,205 lbs., all species), sea scallops (32,610 lbs.), yellowtail flounder (30,290 lbs.), and haddock (22,178 lbs.). The primary reason for yellowtail flounder discards on observed trips was that the fish were smaller than the regulatory minimum size (21,289 lbs., or 70 percent of observed discards). Vessels that had filled their quota discarded another 3,409 lbs. on observed trips, while 4,081 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 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 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 lbs.) and little skates (54,369 lbs.) were the largest components identified by species, but an additional 78,711 lbs. was identified as skates (NK). There were also 10,609 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
Sub-Total		1	1	1	10	10	14
CAT B (regular)	03	1	1	0	0	0	1
	05	0	0	1	0	2	2
	06	2	2	1	0	0	2
	07	0	1	0	0	0	1
Sub-Total		3	3	2	0	4	6
Grand Total		4	4	3	10	14	20

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 (WINDOWPANE)	0	3	136	15	70	3,813	4,037
SCALLOP, SEA	0	112	1	0	303	3,289	3,705
RAVEN, SEA	114	114	217	10	711	2,515	3,681
DOGFISH, SPINY	185	186	0	0	2,895	201	3,467
FLOUNDER, FOURSPOT	0	42	210	0	51	2,238	2,541
HAKE, RED (LING)	8	7	138	0	1,393	218	1,764
HERRING, ATLANTIC	0	1,482	0	0	4	0	1,486
STARFISH, SEASTAR,NK	6	717	2	0	11	713	1,449
FLOUNDER, SUMMER (FLUKE)	0	89	80	10	24	955	1,158
OCEAN POUT	9	41	8	0	128	804	990
Grand Total	53,400	193,142	10,349	2,035	218,374	518,947	996,247

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 Separator	With Separator	Grand 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	263
FLOUNDER, SUMMER (FLUKE)	50	63	113
WOLFFISH, ATLANTIC	25	33	58
Grand Total	150,384	125,549	275,933

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Appendix F
Draft Proposed Regulations

TBD

[*Draft proposed regulations will be included following public hearings and once the Councils have identified the final proposed action for the amendment.*]

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