Northeast Fisheries Science Center Reference Document 07-09

The Analytic Component to the Standardized Bycatch Reporting Methodology Omnibus Amendment: Sampling Design and Estimation of Precision and Accuracy

Second Edition

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

May 2007

Northeast Fisheries Science Center Reference Documents

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This document's publication history is as follows: manuscript submitted for review April 6, 2007; manuscript accepted through technical review April 6, 2007; manuscript accepted through policy review April 6, 2007; and final copy submitted for publication May 8, 2007. This document may be cited as:

Wigley SE, Rago PJ, Sosebee KA, Palka DL. 2007. The analytic component to the Standardized Bycatch Reporting Methodology Omnibus Amendment: sampling design end estimation of precision and accuracy (2nd edition). U.S. Dep. Commer., *Northeast Fish. Sci. Cent. Ref. Doc*. 07-09; 156 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.

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EXECUTIVE SUMMARY

Standardized Bycatch Reporting Methodology (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 efficacy of the allocation of observer days to multiple fisheries to monitor a large number of species under the different Fishery Management Plans (FMPs), the Marine Mammal Protection Act, and the Endangered Species Act. In this report, we examine 45 fleets and 60 species/species groups to encompass all federal FMP-managed species in the Northeast. A comprehensive summarization of 2004 data collected by the Northeast Fisheries Observer Program (NEFOP) is presented, as well as estimation of precision of bycatch for fish, turtles, marine mammals, and sea birds using three methods and two discard ratios, an evaluation of these different methods, and the estimation of sea days required to achieve the desired level of precision. A combined ratio method using a discard-to-kept weight ratio was selected to evaluate the monitoring of bycatch over a diverse range of species and fleets in the Northeast region. We recognize that research on discard estimation is ongoing and future work may lead to improvements of this method. The number of sea days necessary to achieve a 30% coefficient of variation (CV) for all identified fisheries exceeds 31,000 days. Application of additional criteria for evaluating the efficacy of the monitoring program may lead to reductions in the total number of days necessary. An importance filter has been developed to provide a standardized method to further reduce the number of days necessary to estimate infrequent discard events of fish.

List of Acronyms and Abbreviations

ASMFC	=	Atlantic States Marine Fisheries Commission
CFDBS	=	Commercial Fisheries Database System
CV	=	coefficient of variation
d/da	=	discard/days absent
d/k	=	discard/kept
FMP	=	Fishery Management Plan
MA	=	Mid-Atlantic
MAFMC	=	Mid-Atlantic Fishery Management Council
NE	=	New England
NEFMC	=	New England Fishery Management Council
NEFOP	=	Northeast Fisheries Observer Program
NEFSC	=	Northeast Fisheries Science Center
NERO	=	(NMFS) Northeast Regional Office
NMFS	=	National Marine Fisheries Service
NWGB	=	National Working Group on Bycatch
SARC	=	Stock Assessment Review Committee
SBRM	=	Standardized Bycatch Reporting Methodology
SE	=	standard error
VMS	=	Vessel Monitoring System
VTR	=	Vessel Trip Report

List of Revisions (Second Edition)

Revised equations: 2a, 2b, 4, 5, 16a, 16b
New equations: 23, 24, 25, 26

Revised tables: 6, 8, 9, 10a, 10b; 11 and 12 re-ordered to 16 and 17, respectively.
New tables: 11, 12, 13a, 13b, 14, 15

Revised text: associated text for the equations and tables
New text: Sample size analysis, Importance Filters

Revised Appendix Tables: I, IV, V
New Appendix Tables: IV, VII

First edition available at: http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0622/

INTRODUCTION

The second edition of this report includes additional analyses on sample size and a description of the importance filter used to refine the number of sea days needed, as well as revisions to some of the equations and tables (see list of revisions).

This report presents the analyses needed to support the Standardized Bycatch Reporting Methodology (SBRM) required for the omnibus amendment to the Northeast fisheries management plans. These analyses include: (1) a comprehensive summarization of 2004 data collected by the Northeast Fisheries Observer Program (NEFOP); (2) estimation of bycatch precision for fish and protected species using three methods and two discard ratios; (3) evaluation of these different methods; and (4) estimation of sea days required to achieve the desired level of precision. Subsequent SRBM-related analyses 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 report and can be undertaken sequentially in the future, but are not the primary focus for this report.

The methods used in this report 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 Fogarty and Gabriel (2005) for the New England multispecies groundfish 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 fleets and 12 species were examined; in this report, it was necessary to examine 45 fleets and 60 species/species groups to encompass all federally managed species in the Northeast.

The Northeast Fisheries Science Center (NEFSC) administers the NEFOP. The NEFOP observer data is a key component to the SBRM in the Northeast region. The 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 efficacy of the allocation of observer days to multiple fisheries to monitor a large number of species under a 14 different Fishery Management Plans (FMPs), the Marine Mammal Protection Act, and the Endangered Species Act. The SBRM is not intended to be the definitive document on the estimation methods nor is it a compendium of discard rates and totals.[1] 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 observer coverage based on prior information and the expected improvement in overall performance of the program. The general structure helps identify gaps in existing coverage, similarities among groups that allow for realistic imputation, and the tradeoffs associated with coverage levels for different species. The 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 allocation as new information on the results of the previous year's data is obtained.

Throughout this report we will use the term 'bycatch' synonymously with 'discard.' In basic terms, bycatch is defined as living organisms that are captured by fishing gear and returned to the water. We do not define bycatch as the capture and retention of non-target species, nor do we account for potential survival of organisms returned to the water. Most importantly, we do

1. Discard rates are not included in this report.

not base any of our analyses on the potential mortality associated with unobserved encounters with fishing gear. Our 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 units (i.e., trips). Thus our definition of bycatch is restrictive when compared to the definition given by the National Marine Fisheries Service (NMFS 2004).

DESIGN CONSIDERATIONS

Sampling Unit, Response Variables and Precision Goals

Among the most important decisions in the preparation of the SBRM are the definition of the sampling unit, the definition of the quantity to be measured for each sampling unit (in statistical terms this is known at the response variable), and 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, gear, duration, etc.), then an average 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, vessel days fished, or total kept weight of species. Total kept weight is, in this sense, a surrogate for effective fishing power. For finfish and shellfish, the numerator of the bycatch ratio is defined as the total weight of the species or species group discarded. The denominator of the bycatch ratio is either weight of all species kept or fishing effort. Owing to difficulties in interpreting quantitative measures of fishing effort found in the Vessel Trip Report (VTR) data, effort is approximated by days absent. For 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 of 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 dilemma, this study estimates not only bycatch ratios and associated precision (relative standard error) for species complexes relevant to the FMPs (e.g., multi-species groundfish, summer flounder-scup-black sea bass, etc.), but also bycatch ratios and precision for each individual species**.** Stock areas will not be considered in the analyses. Conceptually, the problem of stock area is similar to that of estimating age-specific discard estimates. The full variability of those 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 SBRM is designed to support robust post stratification, sufficient estimation of stock-area, and age-specific estimates of discards.

Although marine mammals and sea birds are not required for evaluation by the Magnuson-Steven Act (NOAA Fisheries 1996), they 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% coefficient of variation (CV) 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% CV for estimates of bycatch for each species/stock taken by the a fishery.*
>
> *Fishery Resources*
> *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 can not be divided into discards and retained catch then the goal is a 20-30% 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). They also noted that under some circumstances, attaining the precision goal alone would not be an efficient use of the public resources.

In the evaluation of precision of discard estimates, a 30% CV 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 report, 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. Our use of CV is equivalent to the term 'proportional standard error;' for the sake of consistency with the NWGB (NMFS 2004) we use CV throughout this report.

The NWGB recommended the precision goals for a 'fishery.' 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 fleets within a fishery.

Definition of Strata – Fishery Identification

To monitor the diverse fisheries off the Northeast coast of the USA 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 six classification variables: calendar quarter, geographical region, gear type, mesh size, access area, and trip category. Some fleets were further stratified due to FMP requirements (e.g., quota-monitoring in the US/Canada Resource Sharing Area, B-days, etc). 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 will 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.

Additionally, trips are classified into two broad geographical regions, New England (NE) and Mid-Atlantic (MA), based upon the port of departure: ports located from Maine to Connecticut were grouped together to form the NE region; ports located in states from New York southward comprised the MA region. While data from both VTR 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. A review of the NEFOP and VTR databases for 2004 revealed few instances (less than 2% of trips) where the change of port of landing from port of departure resulted in a change in region (i.e., NE to MA or vice versa). It should also be pointed out that the basis for classifying trips is the region/port of departure, since areas fished are not always predetermined. The majority (over 93%) of 2004 observer trips both originated and fished in the same region and exhibited the same general pattern observed in the VTR data; however, the proportion of trips that do not do so can be accounted for in the sea day allocation.

Percentage of 2004 observed trips that departed and fished in the NE and MA regions.		
	Area Fished	
Region/port of departure	New England (Subarea 5)	Mid-Atlantic (Subarea 6)
New England	72.4%	6.3%
Mid-Atlantic	0.2%	21.1%

Percentage of 2004 VTRs that departed and fished in the NE and MA regions.		
	Area Fished	
Region/port of departure	New England (Subarea 5)	Mid-Atlantic (Subarea 6)
New England	60.1%	3.8%
Mid-Atlantic	0.8%	35.3%

In these analyses, 14 general gear types were considered: longline, otter trawl, scallop trawl, shrimp trawl, gillnets, scallop dredge, mid-water (paired and single) trawl, 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 Atlantic States Marine Fisheries Commission (ASMFC), these fisheries have bycatch of fish and protected species managed by the New England Fishery Management Council (NEFMC) and the Mid-Atlantic Fishery Management Council (MAFMC); therefore these gear types are included to the extent possible.

Mesh size groups were formed for the otter trawl and gillnet gear types. For otter trawl, two mesh groups were formed: small (<5.5 in) and large (≥5.5 in). For gillnet, three mesh groups were formed: small (<5.5 in), large (5.5–7.99 in), and extra large (≥8 in).

Trips that used either scallop trawl or scallop dredge were further classified into two access areas (open or closed) as well as two trip categories (general or limited).[2] Trips using other gear types were not further classified.

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 14 FMPs of the NEFMC and MAFMC, an all-species combined group, and 5 protected species groups (Table 1). The fisheries encompassing these 60 species/species groups required 45 different fleet sectors to account for all regional, gear, mesh and quota-monitoring status combinations (Table 2a).

DATA SOURCES

The sampling unit used in these analyses is the trip. Trip characteristics are recorded in both the NEFOP and Fishing VTR data sets. 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.

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 fishermen and dealers holding federal permit[3] who catch and buy/sell species regulated by the NEFMC and/or the MAFMC. The mandatory reporting system consists of two components: dealer reporting and 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 VTRs 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 VTR, generally results in a slight underestimation of landings. These disparities are discussed below.

The VTR data have 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).[4]

In these analyses, the 2004 VTR (commercial) data are used to: (1) define the sampling frame of the commercial fishing trips, (2) expand bycatch rates to total discards,[5] and (3) 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 (VMS) and Days-At-Sea data systems cover only portions of the fisheries and therefore are limited in use for this type of analysis.

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2. See http://www.nefmc.org/scallops/index.html for further information on the sea scallop FMP.
3. With the exception of those vessels that hold only federal lobster permits.
4. 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.
5. Total discards are not presented in this report.

The VTR data can be used as a basis for defining the sampling frame, since all federally permitted vessels are required to file a VTR for each fishing trip (see 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. VTR 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 are well known (e.g., Walsh et al. 2002; NMFS 2004). Limitations of the initial VTR data sets 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 VTR data from the Northeast.

Measures to ensure the validity of the VTR database include routine auditing procedures, standardized data entry protocols, and compliance reviews (pers. comm., Greg Power, NERO).

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

The validity of VTR data as a basis for a sampling frame is generally supported by comparisons with total landings data from dealer records. All dealers that buy and sell species regulated by federal FMPs are required to report 100% of the landings. These data are generally thought to constitute a near census of landings. A comparison of species landings from VTR and Dealer records for calendar year 2004 reveals some discrepancies, by species group, between these two sources (see text table below). Overall, there is a 1.4% difference between Dealer and VTR; however, this low percent difference is driven by a -10% difference for herring. If herring is removed from the total, there is a 2.7% difference between the total kept species weight.

The large percent difference for monkfish may be attributed to the misreporting of monkfish product in the VTR. If the incorrect product grade is reported ('monk' vs 'monkt' representing whole monkfish and monkfish tails, respectively), an underestimation of monkfish landings in the VTR may result. Large percent differences for bluefish and spiny dogfish may be attributed to the inability to partition out the mandatory reporting landings (reflective of the VTR data) from the state landings data. This is an issue unique to 2004, when mandatory Dealer electronic reporting was implemented. Additionally, total landings of bluefish and spiny dogfish represent a small fraction of the total landings and these percentage differences are considered to be 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 VTR data are the only source for gear and mesh information, two key components of fisheries. (1994 to present Dealer data do not contain gear and mesh information.)

Species Group	VTR Landings (mt, live)	Dealer Landings (mt, live)	Difference (mt, live)	Percent Difference
Bluefish	2,357	3,423	1,067	31.2%
Herring	94,223	85,456	-8,766	-10.3%
Salmon	-	-		
Red crab	1,733	2,041	307	15.1%
Scallop	242,550	243,736	1,187	0.5%
Mackerel/Squid/Butterfish	97,400	97,083	-317	-0.3%
Monkfish	14,643	21,185	6,543	30.9%
NE Multi-species (Large mesh)	35,101	41,414	6,313	15.2%
NE Multi-species (Small mesh)	8,883	9,277	394	4.2%
Skate Complex (7 species of skates)	13,054	16,073	3,020	18.8%
Dogfish, spiny	600	983	382	38.9%
Fluke/Scup/Black Sea Bass	11,732	13,887	2,155	15.5%
Surf Clam/Ocean Quahog*	295,381	295,381	0	0.0%
Tilefish	1,229	1,216	-13	-1.0%
Total	819,486	831,156	11,670	1.4%
Total minus herring	725,264	745,700	20,436	2.7%

* Surf clam and ocean quahog single source (VTR is the source for the Dealer data).

Measures of fishing effort may be in terms of trips, days absent, or 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 VTR-based landings estimates suggest that some of the expansion factors for estimating total discards and the weighting factors for discard-to-kept ratios will be underestimated slightly. Further work on factors underlying these disparities is needed and will be addressed in a subsequent phase of this project.

Northeast Fisheries Observer Program 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 gear characteristics data, economic information, and biological samples. The NEFOP employs trained sea-going observers to collect these data that also includes weight, by species and disposition (retained and discarded), of the entire catch.

Standard sampling protocols have been established and are utilized throughout the various fisheries.[6] For most gear types, observers use a 'complete' sampling protocol that includes obtaining species weights for both kept and discarded portions of all species in the catch on every haul.

In addition to the 'complete' sampling protocol, there is a 'limited' sampling protocol that is used on some gillnet trips where specific information for marine mammals is collected. In a 'limited' sampling scenario, only kept species weights (no discard weights) are obtained since the observer must watch the gillnet gear during haul-back to observe if marine mammals roll out of the gear before it returns to the deck.

Due to these two sampling protocols for data collection, two data sets were formed using the 2004 NEFOP data: one data set for fish that utilized the 'complete' sampling protocols; another for turtles, marine mammals, and birds that utilized both the 'complete' and 'limited' sampling protocols.

For the fish data set, 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 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 (d/da) analysis, but not in the discard-to-kept (d/k) analysis, because days absent is a 'trip' level variable representing the entire trip, not just the observed portion of the trip. Observer training trips were excluded from the fish data set but were utilized for the protected species set because it was assumed that training trips were capturing protected species information even though all discarded fish information might not be collected. For the protected species data set, all on-watch hauls are included in the data set, regardless of whether discarded fish species were recorded. Since all hauls are used in this data set, it was not necessary to adjust the discard weight to account for non-observed hauls.

Quota-monitoring observed trips were included, by gear type, in the protected species set but were partitioned out into separate strata for the fish set because of the total allowable catch limits associated with these access area programs. There were limitations in carrying estimates for these strata forward due to the inability to identify all quota-monitoring trips in the VTR data.

Species 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 CFDBS conversion factors for the species. All discard hail weights are assumed to be round (live) weight. Turtles, marine mammals, and sea birds are recorded as numbers of individuals.

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, discarded weight of all (combined) species in the trip, and the discard weight of each species are calculated.

A summary of the number of 2004 observed trips and sea days and 2004 commercial VTR trips and sea days by fleet sector and calendar quarter is presented in Tables 2a and 2b. There is a broad range of observer coverage by gear type in 2004; 11 of the 14 gear types had

6. On-vessel sampling of large-volume fisheries can be difficult. Subsampling protocols were under development for the purse seine and mid-water pair trawl fisheries during 2004; thus 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 given in the Northeast Fisheries Observer Program Manual.

observer coverage. 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. There are some gear types with very low industry activity and/or strong seasonal activity patterns, such as Scottish seine and purse seine.

For the fleets examined in the analyses, there were a total of 3,587 observed trips and 126,498 VTR trips resulting in approximately 3% overall coverage. Finer scale coverage rates vary among fleet and quarter. The highest percentage coverage (45%) occurred in the MA closed-area scallop dredge fleet. It should be noted that percentage 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 adequacy.

UNLIKELY CELLS

In the matrix of fleet by species/species group, there are some species and gears that are infeasible combinations (e.g., scallops in longline gear, surf clam in gillnet gear, etc.). With the assistance of the Plan Development Teams and Fishery Management Action Teams, cells 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 cells are indicated in the matrix as gray-shaded cells. For some protected species, there was insufficient information with which to determine whether or not a cell was unlikely. Although all analyses were conducted for all cells in the matrix, often the amount of coverage necessary to achieve a given level of precision for unlikely cells would exceed funding resources. When evaluating coverage, the unlikely cells can be removed to provide a more realistic estimate of necessary coverage. It is important to note that as fishing patterns or species abundance and/or distribution change, these gray-shaded cells may shift to reflect dynamic changes.

The occurrence of trips with zero discards is summarized in Tables 3 and 4 for fish and protected species, respectively. Generally, the unlikely (gray-shaded) cells correspond to trips where 100% of the trips had zero discards for the species. Two notable exceptions are in the scallop dredge fleets, where trips are discarding squid-butterfish-mackerel and surf clam-ocean quahog.

MISSING CELLS: IMPUTATION AND PILOT COVERAGE

The absence of observer coverage in feasible combinations of stratification variables (i.e., cells) causes problems in two ways. First, if the cells 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 a program are restricted to the set of cells with observer data. Second, if the cells 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 impute information about the unknown. 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 coverage. Imputation procedures have been developed

for Northeast groundfish (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 present study, a detailed imputation procedure would be needed to account for the seasonal variability of the species over the geographic range. Further work will 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 that work is complete, a simple imputation approach is used in which data from adjoining strata were used. In this simple imputation only the temporal stratification (calendar quarter) was relaxed to half a year, recognizing that seasonal variation can occur for some species (Tables 2a and 2b). In the case of shrimp trawl, given that the northern shrimp fishery is a seasonal fishery comprising 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., too few data to support the simple imputation approach). In these cases, imputed values were not used, and the fleet was designated as a fleet in need of pilot coverage. If some data were available, then some estimates were derived; however, the sea days needed to achieve a 30% CV were estimated based on pilot coverage levels (details below).

Pilot coverage is defined as a minimum level of coverage to acquire bycatch information with which to calculate variance estimates that in turn can be use to further define the level of sampling needed. Based on *Evaluating Bycatch: A National Approach to Standardized Bycatch Monitoring Programs* (NMFS 2004), pilot coverage can range between 0.5 and 2%. In this study, 2% of the annual VTR trips for a fleet, with a minimum of 12 trips per year (3 trips per quarter), and a maximum of 400 trips per year (100 trips per quarter) was used for pilot coverage. The fleets that needed pilot coverage are indicated in Tables 2a and 2b.

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 trip, then there were insufficient data to apply simple imputation and pilot coverage was used; and
4. if no observer coverage exists in all 4 quarters, then pilot coverage was used.

ESTIMATION OF BYCATCH RATES

There are many different methods for estimating bycatch rates. 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. Allen et al. (2001), however, 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. Within the last year a number of very promising approaches (Miller and Skalski 2006; Kaiser 2006) that combine design and model-based estimation have been proposed. These estimators will be examined in the future. However, we anticipate that the sampling design proposed in this document is sufficiently robust to support many of the newly proposed methods.

For the purpose of the SBRM we examined a number of design-based approaches that have been advocated in the literature and tested the assumptions of each. Bycatch rates were expressed as:

1. the ratio of total weight of one or more species discarded to total weight of one or more species kept;
2. the ratio of total weight of one or more species discarded to days absent;
3. discards per trip.

The basic difference between method (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, p. 164-169). Details of the separate and combined estimators follow a brief introduction to ratio estimators. Overall, we examined two different ratio estimators (d/k vs 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 data sets 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.

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), Equation 1a and 1b, respectively.

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

where R_{jh} is the bycatch rate of species group j in stratum h;
d_{ijh} is the discards (for fish, weight in pounds; 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;
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) $$V\left(\hat{R}_{jh}\right)=\frac{1}{n_h\bar{k}_h^2}\left[\frac{\left(\sum_{i=1}^{n_h}d_{ijh}^2\right)+\hat{R}_{jh}^2\left(\sum_{i=1}^{n_h}k_{ih}^2\right)-2\hat{R}_{jh}\left(\sum_{i=1}^{n_h}d_{ijh}k_{ih}\right)}{(n_h-1)}\right]\left[\frac{N_h-n_h}{N_h}\right]$$

and

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

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;
da_{ih} is the days absents of trip i in stratum h;
n_h is the number of observed trips in stratum h;
N_h is the number of VTR trips in stratum h;
$\bar{k}_h$ is the mean kept landings of all species within the stratum; and
$\overline{da}_h$ is the mean days absent within the stratum.

The CV for the bycatch ratio for species group j in stratum h is defined as

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

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

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

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

where n_h is the number of observed trips in stratum h;
N_h is the number of VTR trips in stratum h;
$\hat{R}$ is the discard ratio of species group j in stratum h; and
$V(\hat{R})$ is the variance of discard ratio of species group j in stratum h.

The number of sea days necessary to achieve a 30% CV for species group j in stratum h is defined as

$$\hat{S}_{30jh} = \hat{T}_{jh} * \overline{DA_h} \tag{5}$$

where $\overline{DA_h}$ is the average trip length of VTR trips in stratum h.

The calculation of sea days uses the average VTR trip length and not average observer trip length. Use of the VTR data, which represents the entire industry, guards against sampling variability induced by small sample sizes. Sampling variability may be bi-directional with observers riding longer or shorter trips on average than industry is making.

Due to minor difficulties with fleet identification, including limitations in identifying VTR trips with regard to access area, some sample size irregularities occurs where $N_h < n_h$. This occurred in three fleets: (1) the NE limited closed area scallop dredge fleet in the first three quarters; (2) the MA limited closed area scallop dredge fleet in the first three quarters; and (3) the MA mid-water paired and single trawl fleet in the first and fourth quarter (Table 2a). To prevent negative sampling fractions in Equations 2, 4, and 16, when $N_h < n_h$, N_h was assigned the value of $n_h + 1$.

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 which 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 $Y=(y/x)X$, where X is the total value of the covariate. The approximate variance of Y based on a ratio estimator can be written as

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

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

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

(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;
ρ^2 is squared correlation coefficient for species j.

Results of the correlation analyses are summarized in Table 5 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 NE large mesh trawl fishery for monkfish, and the large and small mesh multispecies groundfish species. Associations for small mesh trawls in NE were also strong for squid, mackerel and butterfish, and small mesh multispecies. Correlations for skate discard rates were above 0.32 in the NE and MA large mesh trawl fisheries, above 0.48 in the NE and MA extra large mesh gillnet fisheries, and above 0.2 in 4 of the 6 scallop dredge fisheries.

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.[7] These two illustrative plots (Figure 1a and 1b) 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 13 fish species groups in otter trawl and gillnet gears by mesh sizes (presented in Figures 1c–zz and by 5 protected species groups for longline, otter trawl, gillnet, and scallop dredge (Figures 2a–j). Departures from linearity are often controlled by large numbers of trips with zero discards. When trips with zero discards are removed, improvement in linearity occurs.

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

Examples of these are given for large-mesh groundfish discarded in the otter trawl and gillnet fleets (Figures 3a–d).

Rho and sample size analyses (using power = 0.80, alpha = 0.10; alternative hypothesis = 'not equal' and null value = 0) indicated that a low percentage of fleets and species groups had linear relationships using a ratio estimator (d/k or d/da).

ESTIMATION OF TOTAL DISCARDS

Three methods were examined to estimate total annual discards, precision, and coverage necessary to achieve a 30% CV for fleets and species/species groups: (1) **separate ratio method**; (2) **combined ratio method**, and (3) **simple expansion method** (mean discard per trip). Cochran (1963) discusses these three methods in greater detail; we attempt to follow Cochran's notation to facilitate comparisons. 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 30% CV. In these analyses, stratum is defined as fleet and species group. We note that significant improvements in discard estimation may be possible through a variety of species-specific refinements. These might be accomplished via use of additional covariates, post stratification, or other model-based approaches.

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

Method 1. Separate Ratio Method

Total discarded pounds of species *j* using Method 1 is defined as:

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

where $\hat{D}_{1,j}$ is the total discarded pounds for species *j*;
K_h is the VTR total kept pounds in stratum *h*;
DA_h is the VTR 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*.

Variance of $\hat{D}_{1,j}$ is defined as:

(12a) $$V(\hat{D}_{1,j}) = \sum_{h=1}^{L} K_h^2 \left(\frac{N_h - n_h}{n_h N_h} \right) \frac{1}{\left(\frac{\sum_{i=1}^{n_h} k_{ih}}{n_h} \right)^2} \left[\frac{\sum_{i=1}^{n_h} \left(d_{jih}^2 + \left(r_{s,jh} \right)^2 k_{ih}^2 - 2 r_{s,jh} d_{jih} k_{ih} \right)}{n_h - 1} \right]$$

and

(12b) $$V(\hat{D}_{1,j}) = \sum_{h=1}^{L} DA_h^2 \left(\frac{N_h - n_h}{n_h N_h} \right) \frac{1}{\left(\frac{\sum_{i=1}^{n_h} da_{ih}}{n_h} \right)^2} \left[\frac{\sum_{i=1}^{n_h} \left(d_{jih}^2 + \left(r'_{s,jh} \right)^2 da_{ih}^2 - 2 r'_{s,jh} d_{jih} da_{ih} \right)}{n_h - 1} \right]$$

where $\hat{D}_{1,j}$ is the total discarded pounds for species *j*;
K_h is the VTR total kept pounds in stratum *h*;
DA_h is the VTR 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} is days absent from trip *i* in stratum *h*;
N_h is the number of VTR trips in stratum *h*;
n_h is the number of observed trips in stratum *h*.

CV of $\hat{D}_{1,j}$ is defined as:

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

Method 2. Combined Ratio Method

The combined ratio method is based on a ratio estimate pooled over all strata and trips within strata. Total discarded pounds for species *j* is defined as:

(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 $\hat{D}_{2,j}$ is total discarded pounds for species j;
K_h is VTR total kept pounds in stratum h;
DA_h is VTR total days absent in stratum h;
$r_{c,j}$ is the **combined ratio** of species j;
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 VTR trips in stratum h;
n_h is the number of observed trips in stratum h.

In Equations 15a and 15b the summation over strata $h = 1$ to L is over calendar quarters and the other strata values are held constant. Equations 16a and 16b require a more explicit definition of the stratum designation since the summation over quarter relies on an annual average ratio defined in Equation 15.

Variance of $\hat{D}_{2,j}$ for species j is defined as:

(16a) $$V(\hat{D}_{2,j}) = \sum_{q=1}^{4} K_{qh}^2 \left(\frac{N_{qh} - n_{qh}}{n_{qh} N_{qh}} \right) \frac{1}{\left(\frac{\sum_{i=1}^{n_h} k_{iqh}}{n_{qh}} \right)^2} \left[\frac{\sum_{i=1}^{n_{qh}} \left(d_{jiqh}^2 + \left(r_{c,j} \right)^2 k_{iqh}^2 - 2 r_{c,j} \; d_{jiqh} k_{iqh} \right)}{n_{qh} - 1} \right]$$

and

(16b) $$V(D_{2,j}) = \sum_{q=1}^{4} DA_{qh}^2 \left(\frac{N_{qh} - n_{qh}}{n_{qh} N_{qh}} \right) \frac{1}{\left(\frac{\sum_{i=1}^{n_h} da_{iqh}}{n_{qh}} \right)^2} \left[\frac{\sum_{i=1}^{n_{qh}} \left(d_{jiqh}^2 + \left(r'_{c,j} \right)^2 da_{iqh}^2 - 2 r'_{c,j} \; d_{jiqh} da_{iqh} \right)}{n_{qh} - 1} \right]$$

where $\hat{D}_{2,j}$ is total discarded pounds for species j;
K_{qh} is VTR total kept pounds in quarter q and stratum h;
DA_{qh} is VTR total days absent in quarter q and stratum h;
$r_{c,j}$ is the **combined ratio** of species j;
d_{jiqh} is discards of species j from trip i in quarter q and stratum h;
k_{iqh} is kept pounds of all species on trip i in quarter q and stratum h;

da_{iqh} is days absent from trip i in quarter q and stratum h;
N_{qh} is the number of VTR trips in quarter q and stratum h;
n_{qh} is the number of observed trips in quarter q and stratum h.

CV of $\hat{D}_{2,j}$ is defined as:

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

Method 3. Simple Expansion Method: mean discard per trip

Total discarded pounds for species j using Method 3:

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

where d_{jih} is discards of species j from trip i in stratum h;
N_h is the number of VTR trips in stratum h;
n_h is the number of observed trips in stratum h.

Note: $\hat{D}_3$ will differ between d/da and d/k sets due to expansion of discards to account for non-observed hauls in the d/da set.

Variance of $\hat{D}_{3,j}$ for total discarded pounds using Method 3 for species j is defined as:

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

where $\hat{D}_{3,j}$ 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 VTR trips in stratum h;
n_h is the number of observed trips in stratum h.

The CV of $\hat{D}_{3,j}$ is defined as:

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

SAMPLE SIZE ANALYSIS

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

Sample size based upon the variance of the quarterly bycatch ratio

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

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

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), the quarterly sea days were estimated by pilot coverage:

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

where $\hat{T}$ is 2% of the VTR trips in stratum h and quarter q;

3 <= $\hat{T}_{hq}$ <= 100 trips;

$\overline{DA}$ is the average trip length of VTR trips in stratum h and quarter q.

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

Sample size based upon the variance of the composite annual total discard

The number of sea days and trips needed to achieve a 30% CV has been derived based on the variance of the composite annual total discards using the combined ratio method and the d/k bycatch ratio (Equation 16a).

From Equation 16a, let

(23) $$\hat{S}^2_{jqh} = \left[\frac{\sum_{i=1}^{n_{qh}} \left(d^2_{jiqh} + \left(r_{c,jh}\right)^2 k^2_{iqh} - 2r_{c,j}\ d_{jiqh} k_{iqh} \right)}{n_{qh} - 1} \right]$$

and

(24) $$\delta_{qh} = \frac{n_{qh}}{\sum_{q=1}^{4} n_{qh}}$$

where δ_{qh} is the fraction of the trips in quarter q in stratum h;
$r_{c,jh}$ is the combined annual ratio of species j in stratum h;
d_{jiqh} is discards of species j from trip i in stratum h in quarter q;
k_{iqh} is kept pounds of all species on trip i in stratum h in quarter q;
n_{qh} is the number of observed trips in stratum h in quarter q.

The $r_{c,jh}$ in Equation 23 is defined in Equation 15a, where the summation is over quarters within a given strata defined by gear, region, access area, trip type and so forth.

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

(25) $$\hat{T}D_{30\,jh} = \frac{\sum_{q=1}^{4} \left(\frac{K^2_{qh}}{\bar{k}^2_{qh}} \hat{S}^2_{jqh} \frac{1}{\delta_{qh}} \right)}{(0.09) D_{jh}{}^2 + \frac{\sum_{q=1}^{4} \frac{K^2_{qh}}{\bar{k}^2_{qh}} \hat{S}^2_{jqh}}{N_h}}$$

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

(26) $$\hat{S}D_{30\,jh} = \hat{T}D_{30\,jh} * \overline{DA_h}$$

where $\overline{DA_h}$ is the weighted average trip length of VTR trips in stratum h (weighted by the number of VTR trips in each quarter) .

When total discards could not be estimated due to little or no observer coverage (i.e., pilot coverage will be needed) or when total discards are zero (no variance), the sum of the quarterly trips and sum of the quarterly sea days are used (i.e., TD_{30} = sum of quarterly T_{30} and SD_{30} = sum of quarterly S_{30}).

Pilot coverage has been used when the bycatch ratio is zero or when variance of the bycatch ratio or the variance of the composite total discards is zero. It is recognized that pilot coverage may result in too much coverage in cases where no observer coverage is needed for a cell. As new bycatch information is acquired, the unlikely (gray-shaded) cells should be re-

evaluated and updated to prevent the overuse of pilot coverage. As discussed in the 'Importance Filters' section below, when the importance filters are applied, cells with pilot coverage are expected to be excluded when cells have little or no discards due to other factors (e.g., discard amount is extremely low compared to total landings, etc). It should be noted that pilot coverage plays an important role in determining coverage for protected species (species where bycatch may be a rare event) and only the unlikely (gray-shaded) filter is applied to protected species groups (other importance filters are not applied to protected species).

META-ANALYSIS

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

Total discards derived from each method and ratio estimator were compared to each other by plotting all combinations within a single plot 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 Figures 4a–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 Figures 5a–5n. For Figures 4 and 5, 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% confidence region.

Generally, there is close relationship between all methods and ratio estimators for longline, otter trawl, and scallop dredge for total discards (Figures 4a–g). For longline and scallop dredge gear the estimated total discards were strongly correlated among estimators (Figures 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 (Figures 4b,c), especially for high values of discard.

There is some departure between methods and ratio estimators for gillnets in the Mid-Atlantic (Figure 4f) but not in New England (Figure 4g). This may be attributed to the use of days absent with a fixed gear fishery. Some fleets 'tend' their nets while the gear in the water, thus days absent is correlated with soak time; this may not be true for fleets who do not tend.

For measures of uncertainty of the estimate, there was general agreement among the three methods and two ratio estimators (Figures 5a–g). Confidence ellipse for longline, gillnet, and scallop dredge were stronger than for otter trawl; however, otter trawl associations were tight. In general, results in Figures 5h–n suggested a greater degree of dispersion among Methods 1–3 when 'days absent' was used as a measure of fishing effort. Since 'days absent' does not account for variations in steam time vs fishing time nor for 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 Figures 6a–g 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% 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 MA otter trawl where coverage is low and precision estimates are higher, consequently 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%, irrespective of which method was used.

The tables presenting precision (Table 6), ranking of total discards (Table 7), and the sea days and trips necessary to achieve a 30% CV (Tables 8–13) are based upon the variance of the quarterly bycatch ratio and the variance of the composite annual total discard using combined ratio method (Method 2).

The precision of the total discards by fleet and species is presented in Table 6. (See Appendix Table I for individual species.) Cells with adequate precision (at or below 30% CV) are identified with bold font. Note that when a CV is reported for a fleet 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%) had CVs less than or equal to 0.30 (Table 6). For tilefish, 3 of the 4 fleets where discarded tilefish occurred were above 30% CV. Of the 600 cells in the fleet by species matrix, 29% of the cells had CV less than or equal to 30%. 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 (gray-shaded) cells. Additionally, the relative magnitude of the discard should also be considered when evaluating the precision. There are cases, for example, of large-mesh NE multispecies in the mid-water trawls where the magnitude of the total catch, rather than the precision of the estimate, is the most important factor. It is not possible at this time to compile a complete list of all cases.

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 fleet. The rank indicates the relative magnitude of the discarded species group within a fleet. Ranking of total discard weight within a fleet for fish species group are presented in Table 7a, and the ranking of total number of incidental takes of turtles, marine mammals, and sea birds within a fleet are presented in Table 7b. (See Appendix Table II for individual species.) In the gillnet fleets, spiny dogfish are discarded the most (rank = 1 for all gillnet fleets), while in the scallop dredge fleets, 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 fleets than other protected species while sea birds and turtles are encountered more frequently than other protected species in the gillnet and scallop fleets. Total discard weight for fish species and total numbers of incidental takes were also ranked within species group (Tables 7c and 7d, respectively; see Appendix Table III for individual species). Compared to other fleets, the NE large-mesh otter trawl fleet discards the most dogfish and NE multispecies. The open access, limited scallop dredge fleets discard the most scallops and monkfish. Turtles are taken most often in the MA scallop trawl fleets.

The sea days and trips necessary to achieve a 30% CV for each species group and fleet based on the variance of the quarterly bycatch ratio are presented in Table 8 and Table 9, respectively. (See Appendix Tables IV and V 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% CV standard, resource limitations, and relative magnitude of discards. For example, the need for 5,201 observer days to estimate surf clam discards in the large mesh NE otter trawl fishery is driven by imprecise estimates of small numbers. Such an allocation of observer days would be wasteful with respect to surf clam discards and would over-sample by a factor of about 12 the estimated days (403 days) necessary to obtain a CV of 30% for large-mesh groundfish species.

To determine the number of sea days needed to achieve a 30% 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 30% CV or less. Based upon this approach, Tables 10a and 10b presents the number of sea days and trips needed for each fleet for: (1) all 20 species groups considered in this study; (2) 15 species groups[8] (all of the fish species groups plus the turtles); (3) the 20 species groups filtering out the unlikely (gray-shaded) cells; and (4) the 15 species groups filtering out the unlikely cells. In Tables 10a and 10b, the total number of sea days and trips needed to achieve a 30% CV for each of these four scenarios is attained by summing each column. These totals range from 27,856 to 31,771 days; for comparative purposes, approximately 8,000 observer sea days were utilized by the NEFOP in 2004.

The sea days and trips needed to achieve a 30% CV based on the variance of the composite annual total discard for each species group and fleet are presented in Table 11 and Table 12, respectively. (See Appendix Table VI and VII for individual species.) Similar to the sea days and trips based on the variance of the quarterly bycatch ratio, the sea days and trips are additive across fleets within species groups (i.e., column sums); however, the sea days and trips are not additive across species groups within fleets (i.e., row sums).

To determine the number of sea days and trips needed to achieve a 30% 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 30% CV or less. Based on this approach, Tables 13a–b present the number of sea days and trips needed for each fleet for: (1) all 20 species groups considered in the study; (2) 15 species groups (all fish species group and turtles); (3) the 20 species groups filtering out the unlikely (gray-shaded) cells; and (4) the 15 species groups filtering out the unlikely cells. In Tables 13a and 13b, the total number of sea days and trips needed to achieve a 30% CV for each of these four scenarios is attained by summing each column. These totals range from 56,427 to 73,524 days; for comparative purposes, approximately 8,000 observer sea days were utilized by the NEFOP in 2004 and a range between 27,856 to 31,771 days were estimated based on the variance of the quarterly bycatch ratio (Table 10a).

Differences between sample sizes based on the variance of the quarterly bycatch ratio and the variance of the composite annual total discard can be traced back to the differences between variances derived from the separate and the combined ratios. The quarterly-based estimates of sample size rely on the quarterly estimates of variance. Annual estimates, on the other hand, rely on composite estimates of the overall variance of the total and a combined estimate of the overall discard ratio. As a result, the species group identified as the species with the maximum sea days differs between the quarterly-based estimates and the composite-based estimates.

8. Magnuson-Stevens Act covers these 15 species groups.

These two sets of samples size should not be considered upper and lower bounds; instead, they should be considered two alternative methods of dealing with the uncertainty of variance estimates.

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

Given the fourfold disparity between the projected number of sea days needed to meet the CV objective and the maximum number of observer days expended in the history of the NEFOP, it is possible that further reductions in the number of sea days will be necessary. These reductions could be accomplished by applying a series of 'filters' to the number of sea days.

IMPORTANCE FILTERS

The use of importance filters has been established to provide a standardized protocol to further refine the number of observer sea days to levels appropriate with the importance of the discarded species relative to the amount of discard by a fleet component and total fishing mortality. These importance filters further refine the sea days beyond the unlikely (gray-shaded) cell filter. The importance filters eliminate cells where discards are a minor component of the total discards for that species group and eliminate cells where discards are a minor component of the total catch (fishing mortality) for that species group. The importance filters can be applied to Table 8 (sum of the quarterly sea days based on the variance of the quarterly bycatch ratio) or Table 11 (sea days based on the variance of the composite annual total discards). Estimates based on the composite annual total discards were used because they reflect the sentiments of the NEFMC and the MAFMC to achieve precision goals based on annual rather than quarterly values.

For each filter, a matrix of (0,1) is created; a zero indicates the sea days associated with the cell will be eliminated and 1 indicates the sea days associated with the cell will be kept. Although each filter is independent of the others, the filters work together in combination:

I = unlikely cell filter * fraction of discard filter * fraction of mortality due to discards filter.

A cell is included when the value of I equals one; otherwise the cell is excluded.

In the application of the filters, it is not desirable to reduce or eliminate coverage on fleets that constitute a significant source of either landings or discards for a given species group. Fleets that currently land a significant fraction of a resource could become high sources of discards if regulations change. Observer coverage is also needed for the fleets whose discards constitute a significant fraction of the total mortality on the stock.

While it may appear that the unlikely cell filter would become obsolete with the use of fraction of discards filter, the unlikely cell filter remains important for protected species, species with no landings, and species for which no level of discarding is acceptable. The unlikely cell filter is also important in its use as a 'override' mechanism in situations where pilot coverage is evoked due to no variance (observer coverage indicates zero discards).

The importance filters use a cumulative percentage within a species group to standardize the magnitude of discards and fishing mortality of each fleet. By using the cumulative percentages, the importance filters can be used to allocate sea days on the basis of their contribution to total discards and total fishing mortality on the resource.

The fraction of discard filter utilizes the ratio of discards of species group j in fleet h (D_{jh}) to the sum of species group j discards summed over h (D_j). The discard percentages for species group j are then sorted smallest to largest and a cumulative percentage is derived for fleet h within species group j. A percentage value is then selected as a cut-point to eliminate the set of smallest fleets that in aggregate contribute less than or equal to the cut-point value. The single cut-point value is applied to all species groups. Cells that are eliminated are indicated by a zero; cells that remain are indicated by a 1.

It is important to note that a cell is eliminated only when: (1) its percentage value is less than the cut point and (2) its contribution to the sum of the percentages for the smallest cells falls below the cut point.

For example, a 5% cut point will eliminate sea days associated with fleets that contribute to the lower 5% of the total discards for each species group. The sea days associated with the fleets included in the upper 95% of the total discards for each species group will remain.

The fraction of total mortality due to discards filter utilizes the ratio of discards of species group j in fleet h (D_{jh}) to the sum of commercial landings (L_{jh}), recreational landings (R_{jh}), and D_{jh}, summed over h. The filter is applied in exactly the same way as the fraction of discards filter in that the fraction and its cumulative effect are specified. The result of this filter is a set of 0,1 indicators for each cell in the column.

For example, a 1% cut point will eliminate sea days associated with fleets that contribute to the lower 1% of the total fishing mortality due to discards for each species group. The sea days associated with the fleets included in the upper 99% of total fishing mortality due to discards will remain.

The filters are applied simultaneously and are equivalent to a Boolean expression, 'A and B and C'; thus, the cell is included if I = 1. Cells with a zero sum indicate an unimportant cell with respect to discards and landings. A score of 1 indicates an important cell based on all the filters. The sea days associated with a cell containing a zero will be eliminated, and sea days associated with a cell containing a 1 will be included. It should be noted that the elimination of sea days from cells containing zero does not imply these fleets will not have observer coverage; it means that the sea days from these cells will not be used to determine the maximum number of sea days needed for the fleet. The exclusion of a cell implies that it does not constitute an important part of the total discard for a species, nor do the discards make up an important fraction of the total mortality on the species.

A summary of the annual number of sea days needed to monitor all 20 species groups (all fish species, turtles, marine mammals, and sea birds) in this study, and 15 species groups (all fish species groups and turtles) over a range of values for the fraction of discards and the fraction of total fishing mortality due to discarding, are presented in Table 14 and Table 15, respectively. The selection of a cut-point value for each of the two importance filters is based on the need to observe some fraction of the discarding relative to the discards of the species group and some fraction of the total mortality due to discarding. If the lower 5% of all discarding of each species group was not monitored at a level to achieve a 30% CV and lower 1% of total mortality due to discarding was not monitored at a level to achieve a 30% CV, then the annual number of sea

days to monitor all 20 species groups would be 34,717 days (Table 14), and 15,073 days for monitoring 15 species groups (Table 15).

These analyses make up an integrated allocation approach for observer coverage based on relative precision and the relative importance of discards. Both the precision and the magnitude of the total discards are addressed. This approach can help ensure that sea day allocations are not driven by imprecise estimates of small quantities; instead, it allows the relative importance of the discards to be assessed in terms of the overall fishing mortality on the stock.

ACCURACY ANALYSES

Several tests were conducted to evaluate the potential sources of bias in the 2004 data. 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 are different, or if observed vessels fish in different areas than the rest of the fleet. 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 (kept pounds) by species groups for observed and total trips compare favorably (Figure 7**)** and followed 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 8 and 9**),** by species group, indicates no evidence of systematic bias and general symmetry in the pattern of positive and negative differences.[9]

The mean difference of species pounds were generally small relative to total trip pounds and the average catch rates between the two data sets were not significantly different from zero in 12 of the 14 comparisons (Table 16). Also, a paired t-test of the stratum-specific standard deviations of pounds kept showed significant differences from 6 of the 14 comparisons. A strong correlation was detected in trip duration between observed and unobserved trips (Figure 10), with observed trips averaging about a quarter-day longer (Figure 11, Table 16). 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.

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 VTR 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

9. From mid November 2004 through October 2005, Northeast multispecies regulations 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 paper 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 VTR data.

distribution of trips for the stratum as a whole (Table 17). It was possible to compute chi-square statistics for 86 strata. The null hypothesis of observer proportions equal to VTR proportions was rejected ($P<0.05$) in 38 of the 86 comparisons. This analysis used training trips and quota-monitoring trips which have disproportionate higher rate of observer coverage than other observed trips, which may explain the significant differences 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; there is no evidence of bias in the observer data.

OVERLAP ANALYSES

Fishing trips in a given stratum may catch species from more than one species group. 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 NE groundfish can be expanded and applied to the species groups and fleets considered in this study.

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 sensible. Even so, the optimization model is simply a tool to help guide the allocation process.

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 approach 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. It 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. Overall performance is measured as a composite of the precision of discard estimates. Developing a composite measure of performance requires development of weighting factors for each species group and fishery. As the dimensionality of the bycatch allocation process is very high (species groups x strata), the definition of an acceptable set of weighting factors will be challenging.

The optimization model also incorporates explicitly external constraints that affect the allocation of observer effort. While the most important constraint is the total budget for observers, the prescribed percent coverage for regulatory programs (e.g., US/Canada resource sharing areas, B days, and scallop vessels in closed areas) have substantial impacts on the overall performance of the program. The optimization model provides at least one measure of the impacts of externally imposed constraints.

The use of observer data for single species stock assessments and the sea day allocation are presented in Figure 12. This overview illustrates the 'feedback' 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.

SOURCES OF UNCERTAINTY/DISCUSSION

The difficulties of discard estimation are well known and have been described extensively in the literature (e.g., Rochet et al. 2002; Diamond 2003; Rago et al. 2005; Kaiser 2006). In this report we have used a design-based approach 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 such development by ensuring that the sampling is robust regarding uncertainties in the prosecution of fisheries. Allocation of observer effort to fisheries and quarters protects against unforeseen changes in seasonal effort patterns, shifts to new fisheries (e.g., trawlers to general category scallopers), or effects of closed areas. Moreover, the design-based approach can help smooth out the allocation process over time, thereby reducing potential labor problems. A design-based approach for biological sampling has proven to be an excellent technique for monitoring the biological attributes of landings. An extension of this concept to observer coverage has similar advantages.

Some critical areas of concern include the following:

1. measures of overlap
2. influence of zero observations
3. influence of extremely high variation on measures of central tendency
4. alternative predictive variables
5. development of aggregate measures of performance/efficacy for the observer program
6. relationship between design and model based estimators
7. influence of over-stratification on bias of estimation
8. lack of persistence in fishing behavior over years
9. influence of fishing regulations on vessel behavior
10. imprecise estimation of location from VTR
11. utility of aggregate species measures of discard
12. improving correspondence between VTR and Dealer data
13. incorporation of more advanced statistical estimators that explicitly treat zero observations and over-dispersion

The statistical theory applicable to the estimation of fisheries bycatch is evolving rapidly, and significant advances are anticipated. Several promising methods, recently published or now under development, are expected to advance the reliability of discard estimation. Field testing of these newer methods for multiple geographical regions and fisheries will take time. Meanwhile the sampling design developed in this report, and more importantly the underlying data collected by NERO and NEFSC, should retain enough flexibility to accommodate/support many of these newer methods.

SUMMARY AND CONCLUSIONS

We stratified fisheries in the Northeast region into 45 fleets and examined discard rates of 60 species/species groups of fish, turtles, marine mammals, and sea birds using 2004 NEFOP and VTR data. Although several species and gear combinations were identified as unlikely, they were included in the analyses. Since the emphasis of this study is to evaluate the precision and accuracy of the bycatch monitoring program, the discard rates and total discard weight are not presented.

Two ratio estimators were used: discard to days absent and discard to kept 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.

We examined precision of all six estimates for each fleet and species/species group combination. Again, precision levels were comparable for each estimator and method. In the end we selected the combined ratio method using the discard to kept pounds; data for kept pounds are more verifiable than data for days absent, and the combined ratio method better utilized information associated with kept pounds.

A 30% CV was selected as a target level of precision based upon the recommendation of the NWGB. The number of observed sea days (and trips) necessary to achieve a 30% CV for species was derived for each fleet and species/species group combination using two alternative methods. The total estimated number of sea days necessary to achieve a 30% CV exceeded 31,000 days using the variance of the quarterly bycatch ratio, and exceeded 73,000 sea days using the variance of the composite annual total discard.

The use of the importance filter to further refine the number of sea days can help ensure that sea day allocations are not driven by imprecise estimates of small quantities. These analyses make up an integrated allocation approach for observer coverage based on relative precision and the relative importance of discards. Both the precision and the magnitude of the total discards are addressed.

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 amount of kept pounds, trip duration, or area fished between the NEFOP and VTR data.

ACKNOWLEDGMENTS

We wish to thank the Protected Species Branch staff of the Northeast Fisheries Science Center for their guidance on the use protected species data. We thank Jessica Blaylock for her technical assistance in preparing this report and Fred Serchuk for his helpful comments and support during the development of this report.

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Table 1. List of 60 species and species group (in bold) corresponding to the 14 FMPs and 5 turtle, marine mammal, and sea bird groups examined in this report.

BLUEFISH
HERRING
SALMON
RED CRAB
SCALLOP
MACKEREL/SQUID/BUTTERFISH
Mackerel
Illex
Loligo
Butterfish
MONKFISH
NE MULTI_SPECIES (LARGE-MESH)
Cod
Haddock
Yellowtail flounder
American plaice
Witch flounder
Winter flounder
Pollock
Redfish
White hake
Windowpane
Halibut
Ocean pout
NE MULTI_SPECIES (SMALL-MESH)
Silver hake
Offshore hake
Red hake
SKATE COMPLEX (7 species of skates)
DOGFISH, SPINY
FLUKE/SCUP/BLACK SEA BASS
Summer flounder (fluke)
Scup
Black sea bass
SURF CLAM/OCEAN QUAHOG
TILEFISH
ALL SPECIES (Combined)

TURTLES
Green turtle
Leatherback turtle
Loggerhead turtle
Kemp's Ridley turtle
Turtles, unk.
SEALS
Harp seal
Hooded seal
Harbor seal
Gray seal
Seals, unk.
WHALES
Long-fin Pilot whale
Minke whale
Whale, unk.
DOLPHINS/PORPOISE
Whitesided dolphin
Common dolphin
Bottlenose dolphin
Harbor porpoise
Dolphin/porpoise, unk.
SEA BIRDS (ALL)

Table 2a. Number of **trips** in the 2004 NEFOP and VTRs, by fleet and quarter. The comments indicate where imputation and pilot coverage were used (yellow shading indicates the cells used in the imputation) in the fish and protected species (PSPP) data sets.

					NUMBER OF TRIPS IN 2004 OBSERVER PROGRAM											NUMBER OF TRIPS 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	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	1	2	3	2638	6039	14487	10937	34101	Pilot
Lobster Pots	all	all	MA	all	0	0	0	0	0		0	0	0	0	0	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 2b. Number of **sea days** in the 2004 NEFOP and VTRs, by fleet and quarter. The comments indicate where imputation and pilot coverage were used (yellow shading indicates the cells used in the imputation) in the fish and protected species (PSPP) data sets.

					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	1	2	3	3699	7701	16980	13154	41534	Pilot
Lobster Pots	all	all	MA	all	0	0	0	0	0		0	0	0	0	0	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 3. Number of observed trips in 2004 and the percent of observed trips with zero discard, by fleet and fish species groups.

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%

Note: Gray-shade cells indicate unlikely species/gear combinations; U/C = US/Canada; B = B-day

Table 4. Number of observed trips in 2004 and the percent of observed trips with zero incidental takes, by fleet and protected species groups.

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					

Note: Gray-shade cells indicate unlikely species/gear combinations.

Table 5. Summary of correlation (rho) of the ratio estimate (discard to kept estimator), by fish species group and fleet.

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														

Note: Gray-shade cells indicate unlikely species/gear combinations.

Table 5 *continued*. Summary of correlation (rho) of the ratio estimate (discard to kept estimator), by protected species group and fleet.

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

Note: Gray-shade cells indicate unlikely species/gear combinations.

Table 6. The CV of composite annual total discards, by fleet and species group (bold font indicates CV is less or equal to 30%) derived from 2004 NEFOP data; *see Appendix Table I for all species.* The 2004 observed trips for fish is given.

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	1.077	**0.168**	*	0.482	**0.135**	0.421	**0.222**	**0.159**	0.396	**0.126**	0.326	**0.291**	**0.198**	*	
Scallop Dredge	closed	limited	MA	all	35	1.208	0.660	*	0.357	**0.198**	0.310	**0.280**	0.712	**0.268**	**0.142**	0.425	0.383	0.321	*	
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	*	*	*	0.545	1.048	0.708	0.539	*	**0.246**	1.165	*	*	
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

Note: Gray-shade cells indicate unlikely species/gear combinations; when bycatch ratio = 0, CV = null (*); blank = no coverage.

Table 6 *continued.* The CV of composite annual total discard, by fleet and species group (bold font indicates CV is less or equal to 30%) derived from 2004 NEFOP data; *see Appendix Table I for all species.* The 2004 observed trips for fish is given.

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	**0.165**	*	*	*	**0.163**	**0.119**	
Scallop Dredge	closed	limited	MA	all	35	*	*	*	*	*	**0.119**	
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	*	*	*	*	*	0.408	
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

Note: Gray-shade cells indicate unlikely species/gear combinations; when bycatch ratio = 0, CV = null (*); blank = no coverage.

Table 7a. Rank of total discard weight **within fleet** for fish species groups derived from 2004 NEFOP data; *see Appendix Table II for all species.*

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														

Note: Gray-shade cells indicate unlikely species/gear combinations; * indicate no discards of these species occurred.

Table 7b. Rank of total number of incidental takes **within fleet** for protected species groups derived from 2004 NEFOP data; *see Appendix Table II for all species.*

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						

Note: Gray-shade cells indicate unlikely species/gear combinations; * indicate no discards of these species occurred.

Table 7c. Rank of total discard weight **within species group** for fish species groups derived from 2004 NEFOP data; *see Appendix Table III for all species.*

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														

Note: Gray-shade cells indicate unlikely species/gear combinations; * indicate no discards of these species occurred.

Table 7d. Rank of total number of incidental takes **within species group** for protected species groups derived from 2004 NEFOP data; *see Appendix Table III for all species.*

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						

Note: Gray-shade cells indicate unlikely species/gear combinations; * indicate no discards of these species occurred.

Table 8. Number of **sea days** needed to achieve a 30% CV based on the **quarterly bycatch ratio,** and the 2004 observed sea days for fish species, by fleet and species group; *see Appendix Table IV for all species.*

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	72	59	112	249	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	1864	1808	211	2576	2496	601	746	802	899	1068	1031	1292	1654	1567	
Otter Trawl	all	all	NE	large	1076	4514	3937	730	2943	2930	1194	340	403	801	736	870	2655	5201	2448	
Otter Trawl	all	all	MA	small	471	1350	1411	196	668	1606	1494	1100	807	1068	639	1006	804	2705	759	
Otter Trawl	all	all	MA	large	183	503	781	342	342	729	631	366	359	725	199	643	373	984	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	155	51	51	399	119	181	115	85	292	80	443	408	51	51	pilot
Shrimp Trawl	all	all	NE	all	12	42	101	42	42	389	401	25	23	136	273	385	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	1487	760	141	3213	539	2323	1275	287	1142	828	454	2180	141	141	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	533	688	1119	144	1276	1511	2477	452	550	2176	287	452	1325	144	448	
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	105	29	29	29	29	29	29	19	29	99	96	29	29	29	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	30	131	68	68	68	301	68	104	68	68	55	58	120	68	68	pilot for fish
Scallop Dredge	open	limited	NE	all	344	269	269	269	992	724	1466	556	1129	970	269	1179	1038	1452	269	
Scallop Dredge	open	limited	MA	all	591	329	329	329	870	559	1152	458	1118	2936	294	2350	566	2410	329	
Scallop Dredge	open	general	NE	all	11	92	92	92	92	204	176	117	82	135	120	120	92	190	92	pilot
Scallop Dredge	open	general	MA	all	33	96	96	96	96	254	250	66	194	113	76	130	245	220	96	
Scallop Dredge	closed	limited	NE	all	805	1469	392	139	1610	313	839	357	233	727	165	765	693	1813	139	
Scallop Dredge	closed	limited	MA	all	373	369	228	108	182	191	368	116	361	410	162	296	216	291	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	371	611	56	56	409	692	437	540	832	685	256	462	56	56	
Mid-water paired & single Trawl	all	all	MA	all	39	35	288	35	35	35	44	366	364	45	35	49	354	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	103	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	172	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	137	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	15,364	14,016	4,573	16,986	14,833	16,019	8,583	9,170	15,026	7,645	12,446	14,411	18,981	8,514	
Total Sea Days excluding shaded cells						11,484	11,315	0	8,952	10,409	14,384	7,571	8,908	13,796	5,930	11,002	12,499	133	5,286	

Note: Gray-shade cells indicate unlikely species/gear combinations.

Table 8 *continued.* Number of **sea days** needed to achieve a 30% CV based on the **quarterly bycatch ratio,** and the 2004 observed sea days for protected species, by fleet and species group; *see Appendix Table IV for all species.*

Gear Type	Gear code	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	010	all	all	NE	all	133	35	35	35	35	214	146	
Longline	010	all	all	MA	all	11	76	76	76	76	76	76	pilot
Otter Trawl	050	all	all	NE	small	577	211	211	1457	1525	2060	436	
Otter Trawl	050	all	all	NE	large	1947	730	730	3609	2027	4349	440	
Otter Trawl	050	all	all	MA	small	499	1473	196	196	1300	833	454	
Otter Trawl	050	all	all	MA	large	186	342	342	342	342	447	126	
Scallop Trawl	052	open	limited	MA	all	22	95	95	95	95	95	95	pilot
Scallop Trawl	052	open	general	MA	all	71	51	51	51	51	51	38	pilot
Shrimp Trawl	058	all	all	NE	all	12	42	42	42	42	42	43	
Shrimp Trawl	058	all	all	MA	all	2	76	76	76	76	76	55	pilot
Sink, Anchor, Drift Gillnet	100, 110	all	all	NE	small	1	12	12	12	12	12	12	pilot
Sink, Anchor, Drift Gillnet	100, 110	all	all	NE	large	876	141	1058	141	1148	3165	217	
Sink, Anchor, Drift Gillnet	100, 110	all	all	NE	xlg	701	144	1314	144	1418	2836	170	
Sink, Anchor, Drift Gillnet	100, 110	all	all	MA	small	375	993	62	62	62	372	62	pilot for fish
Sink, Anchor, Drift Gillnet	100, 110	all	all	MA	large	85	104	29	29	29	157	95	pilot for fish
Sink, Anchor, Drift Gillnet	100, 110	all	all	MA	xlg	152	662	1018	68	497	1022	51	pilot for fish
Scallop Dredge	132	open	limited	NE	all	457	2132	269	269	269	790	258	
Scallop Dredge	132	open	limited	MA	all	675	3283	329	329	329	329	209	
Scallop Dredge	132	open	general	NE	all	24	92	92	92	92	92	88	pilot
Scallop Dredge	132	open	general	MA	all	55	96	96	96	96	96	18	
Scallop Dredge	132	closed	limited	NE	all	805	275	139	139	139	333	181	
Scallop Dredge	132	closed	limited	MA	all	373	108	108	108	108	108	99	
Scallop Dredge	132	closed	general	NE	all	0	24	24	24	24	24	24	pilot
Scallop Dredge	132	closed	general	MA	all	2	21	21	21	21	21	21	pilot
Mid-water paired & single Trawl	170, 370	all	all	NE	all	242	56	56	494	301	512	287	
Mid-water paired & single Trawl	170, 370	all	all	MA	all	42	35	35	35	35	35	99	
Fish Pots/ Traps	181	all	all	NE	all	0	20	20	20	20	20	20	pilot
Fish Pots/ Traps	181	all	all	MA	all	9	40	40	40	40	40	37	pilot
Purse Seine	121,120	all	all	NE	all	53	19	19	19	19	19	119	
Purse Seine	121,120	all	all	MA	all	2	9	9	9	9	9	9	pilot
Hand Line	020	all	all	NE	all	18	72	72	72	72	72	137	pilot
Hand Line	020	all	all	MA	all	11	133	133	133	133	133	133	pilot
Scottish Seine	360	all	all	NE	all	8	12	12	12	12	12	20	pilot
Clam Quahog Dredge	400	all	all	NE	all	0	50	50	50	50	50	50	pilot
Clam Quahog Dredge	400	all	all	MA	all	0	84	84	84	84	84	84	pilot
Crab Pots	300	all	all	NE	all	0	101	101	101	101	101	101	pilot
Crab Pots	300	all	all	MA	all	0	28	28	28	28	28	28	pilot
Lobster Pots	200	all	all	NE	all	3	439	439	439	439	439	439	pilot
Lobster Pots	200	all	all	MA	all	0	89	89	89	89	89	89	pilot
Total Sea Days						8,429	12,404	7,610	9,136	11,244	19,241	5,067	
Total Sea Days excluding shaded cells							12,404	6,326	8,060	11,244	19,241	5,067	

Note: Gray-shade cells indicate unlikely species/gear combinations.

Table 9. Number of **trips** needed to achieve a 30% CV based on the **quarterly bycatch ratio,** and the 2004 observed sea days for fish species, by fleet and species group; *see Appendix Table V 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	53	47	83	185	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	653	594	70	872	831	209	258	275	307	376	357	434	593	545	
Otter Trawl	all	all	NE	large	386	1877	1636	304	1351	1238	471	147	164	336	289	347	1025	2193	884	
Otter Trawl	all	all	MA	small	194	681	640	104	387	849	726	577	384	537	314	496	410	1324	279	
Otter Trawl	all	all	MA	large	75	248	302	177	177	381	291	201	181	338	109	269	156	484	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	72	25	25	196	56	85	54	41	142	39	216	200	25	25	pilot
Shrimp Trawl	all	all	NE	all	12	42	100	42	42	386	397	24	22	135	270	381	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	1070	571	104	2352	346	1748	952	216	830	609	338	1610	104	104	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	445	441	864	94	990	1037	1709	295	329	1406	180	287	968	94	253	
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	100	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	94	51	51	51	211	51	76	51	51	42	44	87	51	51	pilot for fish
Scallop Dredge	open	limited	NE	all	26	25	25	25	95	66	137	51	106	90	25	109	94	134	25	
Scallop Dredge	open	limited	MA	all	69	36	36	36	97	62	129	51	124	334	33	272	64	277	36	
Scallop Dredge	open	general	NE	all	9	71	71	71	71	149	130	89	64	102	91	91	71	140	71	pilot
Scallop Dredge	open	general	MA	all	22	69	69	69	69	182	183	45	139	81	54	94	178	161	69	
Scallop Dredge	closed	limited	NE	all	86	173	38	15	190	33	95	40	24	82	18	86	79	209	15	
Scallop Dredge	closed	limited	MA	all	35	41	24	12	21	21	39	13	40	45	17	32	24	31	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	156	232	21	21	155	290	189	241	335	286	106	190	21	21	
Mid-water paired & single Trawl	all	all	MA	all	13	11	83	12	12	12	14	106	105	15	12	18	102	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	97	37	37	37	37	37	37	37	pilot
Purse Seine	all	all	NE	all	16	10	82	10	10	10	76	10	80	10	10	84	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	129	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					2,272	6,908	6,508	2,306	8,069	7,093	7,846	4,305	3,731	6,261	3,964	4,916	6,827	6,970	3,695	
Total Trips excluding shaded cells						5,585	5,344	0	3,114	4,062	6,612	3,509	3,554	5,314	2,868	3,734	5,714	139	1,980	

Note: Gray-shade cells indicate unlikely species/gear combinations.

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Table 9 *continued*. Number of **trips** needed to achieve a 30% CV based on the **quarterly bycatch ratio,** and the 2004 observed trips for protected species (PSPP), by fleet and species group; *see Appendix Table V 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	187	106	
Longline	all	all	MA	all	2	12	12	12	12	12	12	pilot
Otter Trawl	all	all	NE	small	200	70	70	483	526	652	150	
Otter Trawl	all	all	NE	large	539	304	304	1534	762	1916	173	
Otter Trawl	all	all	MA	small	205	874	104	104	774	513	213	
Otter Trawl	all	all	MA	large	76	177	177	177	177	251	64	
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	18	pilot
Shrimp Trawl	all	all	NE	all	12	42	42	42	42	42	42	
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	757	104	867	2327	159	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	569	94	894	94	899	2058	108	
Sink, Anchor, Drift Gillnet	all	all	MA	small	358	933	58	58	58	359	58	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	81	101	27	27	27	139	91	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	142	494	764	51	406	766	39	pilot for fish
Scallop Dredge	open	limited	NE	all	36	200	25	25	25	72	24	
Scallop Dredge	open	limited	MA	all	78	368	36	36	36	36	24	
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	31	15	15	15	34	19	
Scallop Dredge	closed	limited	MA	all	35	12	12	12	12	12	11	
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	187	90	208	117	
Mid-water paired & single Trawl	all	all	MA	all	14	12	12	12	12	12	30	
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	58	
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	129	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	20	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					3,587	4,990	4,471	4,115	5,881	10,711	2,602	
Total Trips excluding shaded cells						4,990	4,134	3,860	5,881	10,711	2,602	

Note: Gray-shade cells indicate unlikely species/gear combinations.

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Table 10a. The maximum number of **sea days** (baseline and filtered) needed to achieve a 30% CV based on the **quarterly bycatch ratio** for any of the species groups (20 species groups) and for any of the fish and turtle species groups (15 species groups), by fleet. Filtered values exclude unlikely (gray-shaded) cells within a fleet. The 2004 observed sea days for fish species and protected species (PSPP) are presented for comparison purposes.

							BASELINE		FILTER APPLIED	
Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	2004 OB FISH sea days	2004 OB PSPP sea days	Sea days needed for 20 species groups by fleet	Sea days needed for 15 species groups by fleet	Sea days needed for 20 species groups by fleet	Sea days needed for 15 species groups by fleet
Longline	all	all	NE	all	12	133	249	249	249	249
Longline	all	all	MA	all	0	11	76	76	76	76
Otter Trawl	all	all	NE	small	449	577	2576	2576	2576	2576
Otter Trawl	all	all	NE	large	1076	1947	5201	5201	4514	4514
Otter Trawl	all	all	MA	small	471	499	2705	2705	1606	1606
Otter Trawl	all	all	MA	large	183	186	984	984	781	781
Scallop Trawl	open	limited	MA	all	11	22	95	95	95	95
Scallop Trawl	open	general	MA	all	56	71	443	443	443	443
Shrimp Trawl	all	all	NE	all	12	12	401	401	401	401
Shrimp Trawl	all	all	MA	all	2	2	76	76	76	76
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	1	12	12	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	657	876	3213	3213	3165	2323
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	533	701	2836	2477	2836	2477
Sink, Anchor, Drift Gillnet	all	all	MA	small	3	375	993	993	993	993
Sink, Anchor, Drift Gillnet	all	all	MA	large	4	85	157	105	157	105
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	30	152	1022	662	1022	662
Scallop Dredge	open	limited	NE	all	344	457	2132	2132	2132	2132
Scallop Dredge	open	limited	MA	all	591	675	3283	3283	3283	3283
Scallop Dredge	open	general	NE	all	11	24	204	204	204	204
Scallop Dredge	open	general	MA	all	33	55	254	254	254	254
Scallop Dredge	closed	limited	NE	all	805	805	1813	1813	1610	1610
Scallop Dredge	closed	limited	MA	all	373	373	410	410	410	410
Scallop Dredge	closed	general	NE	all	0	0	24	24	24	24
Scallop Dredge	closed	general	MA	all	2	2	21	21	21	21
Mid-water paired & single Trawl	all	all	NE	all	165	242	832	832	832	832
Mid-water paired & single Trawl	all	all	MA	all	39	42	366	366	366	366
Fish Pots/ Traps	all	all	NE	all	0	0	20	20	20	20
Fish Pots/ Traps	all	all	MA	all	6	9	103	103	40	40
Purse Seine	all	all	NE	all	33	53	172	172	172	172
Purse Seine	all	all	MA	all	0	2	9	9	9	9
Hand Line	all	all	NE	all	6	18	137	137	137	137
Hand Line	all	all	MA	all	0	11	133	133	133	133
Scottish Seine	all	all	NE	all	5	8	30	30	30	30
Clam Quahog Dredge	all	all	NE	all	0	0	50	50	50	50
Clam Quahog 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	3	439	439	439	439
Lobster Pots	all	all	MA	all	0	0	89	89	89	89
Total Sea Days					5,913	8,429	31,771	31,001	29,468	27,856

Table 10b. The maximum number of **trips** (baseline and filtered) needed to achieve a 30% CV based on the **quarterly bycatch ratio** for any of the species groups (20 species groups) and for any of the fish and turtle species groups (15 species groups). Filtered values exclude unlikely (gray-shaded) cells within a fleet. The 2004 observed sea days for fish species and protected species (PSPP) are presented for comparison purposes.

							BASELINE		FILTER APPLIED	
Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	2004 OB FISH TRIPS	2004 OB PSPP TRIPS	Trips needed for 20 species groups by fleet	Trips needed for 15 species groups by fleet	Trips needed for 20 species groups by fleet	Trips needed for 15 species groups by fleet
Longline	all	all	NE	all	12	119	187	185	187	185
Longline	all	all	MA	all	0	2	12	12	12	12
Otter Trawl	all	all	NE	small	142	200	872	872	872	872
Otter Trawl	all	all	NE	large	386	539	2193	2193	1916	1877
Otter Trawl	all	all	MA	small	194	205	1324	1324	874	874
Otter Trawl	all	all	MA	large	75	76	484	484	381	381
Scallop Trawl	open	limited	MA	all	1	3	12	12	12	12
Scallop Trawl	open	general	MA	all	31	39	216	216	216	216
Shrimp Trawl	all	all	NE	all	12	12	397	397	397	397
Shrimp Trawl	all	all	MA	all	2	2	13	13	13	13
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	1	12	12	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	577	772	2352	2352	2327	1748
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	445	569	2058	1709	2058	1709
Sink, Anchor, Drift Gillnet	all	all	MA	small	3	358	933	933	933	933
Sink, Anchor, Drift Gillnet	all	all	MA	large	4	81	139	101	139	101
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	27	142	766	494	766	494
Scallop Dredge	open	limited	NE	all	26	36	200	200	200	200
Scallop Dredge	open	limited	MA	all	69	78	368	368	368	368
Scallop Dredge	open	general	NE	all	9	20	149	149	149	149
Scallop Dredge	open	general	MA	all	22	39	183	183	182	182
Scallop Dredge	closed	limited	NE	all	86	86	209	209	190	190
Scallop Dredge	closed	limited	MA	all	35	35	45	45	45	45
Scallop Dredge	closed	general	NE	all	0	0	12	12	12	12
Scallop Dredge	closed	general	MA	all	1	1	15	15	15	15
Mid-water paired & single Trawl	all	all	NE	all	66	99	335	335	335	335
Mid-water paired & single Trawl	all	all	MA	all	13	14	106	106	106	106
Fish Pots/ Traps	all	all	NE	all	0	0	19	19	19	19
Fish Pots/ Traps	all	all	MA	all	6	8	97	97	37	37
Purse Seine	all	all	NE	all	16	26	84	84	84	84
Purse Seine	all	all	MA	all	0	2	9	9	9	9
Hand Line	all	all	NE	all	6	9	129	129	129	129
Hand Line	all	all	MA	all	0	3	126	126	126	126
Scottish Seine	all	all	NE	all	5	8	30	30	30	30
Clam Quahog Dredge	all	all	NE	all	0	0	69	69	69	69
Clam Quahog Dredge	all	all	MA	all	0	0	69	69	69	69
Crab Pots	all	all	NE	all	0	0	12	12	12	12
Crab Pots	all	all	MA	all	0	0	27	27	27	27
Lobster Pots	all	all	NE	all	0	3	353	353	353	353
Lobster Pots	all	all	MA	all	0	0	75	75	75	75
Total Trips					2,272	3,587	14,693	14,033	13,759	12,480

Table 11. Number of **sea days** needed to achieve a 30% CV based on the **composite annual total discard,** and the 2004 observed sea days for fish species, by fleet and species group; *see Appendix Table VI for all species.*

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
Longline	all	all	NE	all	12	35	35	35	35	35	35	35	27	185	89	99	35	35	35
Longline	all	all	MA	all	0	76	76	76	76	76	76	76	76	76	76	76	76	76	76
Otter Trawl	all	all	NE	small	449	1103	882	211	848	1998	249	757	266	269	2024	492	455	3822	441
Otter Trawl	all	all	NE	large	1076	26644	12864	730	798	1233	3159	81	107	341	316	614	1034	15593	2692
Otter Trawl	all	all	MA	small	471	2231	1869	196	5417	1162	1125	497	429	944	202	532	584	836	3057
Otter Trawl	all	all	MA	large	183	3625	883	342	342	311	242	140	101	998	70	481	98	584	342
Scallop Trawl	open	limited	MA	all	11	95	95	95	95	95	95	95	95	95	95	95	95	95	95
Scallop Trawl	open	general	MA	all	56	155	51	51	399	119	181	115	85	292	80	443	408	51	51
Shrimp Trawl	all	all	NE	all	12	42	92	42	42	353	364	22	20	123	247	349	42	42	42
Shrimp Trawl	all	all	MA	all	2	76	76	76	76	76	76	76	76	76	76	76	76	76	76
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	657	443	486	141	2592	4357	3758	408	83	313	482	109	3767	141	141
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	533	267	1004	144	3266	1255	1701	238	206	2059	109	214	417	144	502
Sink, Anchor, Drift Gillnet	all	all	MA	small	3	62	62	62	62	62	62	62	62	62	62	62	62	62	62
Sink, Anchor, Drift Gillnet	all	all	MA	large	4	105	29	29	29	29	29	29	19	29	99	96	29	29	29
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	30	131	68	68	68	301	68	104	68	68	55	58	120	68	68
Scallop Dredge	open	limited	NE	all	344	269	269	269	1596	80	1380	320	708	534	177	807	649	478	269
Scallop Dredge	open	limited	MA	all	591	329	329	329	8713	280	641	213	411	3080	114	371	465	2958	329
Scallop Dredge	open	general	NE	all	11	92	92	92	92	204	176	117	82	135	120	120	92	190	92
Scallop Dredge	open	general	MA	all	33	96	96	96	96	54	293	17	40	96	17	124	88	271	96
Scallop Dredge	closed	limited	NE	all	805	3861	344	139	1473	167	1301	429	227	1180	145	857	703	375	139
Scallop Dredge	closed	limited	MA	all	373	1777	772	108	341	157	337	283	1136	287	88	567	481	334	108
Scallop Dredge	closed	general	NE	all	0	24	24	24	24	24	24	24	24	24	24	24	24	24	24
Scallop Dredge	closed	general	MA	all	2	21	21	21	21	21	21	21	21	21	21	21	21	21	21
Mid-water paired & single Trawl	all	all	NE	all	165	699	747	56	56	1793	346	718	688	1218	1034	316	697	56	56
Mid-water paired & single Trawl	all	all	MA	all	39	182	453	35	35	35	167	492	281	182	35	43	557	35	35
Fish Pots/ Traps	all	all	NE	all	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Fish Pots/ Traps	all	all	MA	all	6	40	40	40	40	40	40	103	40	40	40	40	40	40	40
Purse Seine	all	all	NE	all	33	19	219	19	19	19	206	19	217	19	19	217	19	19	19
Purse Seine	all	all	MA	all	0	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Hand Line	all	all	NE	all	6	72	72	72	72	72	72	72	137	72	72	72	72	72	72
Hand Line	all	all	MA	all	0	133	133	133	133	133	133	133	133	133	133	133	133	133	133
Scottish Seine	all	all	NE	all	5	12	12	12	12	12	12	12	14	12	12	12	30	12	12
Clam Quahog Dredge	all	all	NE	all	0	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Clam Quahog Dredge	all	all	MA	all	0	84	84	84	84	84	84	84	84	84	84	84	84	84	84
Crab Pots	all	all	NE	all	0	101	101	101	101	101	101	101	101	101	101	101	101	101	101
Crab Pots	all	all	MA	all	0	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Lobster Pots	all	all	NE	all	0	439	439	439	439	439	439	439	439	439	439	439	439	439	439
Lobster Pots	all	all	MA	all	0	89	89	89	89	89	89	89	89	89	89	89	89	89	89
Total Sea Days					5,913	43,547	23,025	4,573	27,698	15,384	17,200	6,541	6,712	13,792	6,965	8,351	12,200	27,502	9,984
Total Sea Days excluding shaded cells						35,867	19,828	0	5,547	6,049	15,522	5,528	6,450	12,562	4,901	6,943	9,850	133	6,703

Note: Gray-shade cells indicate unlikely species/gear combinations.

Table 11 *continued.* Number of **sea days** needed to achieve a 30% CV based on the **composite annual total discard,** and the 2004 observed sea days for protected species, by fleet and species group; *see Appendix Table VI 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
Longline	all	all	NE	all	133	35	35	35	35	267	57
Longline	all	all	MA	all	11	76	76	76	76	76	76
Otter Trawl	all	all	NE	small	577	211	211	3082	2265	1870	183
Otter Trawl	all	all	NE	large	1947	730	730	10526	2111	3237	159
Otter Trawl	all	all	MA	small	499	1229	196	196	1164	1880	250
Otter Trawl	all	all	MA	large	186	342	342	342	342	727	55
Scallop Trawl	open	limited	MA	all	22	95	95	95	95	95	95
Scallop Trawl	open	general	MA	all	71	51	51	51	51	51	38
Shrimp Trawl	all	all	NE	all	12	42	42	42	42	42	39
Shrimp Trawl	all	all	MA	all	2	76	76	76	76	76	55
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	12	12	12	12	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	876	141	531	141	1398	1306	82
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	701	144	470	144	806	2661	59
Sink, Anchor, Drift Gillnet	all	all	MA	small	375	1259	62	62	62	880	62
Sink, Anchor, Drift Gillnet	all	all	MA	large	85	653	29	29	29	311	95
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	152	468	804	68	1272	806	51
Scallop Dredge	open	limited	NE	all	457	1261	269	269	269	3194	123
Scallop Dredge	open	limited	MA	all	675	3956	329	329	329	329	89
Scallop Dredge	open	general	NE	all	24	92	92	92	92	92	88
Scallop Dredge	open	general	MA	all	55	96	96	96	96	96	14
Scallop Dredge	closed	limited	NE	all	805	414	139	139	139	407	130
Scallop Dredge	closed	limited	MA	all	373	108	108	108	108	108	61
Scallop Dredge	closed	general	NE	all	0	24	24	24	24	24	24
Scallop Dredge	closed	general	MA	all	2	21	21	21	21	21	21
Mid-water paired & single Trawl	all	all	NE	all	242	56	56	1606	1464	808	193
Mid-water paired & single Trawl	all	all	MA	all	42	35	35	35	35	35	111
Fish Pots/ Traps	all	all	NE	all	0	20	20	20	20	20	20
Fish Pots/ Traps	all	all	MA	all	9	40	40	40	40	40	37
Purse Seine	all	all	NE	all	53	19	19	19	19	19	143
Purse Seine	all	all	MA	all	2	9	9	9	9	9	9
Hand Line	all	all	NE	all	18	72	72	72	72	72	137
Hand Line	all	all	MA	all	11	133	133	133	133	133	133
Scottish Seine	all	all	NE	all	8	12	12	12	12	12	20
Clam Quahog Dredge	all	all	NE	all	0	50	50	50	50	50	50
Clam Quahog Dredge	all	all	MA	all	0	84	84	84	84	84	84
Crab Pots	all	all	NE	all	0	101	101	101	101	101	101
Crab Pots	all	all	MA	all	0	28	28	28	28	28	28
Lobster Pots	all	all	NE	all	3	439	439	439	439	439	439
Lobster Pots	all	all	MA	all	0	89	89	89	89	89	89
Total Sea Days					8,429	12,721	6,025	18,791	13,507	20,503	3,513
Total Sea Days excluding shaded cells						12,721	4,742	17,714	13,507	20,503	3,513

Note: Gray-shade cells indicate unlikely species/gear combinations.

Table 12. Number of **trips** needed to achieve a 30% CV based on the **composite annual total discard,** and the 2004 observed trips of fish species, by fleet and species group; *see Appendix Table VII 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
Longline	all	all	NE	all	12	26	26	26	26	26	26	26	21	144	69	78	26	26	26
Longline	all	all	MA	all	0	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Otter Trawl	all	all	NE	small	142	364	291	70	280	659	82	250	88	89	668	162	150	1260	146
Otter Trawl	all	all	NE	large	386	11227	5420	304	336	520	1331	34	45	143	133	259	436	6570	1134
Otter Trawl	all	all	MA	small	194	1189	995	104	2885	619	599	265	229	503	108	283	311	445	1628
Otter Trawl	all	all	MA	large	75	1879	458	177	177	161	125	72	52	517	36	249	51	303	177
Scallop Trawl	open	limited	MA	all	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Scallop Trawl	open	general	MA	all	31	72	25	25	196	56	85	54	41	142	39	216	200	25	25
Shrimp Trawl	all	all	NE	all	12	42	91	42	42	350	361	22	20	122	245	346	42	42	42
Shrimp Trawl	all	all	MA	all	2	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	577	327	359	104	1913	3216	2774	301	61	231	356	81	2780	104	104
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	445	175	657	94	2139	822	1114	156	135	1348	71	140	273	94	329
Sink, Anchor, Drift Gillnet	all	all	MA	small	3	58	58	58	58	58	58	58	58	58	58	58	58	58	58
Sink, Anchor, Drift Gillnet	all	all	MA	large	4	100	27	27	27	27	27	27	17	27	95	91	27	27	27
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	27	94	51	51	51	211	51	76	51	51	42	44	87	51	51
Scallop Dredge	open	limited	NE	all	26	25	25	25	146	7	126	29	65	49	16	74	59	44	25
Scallop Dredge	open	limited	MA	all	69	36	36	36	966	31	71	24	46	342	13	41	52	328	36
Scallop Dredge	open	general	NE	all	9	71	71	71	71	149	130	89	64	102	91	91	71	140	71
Scallop Dredge	open	general	MA	all	22	69	69	69	69	39	210	12	29	69	12	89	63	194	69
Scallop Dredge	closed	limited	NE	all	86	449	40	15	171	19	151	50	26	137	17	100	82	44	15
Scallop Dredge	closed	limited	MA	all	35	194	84	12	37	17	37	31	124	31	10	62	53	37	12
Scallop Dredge	closed	general	NE	all	0	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Scallop Dredge	closed	general	MA	all	1	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Mid-water paired & single Trawl	all	all	NE	all	66	266	285	21	21	683	132	274	262	464	394	121	266	21	21
Mid-water paired & single Trawl	all	all	MA	all	13	52	130	12	12	12	48	141	81	52	12	12	160	12	12
Fish Pots/ Traps	all	all	NE	all	0	19	19	19	19	19	19	19	19	19	19	19	19	19	19
Fish Pots/ Traps	all	all	MA	all	6	37	37	37	37	37	37	97	37	37	37	37	37	37	37
Purse Seine	all	all	NE	all	16	10	108	10	10	10	102	10	107	10	10	107	10	10	10
Purse Seine	all	all	MA	all	0	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Hand Line	all	all	NE	all	6	68	68	68	68	68	68	68	129	68	68	68	68	68	68
Hand Line	all	all	MA	all	0	126	126	126	126	126	126	126	126	126	126	126	126	126	126
Scottish Seine	all	all	NE	all	5	12	12	12	12	12	12	12	14	12	12	12	30	12	12
Clam Quahog Dredge	all	all	NE	all	0	69	69	69	69	69	69	69	69	69	69	69	69	69	69
Clam Quahog Dredge	all	all	MA	all	0	69	69	69	69	69	69	69	69	69	69	69	69	69	69
Crab Pots	all	all	NE	all	0	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Crab Pots	all	all	MA	all	0	27	27	27	27	27	27	27	27	27	27	27	27	27	27
Lobster Pots	all	all	NE	all	0	353	353	353	353	353	353	353	353	353	353	353	353	353	353
Lobster Pots	all	all	MA	all	0	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Total Trips					2,272	17,678	10,260	2,306	10,588	8,647	8,594	3,015	2,641	5,584	3,447	3,658	6,227	10,788	4,971
Total Trips excluding shaded cells						15,925	9,034	0	1,539	2,468	7,333	2,219	2,464	4,637	2,243	2,511	4,981	139	3,180

Note: Gray-shade cells indicate unlikely species/gear combinations.

Table 12 *continued*. Number of **trips** needed to achieve a 30% CV based on the **composite annual total discard,** and the 2004 observed trips for protected species (PSPP), by fleet and species group; *see Appendix Table VII 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
Longline	all	all	NE	all	119	26	26	26	26	208	44
Longline	all	all	MA	all	2	12	12	12	12	12	12
Otter Trawl	all	all	NE	small	200	70	70	1016	747	617	60
Otter Trawl	all	all	NE	large	539	304	304	4435	890	1364	67
Otter Trawl	all	all	MA	small	205	654	104	104	620	1001	133
Otter Trawl	all	all	MA	large	76	177	177	177	177	377	29
Scallop Trawl	open	limited	MA	all	3	12	12	12	12	12	12
Scallop Trawl	open	general	MA	all	39	25	25	25	25	25	18
Shrimp Trawl	all	all	NE	all	12	42	42	42	42	42	38
Shrimp Trawl	all	all	MA	all	2	13	13	13	13	13	9
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	12	12	12	12	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	772	104	392	104	1032	964	61
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	569	94	308	94	528	1742	38
Sink, Anchor, Drift Gillnet	all	all	MA	small	358	1195	58	58	58	835	58
Sink, Anchor, Drift Gillnet	all	all	MA	large	81	604	27	27	27	288	91
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	142	351	604	51	955	605	39
Scallop Dredge	open	limited	NE	all	36	115	25	25	25	292	11
Scallop Dredge	open	limited	MA	all	78	439	36	36	36	36	10
Scallop Dredge	open	general	NE	all	20	71	71	71	71	71	69
Scallop Dredge	open	general	MA	all	39	69	69	69	69	69	10
Scallop Dredge	closed	limited	NE	all	86	48	15	15	15	47	15
Scallop Dredge	closed	limited	MA	all	35	12	12	12	12	12	7
Scallop Dredge	closed	general	NE	all	0	12	12	12	12	12	12
Scallop Dredge	closed	general	MA	all	1	15	15	15	15	15	15
Mid-water paired & single Trawl	all	all	NE	all	99	21	21	612	558	308	73
Mid-water paired & single Trawl	all	all	MA	all	14	12	12	12	12	12	32
Fish Pots/ Traps	all	all	NE	all	0	19	19	19	19	19	19
Fish Pots/ Traps	all	all	MA	all	8	37	37	37	37	37	34
Purse Seine	all	all	NE	all	26	10	10	10	10	10	71
Purse Seine	all	all	MA	all	2	9	9	9	9	9	9
Hand Line	all	all	NE	all	9	68	68	68	68	68	129
Hand Line	all	all	MA	all	3	126	126	126	126	126	126
Scottish Seine	all	all	NE	all	8	12	12	12	12	12	20
Clam Quahog Dredge	all	all	NE	all	0	69	69	69	69	69	69
Clam Quahog Dredge	all	all	MA	all	0	69	69	69	69	69	69
Crab Pots	all	all	NE	all	0	12	12	12	12	12	12
Crab Pots	all	all	MA	all	0	27	27	27	27	27	27
Lobster Pots	all	all	NE	all	3	353	353	353	353	353	353
Lobster Pots	all	all	MA	all	0	75	75	75	75	75	75
Total Trips					3,587	5,397	3,360	7,975	6,887	9,877	1,992
Total Trips excluding shaded cells						5,397	3,023	7,720	6,887	9,877	1,992

Note: Gray-shade cells indicate unlikely species/gear combinations.

Table 13a. The maximum number of **sea days** (baseline and filtered) needed to achieve a 30% CV based on the **composite annual total discard** for any of the species groups (20 species groups) and for any of the fish and turtle species groups (15 species groups), by fleet. Filtered values exclude unlikely (gray-shaded) cells within a fleet. The 2004 observed sea days for fish species and protected species (PSPP) are presented for comparison purposes.

							BASELINE		FILTER APPLIED	
Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	2004 OB FISH sea days	2004 OB PSPP sea days	Sea days needed for 20 species groups by fleet	Sea days needed for 15 species groups by fleet	Sea days needed for 20 species groups by fleet	Sea days needed for 15 species groups by fleet
Longline	all	all	NE	all	12	133	267	185	267	185
Longline	all	all	MA	all	0	11	76	76	76	76
Otter Trawl	all	all	NE	small	449	577	3822	3822	3082	2024
Otter Trawl	all	all	NE	large	1076	1947	26644	26644	26644	26644
Otter Trawl	all	all	MA	small	471	499	5417	5417	3057	3057
Otter Trawl	all	all	MA	large	183	186	3625	3625	3625	3625
Scallop Trawl	open	limited	MA	all	11	22	95	95	95	95
Scallop Trawl	open	general	MA	all	56	71	443	443	443	443
Shrimp Trawl	all	all	NE	all	12	12	364	364	364	364
Shrimp Trawl	all	all	MA	all	2	2	76	76	76	76
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	1	12	12	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	657	876	4357	4357	3767	3767
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	533	701	3266	3266	2661	2059
Sink, Anchor, Drift Gillnet	all	all	MA	small	3	375	1259	1259	1259	1259
Sink, Anchor, Drift Gillnet	all	all	MA	large	4	85	653	653	653	653
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	30	152	1272	468	1272	468
Scallop Dredge	open	limited	NE	all	344	457	3194	1596	3194	1596
Scallop Dredge	open	limited	MA	all	591	675	8713	8713	3956	3956
Scallop Dredge	open	general	NE	all	11	24	204	204	204	204
Scallop Dredge	open	general	MA	all	33	55	293	293	124	124
Scallop Dredge	closed	limited	NE	all	805	805	3861	3861	1473	1473
Scallop Dredge	closed	limited	MA	all	373	373	1777	1777	1136	1136
Scallop Dredge	closed	general	NE	all	0	0	24	24	24	24
Scallop Dredge	closed	general	MA	all	2	2	21	21	21	21
Mid-water paired & single Trawl	all	all	NE	all	165	242	1793	1793	1606	1218
Mid-water paired & single Trawl	all	all	MA	all	39	42	557	557	492	492
Fish Pots/ Traps	all	all	NE	all	0	0	20	20	20	20
Fish Pots/ Traps	all	all	MA	all	6	9	103	103	40	40
Purse Seine	all	all	NE	all	33	53	219	219	219	219
Purse Seine	all	all	MA	all	0	2	9	9	9	9
Hand Line	all	all	NE	all	6	18	137	137	137	137
Hand Line	all	all	MA	all	0	11	133	133	133	133
Scottish Seine	all	all	NE	all	5	8	30	30	30	30
Clam Quahog Dredge	all	all	NE	all	0	0	50	50	50	50
Clam Quahog 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	3	439	439	439	439
Lobster Pots	all	all	MA	all	0	0	89	89	89	89
Total Sea Days					5,913	8,429	73,524	71,041	60,959	56,427

Table 13b. The maximum number of **trips** (baseline and filtered) needed to achieve a 30% CV based on the **total composite 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 unlikely (gray-shaded) cells within a fleet. The 2004 observed sea days for fish species and protected species (PSPP) are presented for comparison purposes.

							BASELINE		FILTER APPLIED	
Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	2004 OB FISH TRIPS	2004 OB PSPP TRIPS	Trips needed for 20 species groups by fleet	Trips needed for 15 species groups by fleet	Trips needed for 20 species groups by fleet	Trips needed for 15 species groups by fleet
Longline	all	all	NE	all	12	119	208	144	208	144
Longline	all	all	MA	all	0	2	12	12	12	12
Otter Trawl	all	all	NE	small	142	200	1260	1260	1016	668
Otter Trawl	all	all	NE	large	386	539	11227	11227	11227	11227
Otter Trawl	all	all	MA	small	194	205	2885	2885	1628	1628
Otter Trawl	all	all	MA	large	75	76	1879	1879	1879	1879
Scallop Trawl	open	limited	MA	all	1	3	12	12	12	12
Scallop Trawl	open	general	MA	all	31	39	216	216	216	216
Shrimp Trawl	all	all	NE	all	12	12	361	361	361	361
Shrimp Trawl	all	all	MA	all	2	2	13	13	13	13
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	1	12	12	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	577	772	3216	3216	2780	2780
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	445	569	2139	2139	1742	1348
Sink, Anchor, Drift Gillnet	all	all	MA	small	3	358	1195	1195	1195	1195
Sink, Anchor, Drift Gillnet	all	all	MA	large	4	81	604	604	604	604
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	27	142	955	351	955	351
Scallop Dredge	open	limited	NE	all	26	36	292	146	292	146
Scallop Dredge	open	limited	MA	all	69	78	966	966	439	439
Scallop Dredge	open	general	NE	all	9	20	149	149	149	149
Scallop Dredge	open	general	MA	all	22	39	210	210	89	89
Scallop Dredge	closed	limited	NE	all	86	86	449	449	171	171
Scallop Dredge	closed	limited	MA	all	35	35	194	194	124	124
Scallop Dredge	closed	general	NE	all	0	0	12	12	12	12
Scallop Dredge	closed	general	MA	all	1	1	15	15	15	15
Mid-water paired & single Trawl	all	all	NE	all	66	99	683	683	612	464
Mid-water paired & single Trawl	all	all	MA	all	13	14	160	160	141	141
Fish Pots/ Traps	all	all	NE	all	0	0	19	19	19	19
Fish Pots/ Traps	all	all	MA	all	6	8	97	97	37	37
Purse Seine	all	all	NE	all	16	26	108	108	108	108
Purse Seine	all	all	MA	all	0	2	9	9	9	9
Hand Line	all	all	NE	all	6	9	129	129	129	129
Hand Line	all	all	MA	all	0	3	126	126	126	126
Scottish Seine	all	all	NE	all	5	8	30	30	30	30
Clam Quahog Dredge	all	all	NE	all	0	0	69	69	69	69
Clam Quahog Dredge	all	all	MA	all	0	0	69	69	69	69
Crab Pots	all	all	NE	all	0	0	12	12	12	12
Crab Pots	all	all	MA	all	0	0	27	27	27	27
Lobster Pots	all	all	NE	all	0	3	353	353	353	353
Lobster Pots	all	all	MA	all	0	0	75	75	75	75
Total Trips					2,272	3,587	30,450	29,636	26,971	25,266

Table 14. The number of annual **sea days** needed to achieve a 30% CV based on the composite annual total discards for 39 fleets and **20 species groups** and the maximum sea days in each fleet, over a range of values for the 'fraction of total mortality due to discards' and the 'fraction of discard' filters; the unlikely (gray-shaded) cell filter is included. The 20 species groups include the 14 fish species groups, a turtle species group, 3 marine mammal species groups, a sea birds species group and an all species group.

	Fraction of Total Mortality															
34,717	0	0.005	0.01	0.015	0.02	0.025	0.03	0.035	0.04	0.045	0.05	0.06	0.07	0.08	0.09	0.1
0	60,959	35,335	34,944	34,944	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.01	52,226	34,973	34,944	34,944	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.02	51,987	34,944	34,944	34,944	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.03	51,956	34,747	34,747	34,747	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.04	51,926	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.05	51,652	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.06	51,652	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.07	51,652	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.08	51,652	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.09	51,652	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.1	35,159	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.11	35,159	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.12	35,159	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.13	35,159	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.14	35,133	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.15	35,133	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.2	34,767	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.25	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.3	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.35	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.4	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.45	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.5	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.55	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.6	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717
0.7	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717	34,717

Table 15. The number of annual **sea days** needed to achieve a 30% CV based on the composite annual total discards for 39 fleets and **15 species groups** and the maximum sea days in each fleet, over a range of values for the 'fraction of total mortality due to discards' and the 'fraction of discard' filters; the unlikely (gray-shaded) cell filter is included. The 15 species groups include the 14 fish species groups and the turtle species group.

	Fraction of Total Mortality															
15,073	0	0.005	0.01	0.015	0.02	0.025	0.03	0.035	0.04	0.045	0.05	0.06	0.07	0.08	0.09	0.1
0	56,427	16,446	15,364	15,364	15,069	15,069	15,069	15,005	15,005	15,005	15,005	14,744	14,744	14,744	14,674	14,674
0.01	44,432	16,084	15,364	15,364	15,069	15,069	15,069	15,005	15,005	15,005	15,005	14,744	14,744	14,744	14,674	14,674
0.02	43,421	16,056	15,364	15,364	15,069	15,069	15,069	15,005	15,005	15,005	15,005	14,744	14,744	14,744	14,674	14,674
0.03	43,239	15,858	15,167	15,167	15,069	15,069	15,069	15,005	15,005	15,005	15,005	14,744	14,744	14,744	14,674	14,674
0.04	43,210	15,828	15,137	15,137	15,069	15,069	15,069	15,005	15,005	15,005	15,005	14,744	14,744	14,744	14,674	14,674
0.05	42,871	15,764	15,073	15,073	15,005	15,005	15,005	15,005	15,005	15,005	15,005	14,744	14,744	14,744	14,674	14,674
0.06	42,871	15,764	15,073	15,073	15,005	15,005	15,005	15,005	15,005	15,005	15,005	14,744	14,744	14,744	14,674	14,674
0.07	42,842	15,764	15,073	15,073	15,005	15,005	15,005	15,005	15,005	15,005	15,005	14,744	14,744	14,744	14,674	14,674
0.08	42,842	15,764	14,813	14,813	14,744	14,744	14,744	14,744	14,744	14,744	14,744	14,744	14,744	14,744	14,674	14,674
0.09	42,842	15,764	14,813	14,813	14,744	14,744	14,744	14,744	14,744	14,744	14,744	14,744	14,744	14,744	14,674	14,674
0.1	18,516	15,764	14,813	14,813	14,744	14,744	14,744	14,744	14,744	14,744	14,744	14,744	14,744	14,744	14,674	14,674
0.11	18,516	15,764	14,742	14,742	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674
0.12	18,516	15,764	14,742	14,742	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674
0.13	18,516	15,764	14,742	14,742	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674
0.14	18,490	15,764	14,742	14,742	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674
0.15	18,490	15,764	14,742	14,742	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674
0.2	17,472	15,764	14,742	14,742	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674
0.25	17,328	15,670	14,742	14,742	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674	14,674
0.3	17,189	15,294	14,602	14,602	14,534	14,534	14,534	14,534	14,534	14,534	14,534	14,534	14,534	14,534	14,534	14,534
0.35	17,189	15,294	14,602	14,602	14,534	14,534	14,534	14,534	14,534	14,534	14,534	14,534	14,534	14,534	14,534	14,534
0.4	14,152	13,725	13,033	13,033	12,965	12,965	12,964	12,964	12,779	12,779	12,721	12,721	12,721	12,721	12,721	12,721
0.45	14,152	13,725	13,033	13,033	12,965	12,965	12,964	12,964	12,779	12,779	12,721	12,721	12,721	12,721	12,721	12,721
0.5	14,152	13,725	13,033	13,033	12,965	12,965	12,964	12,964	12,779	12,779	12,721	12,721	12,721	12,721	12,721	12,721
0.55	14,152	13,725	13,033	13,033	12,965	12,965	12,964	12,964	12,779	12,779	12,721	12,721	12,721	12,721	12,721	12,721
0.6	13,725	13,725	13,033	13,033	12,965	12,965	12,964	12,964	12,779	12,779	12,721	12,721	12,721	12,721	12,721	12,721
0.7	13,725	13,725	13,033	13,033	12,965	12,965	12,964	12,964	12,779	12,779	12,721	12,721	12,721	12,721	12,721	12,721

Table 16. 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 VTR and Observer (OB) trips.

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 17. Summary of contingency table analyses of spatial distribution of 2004 VTR and observed trips. Expected value of observed trips is based of proportions of VTR 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 VTR database. *Yellow-shade indicates p-value > 0.05.*

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

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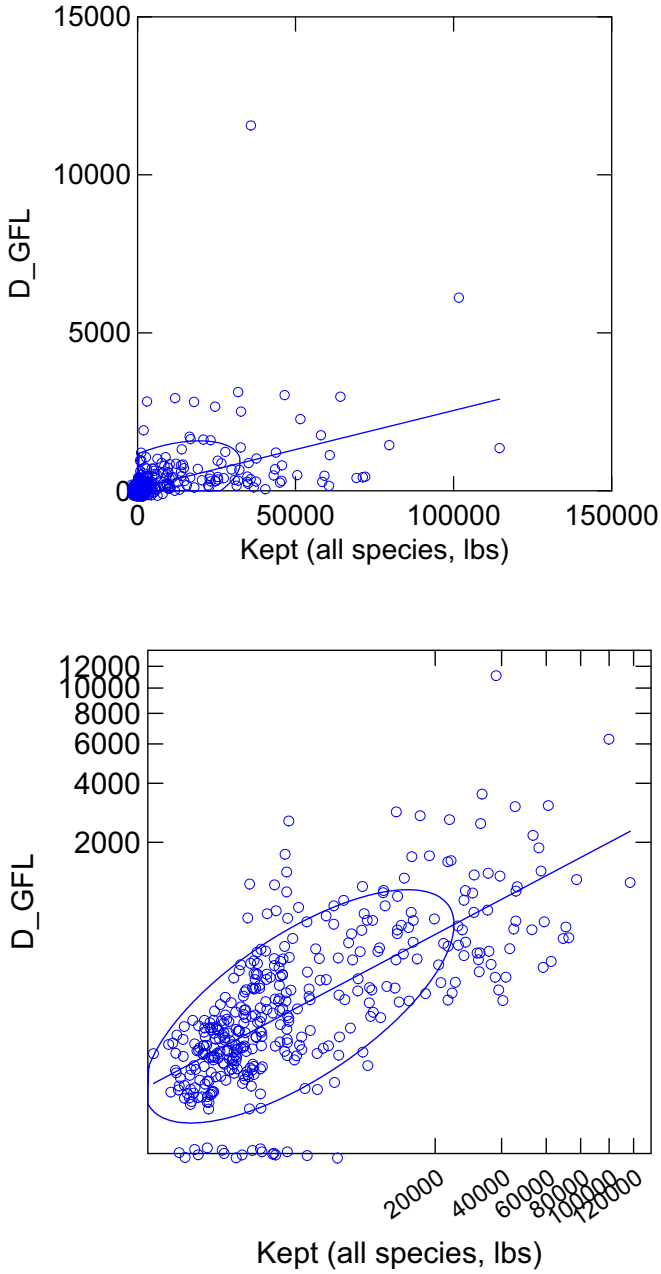


Figure 1a. Comparison of nominal scale (top) and fourth root transformation (bottom) of **NE multispecies (large-mesh) discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed large mesh (=>5.5 in) otter trawl trips in New England; each dot represents a trip.

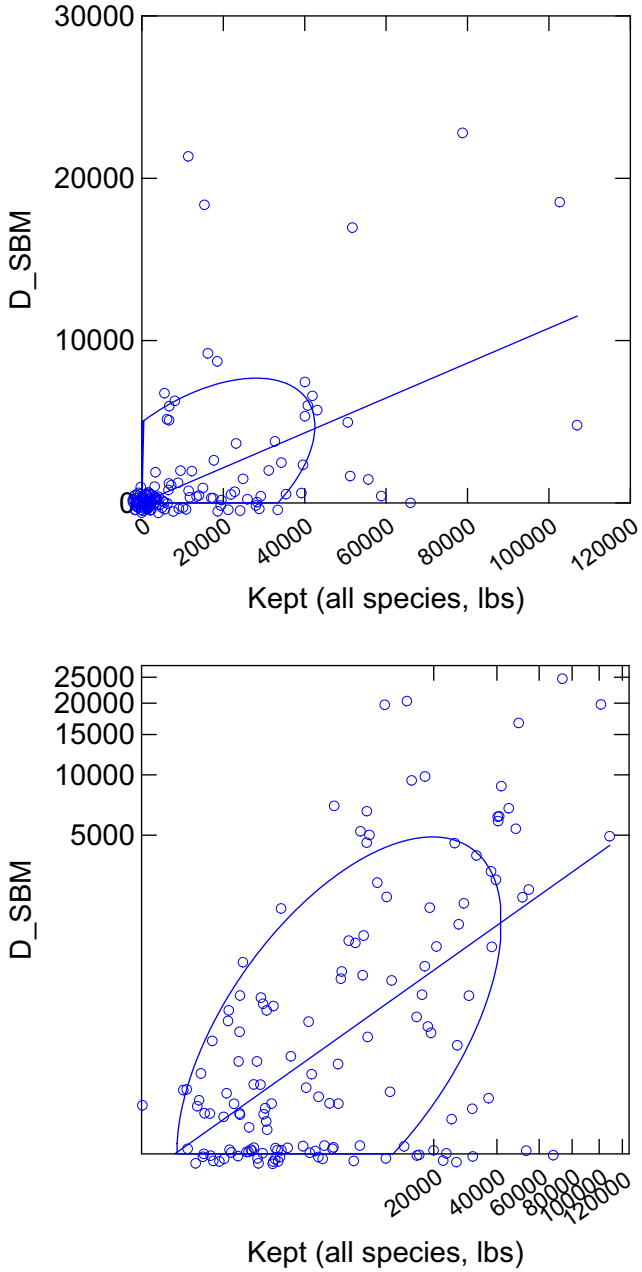


Figure 1b. Comparison of nominal scale (top) and fourth root transformation (bottom) of **squid-butterfish-mackerel discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed small mesh (<5.5 in) otter trawl trips in New England; each dot represents a trip.

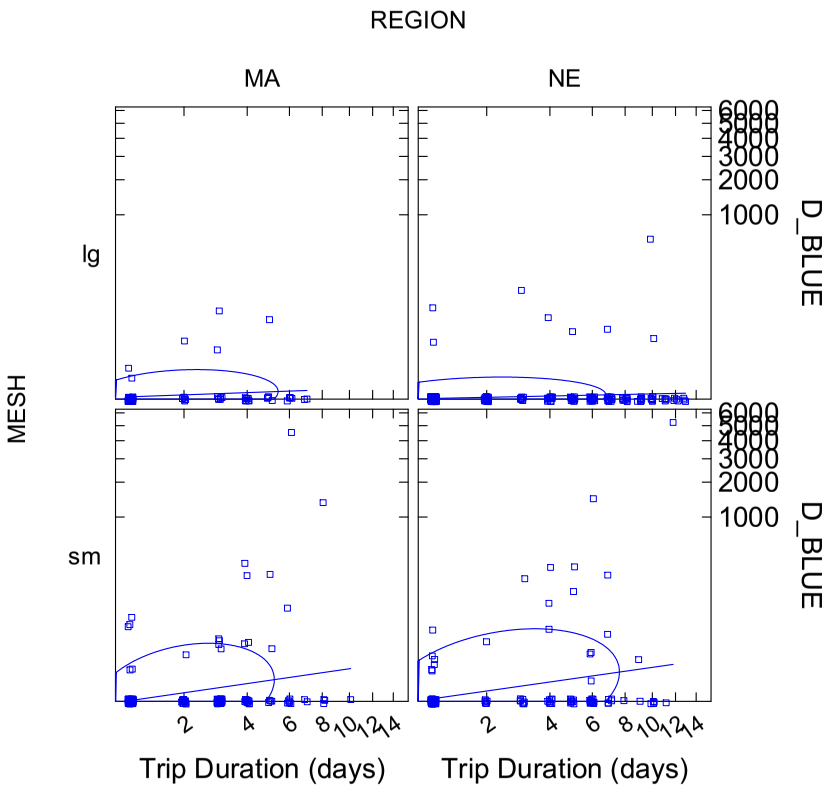


Figure 1c. Comparison of **bluefish discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

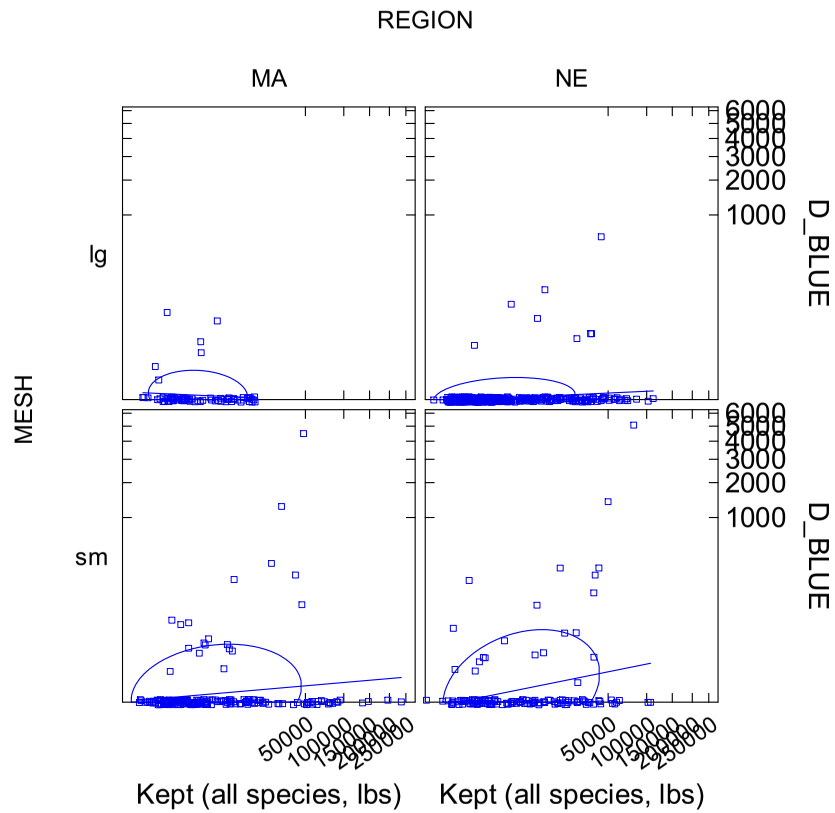


Figure 1d. Comparison of **bluefish discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5 .5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

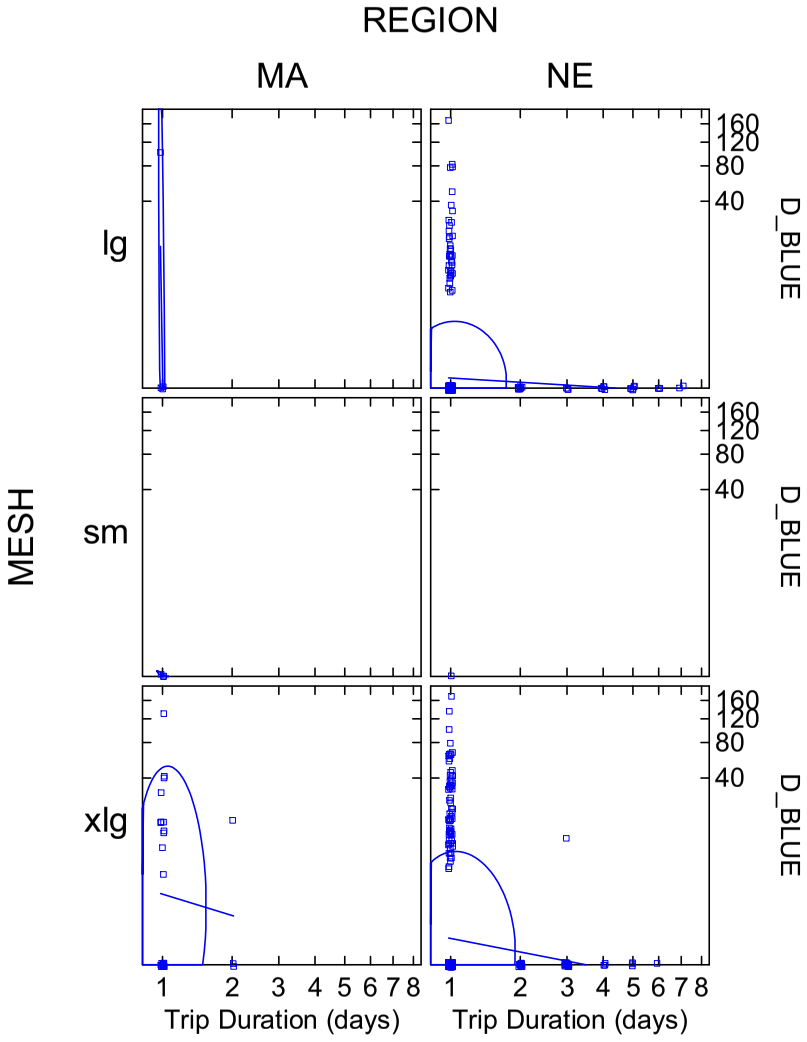


Figure 1e. Comparison of **bluefish discards** (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm < 5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

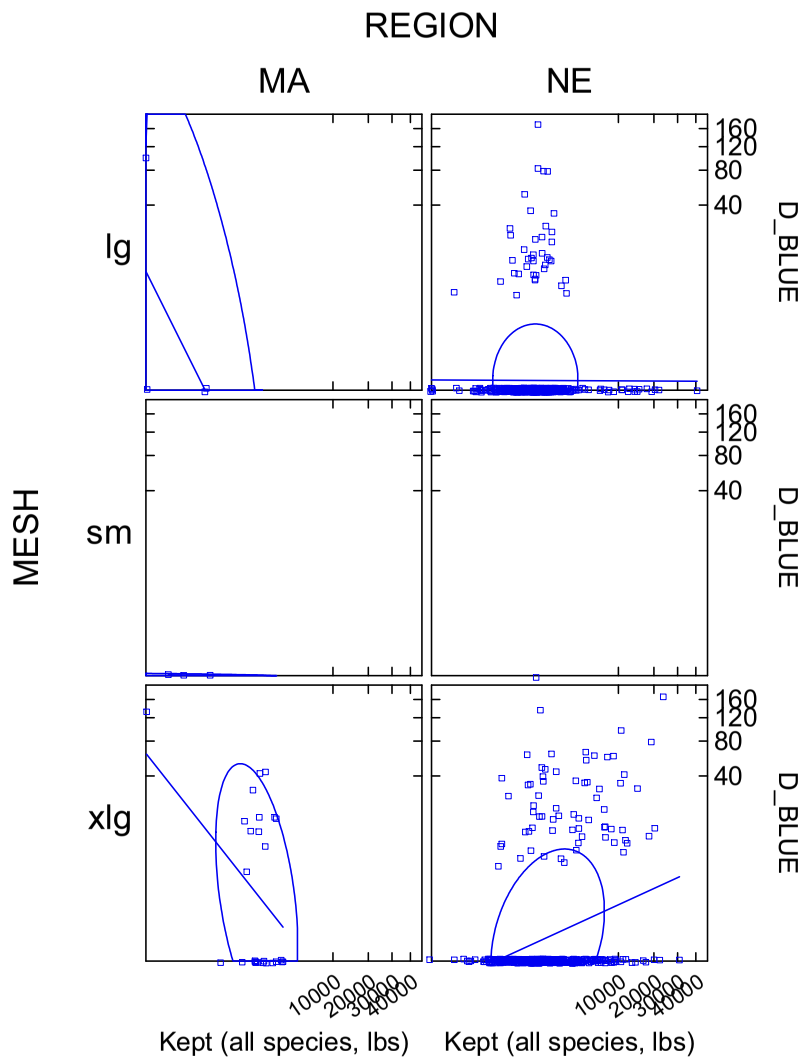


Figure 1f. Comparison of **bluefish discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

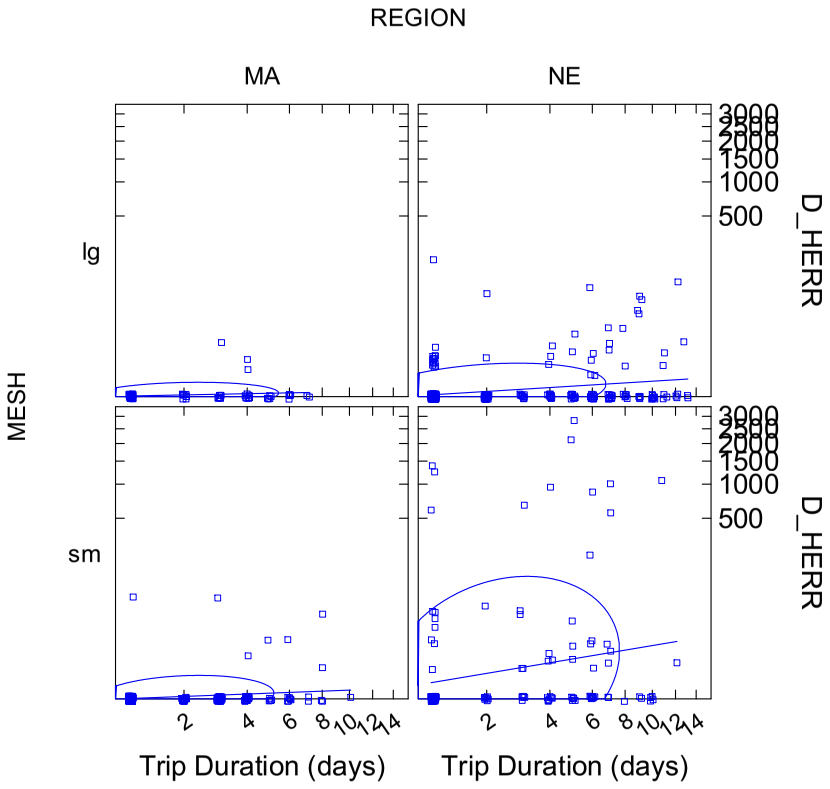


Figure 1g. Comparison of **herring discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

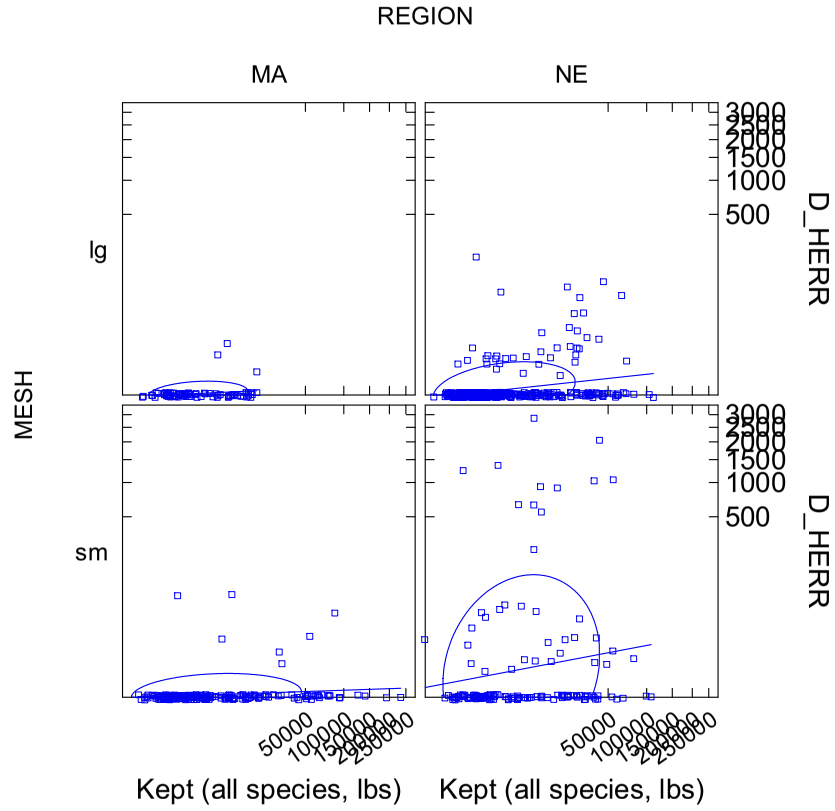


Figure 1h. Comparison of **herring discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

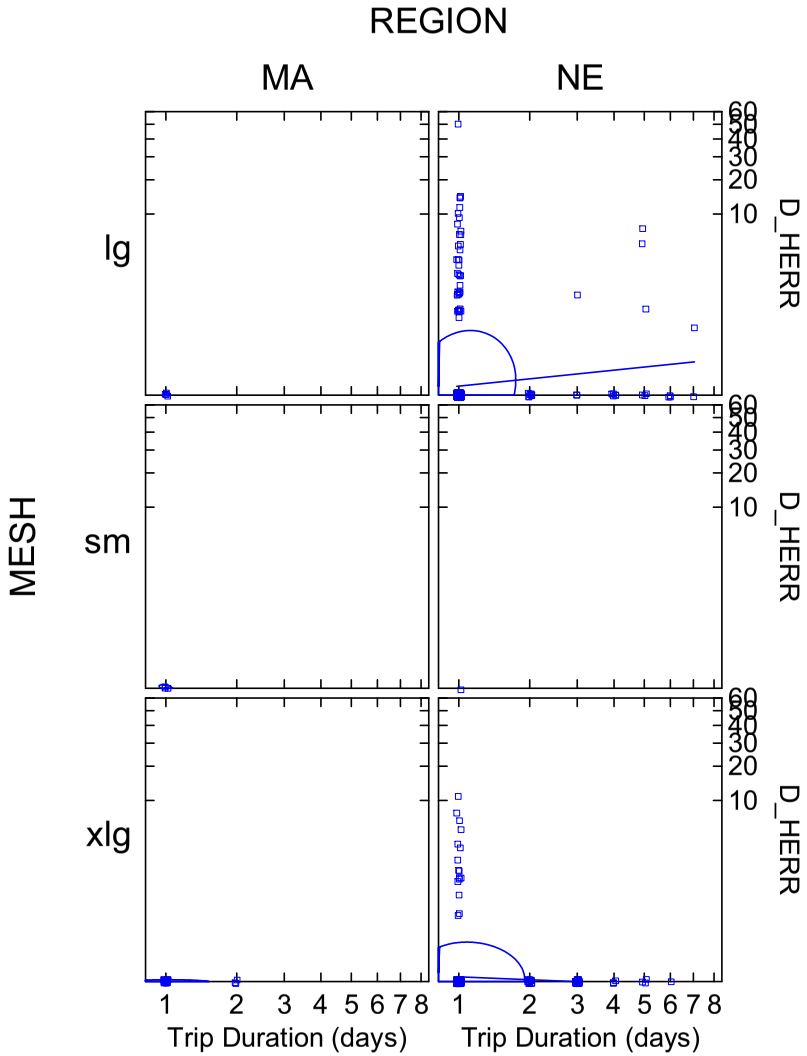


Figure 1i. Comparison of **herring discards** (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; and xlg > 8 in); fourth root transformation used, each dot represents a trip.

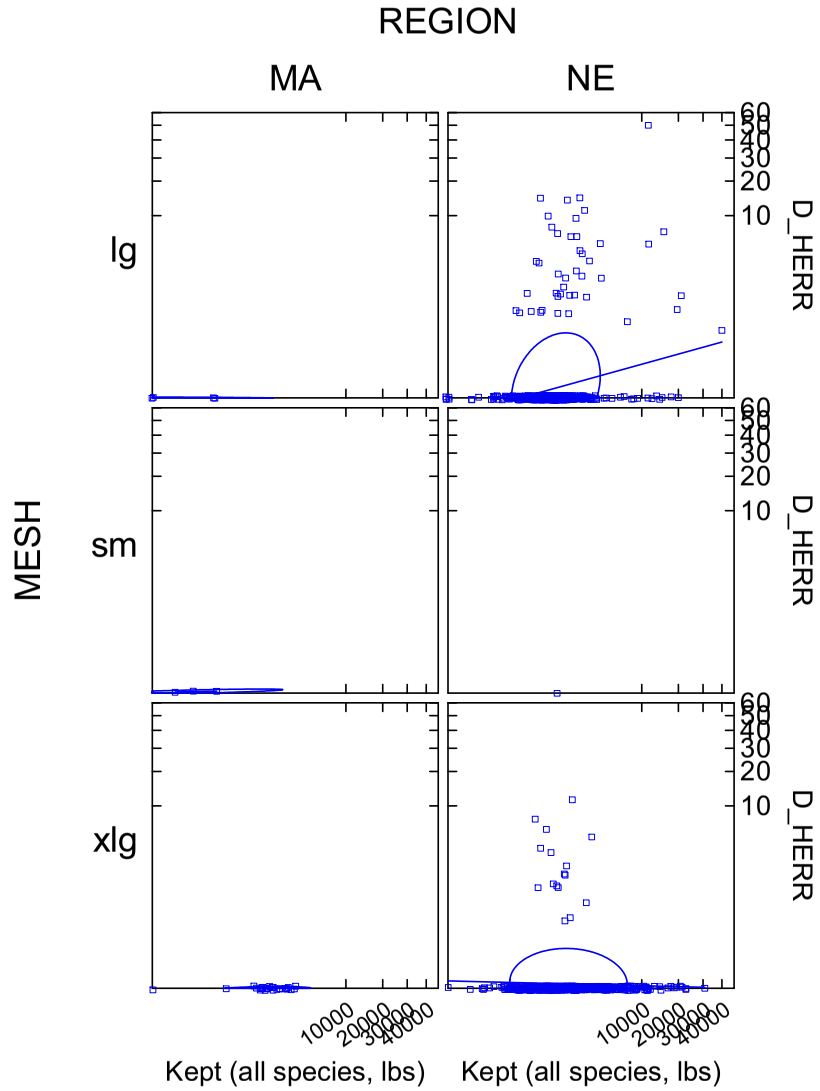


Figure 1j. Comparison of **herring discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; and xlg >8 in); fourth root transformation used, each dot represents a trip.

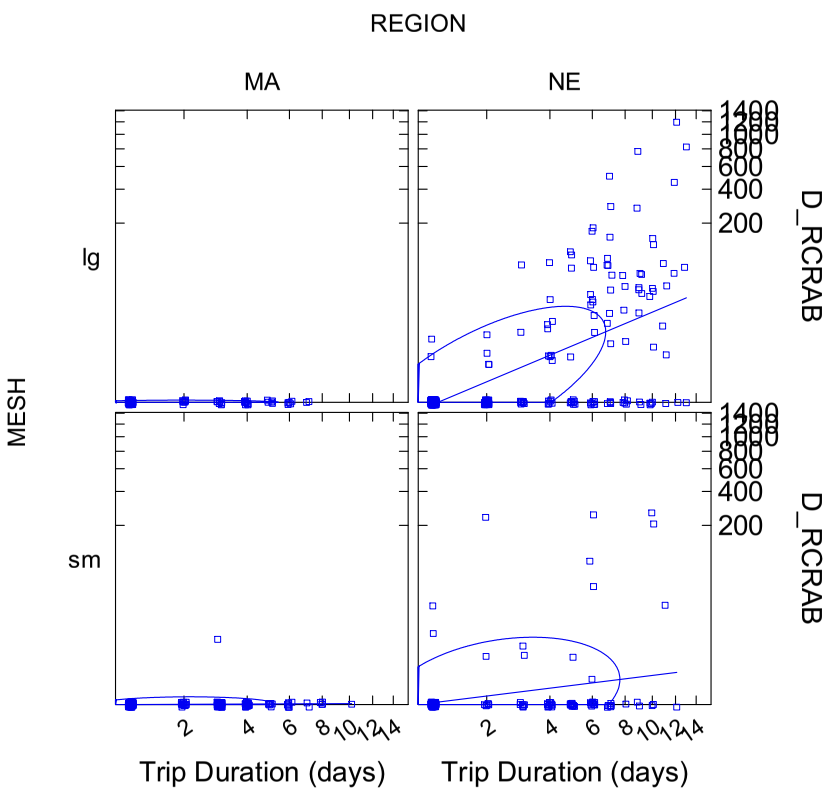


Figure 1k. Comparison of **red crab discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

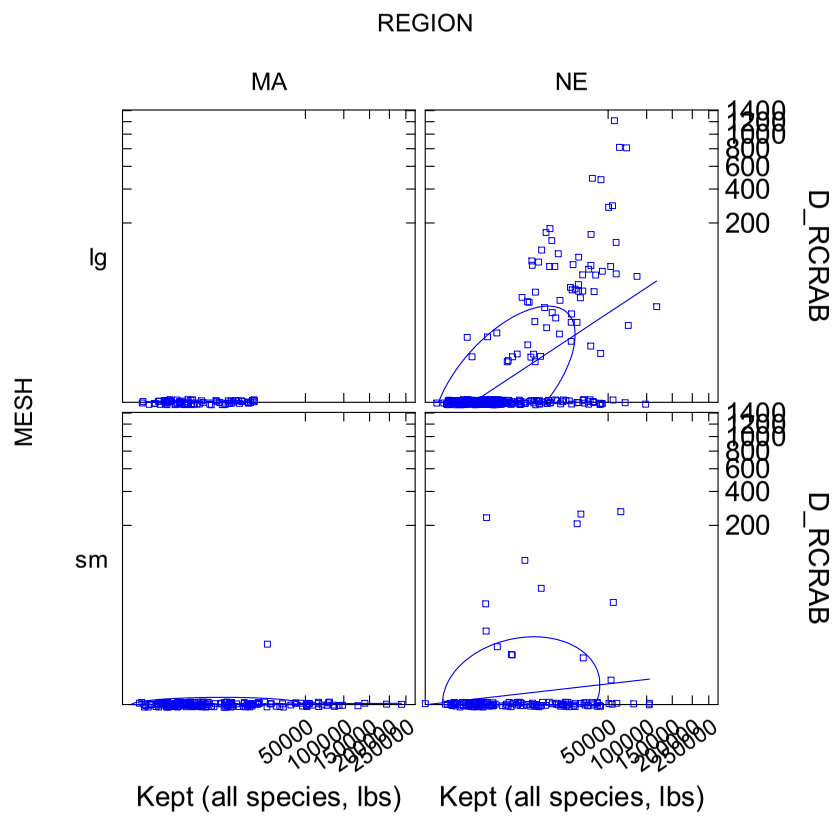


Figure 1l. Comparison of **red crab discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

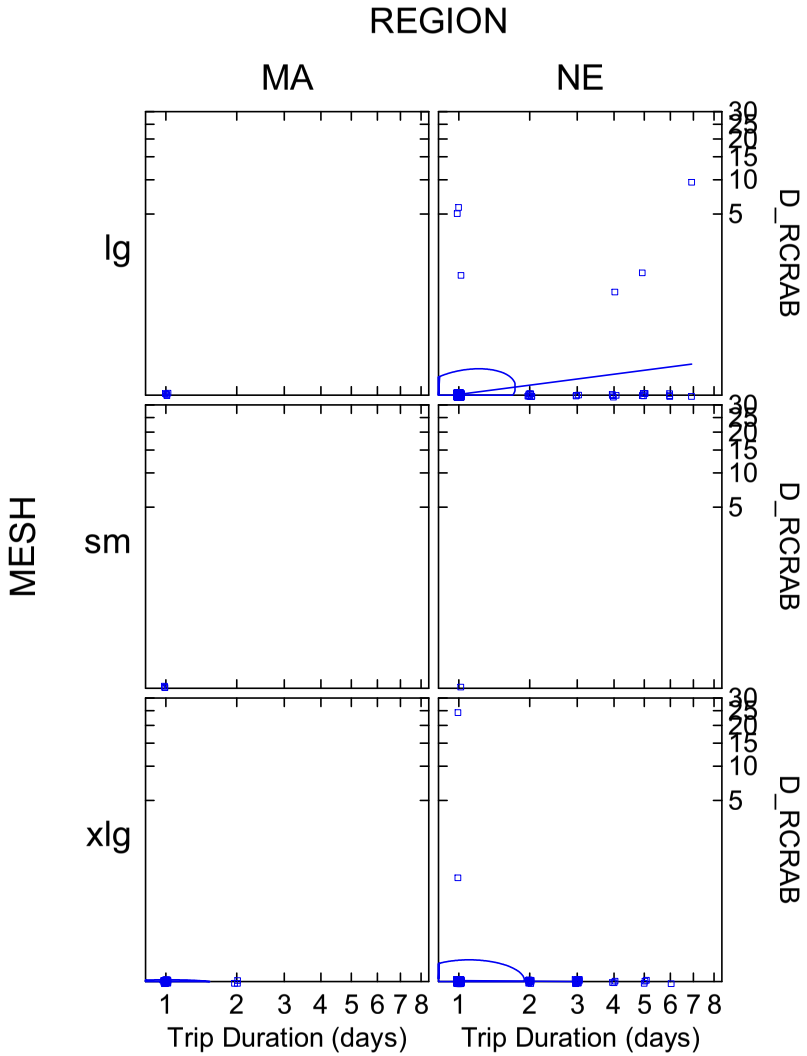


Figure 1m. Comparison of **red crab discards** (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

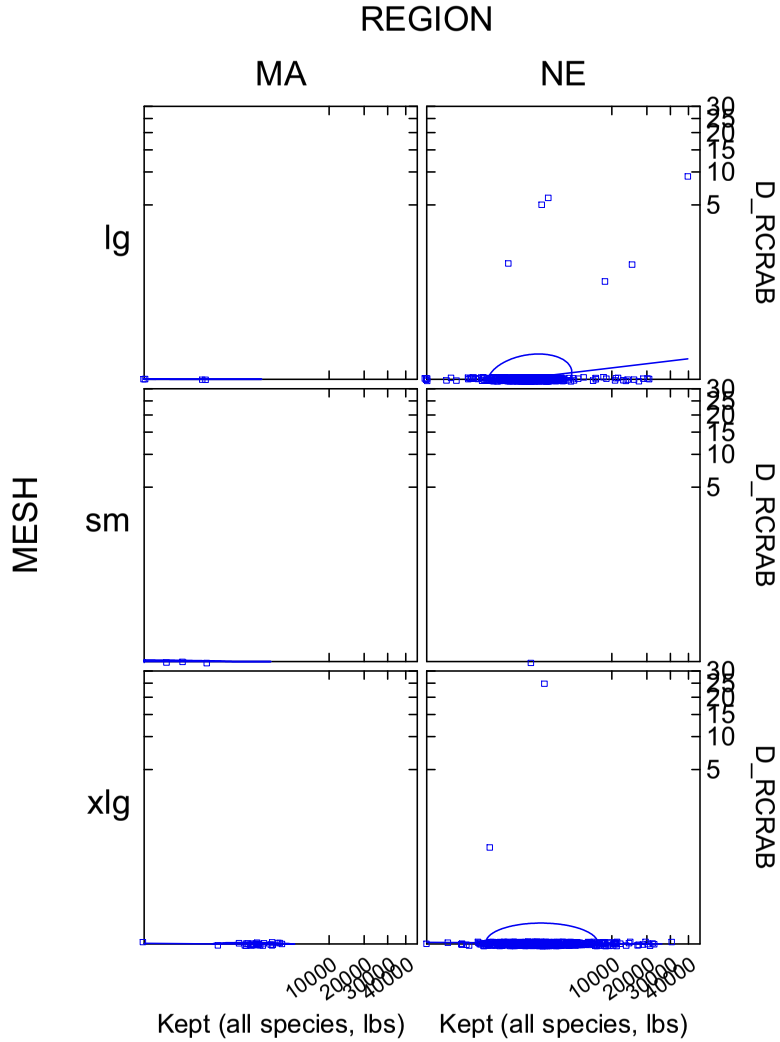


Figure 1n. Comparison of **red crab discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

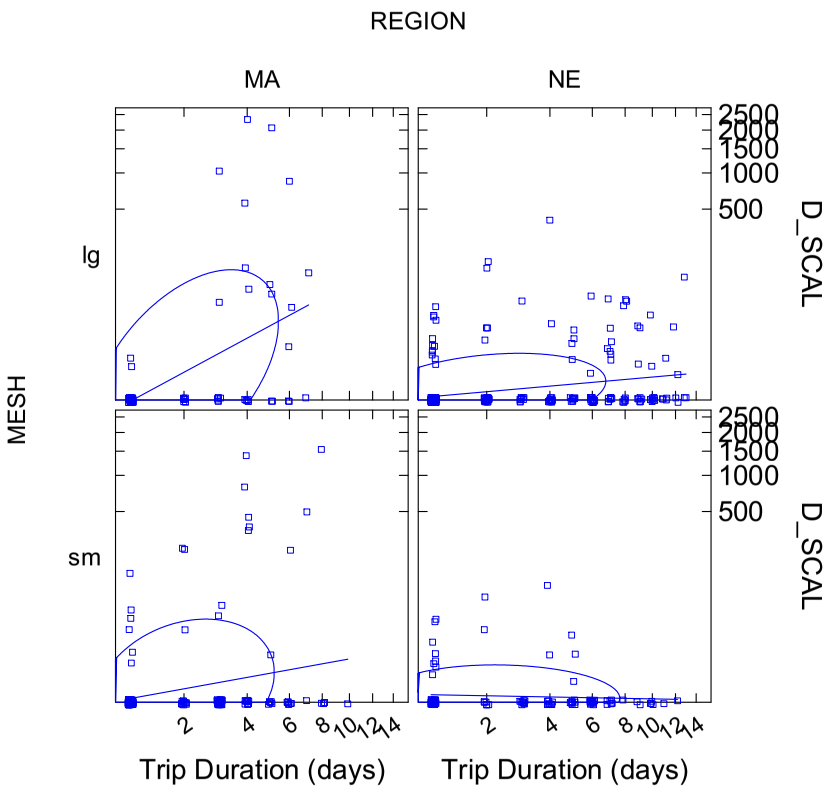


Figure 1o. Comparison of **scallop discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

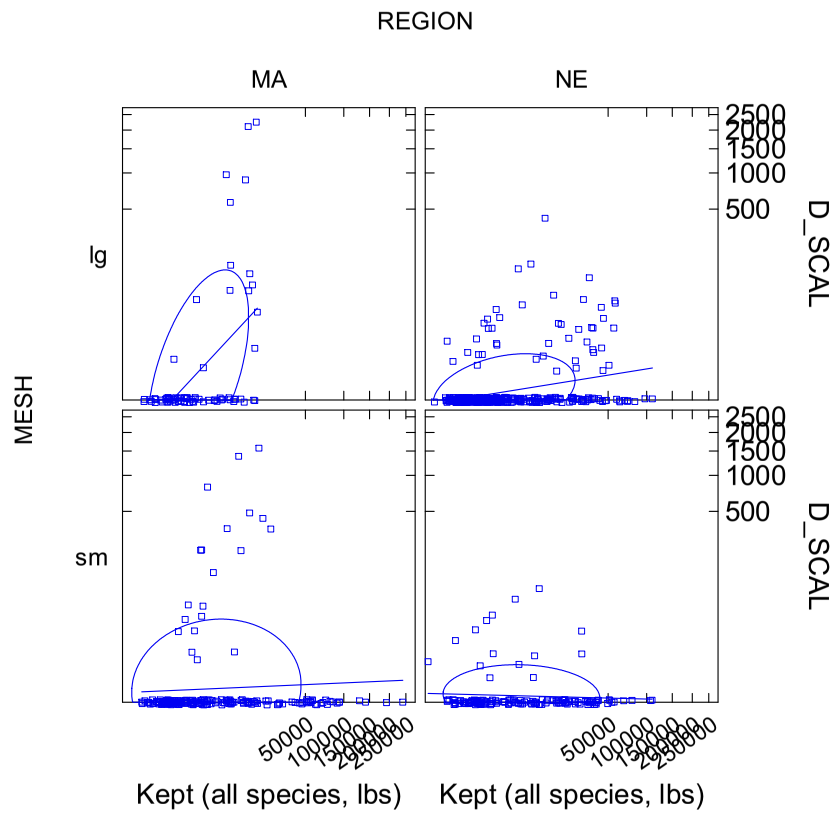


Figure 1p. Comparison of **scallop discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

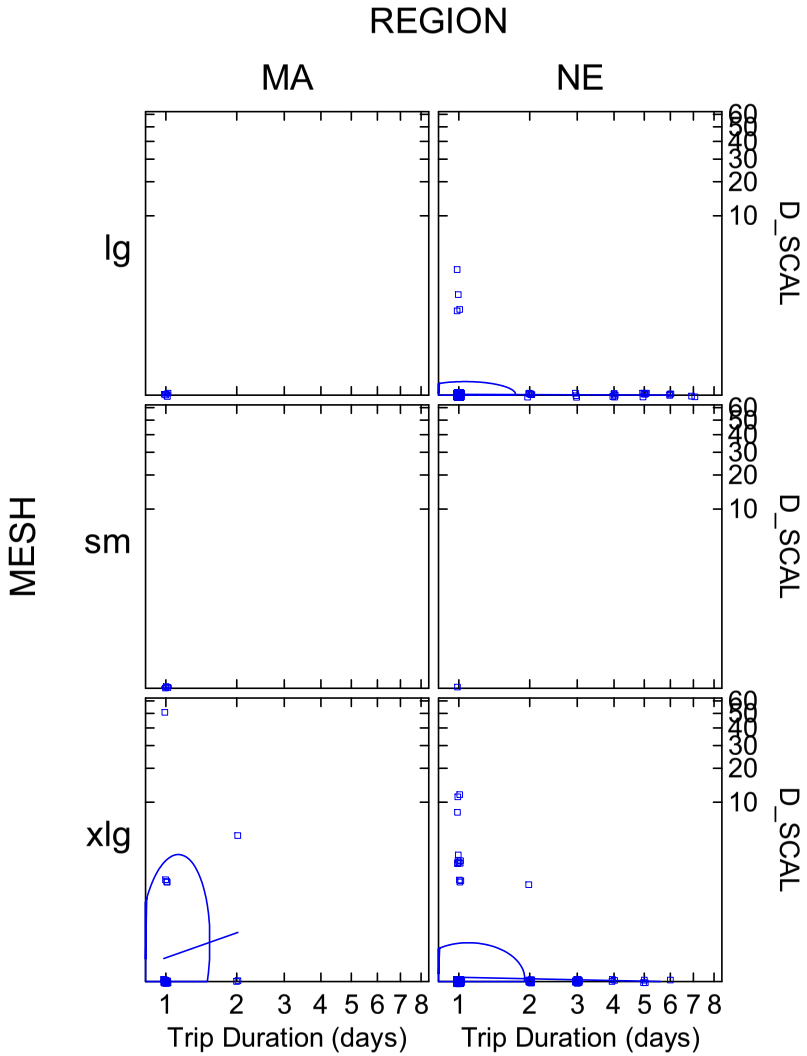


Figure 1q. Comparison of **scallop discards** (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg > 8 in); fourth root transformation used, each dot represents a trip.

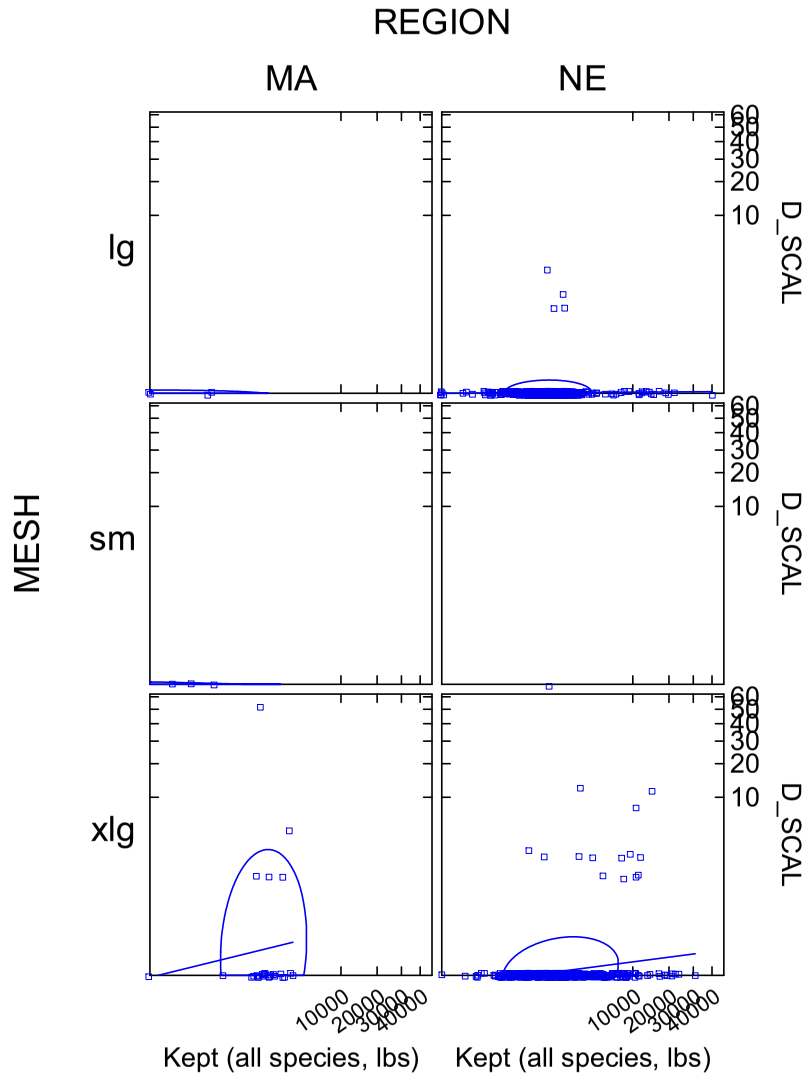


Figure 1r. Comparison of **scallop discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

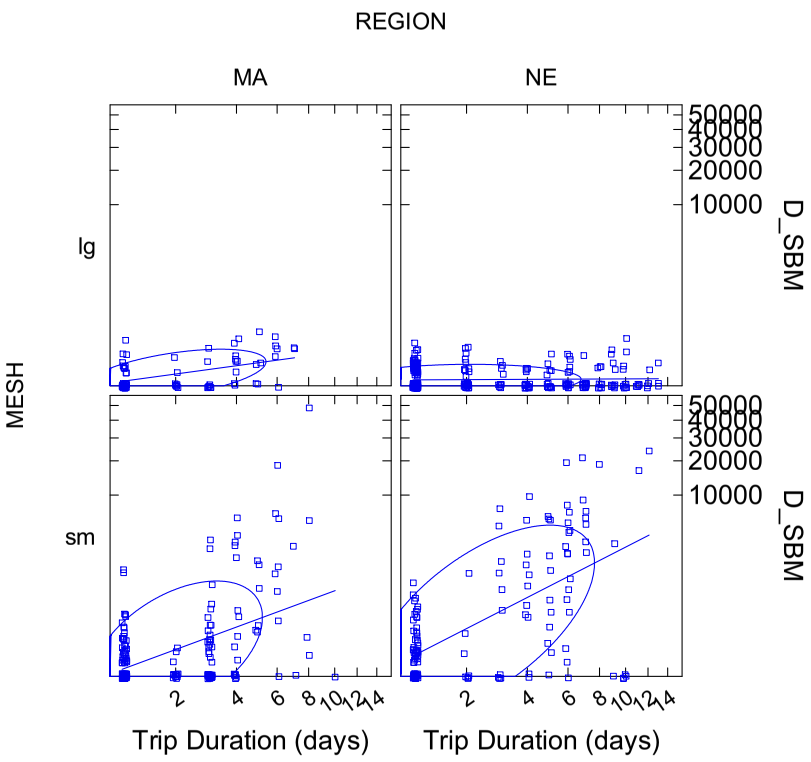


Figure 1s. Comparison of **squid-butterfish-mackerel discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 in, and lg =>5.5 in); fourth root transformation used, each dot represents a trip.

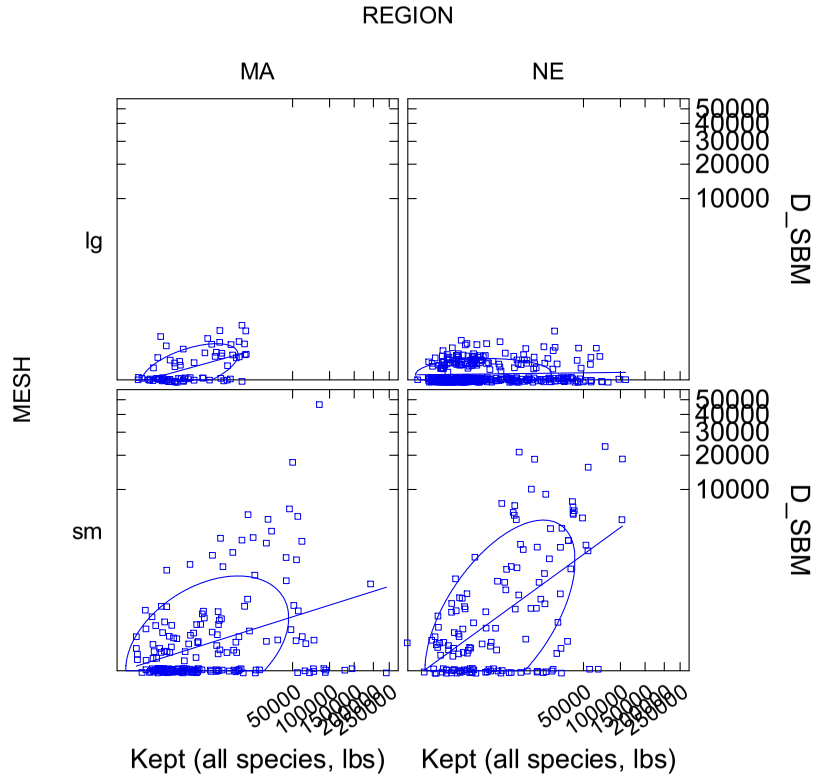


Figure 1t. Comparison of **squid-butterfish-mackerel discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

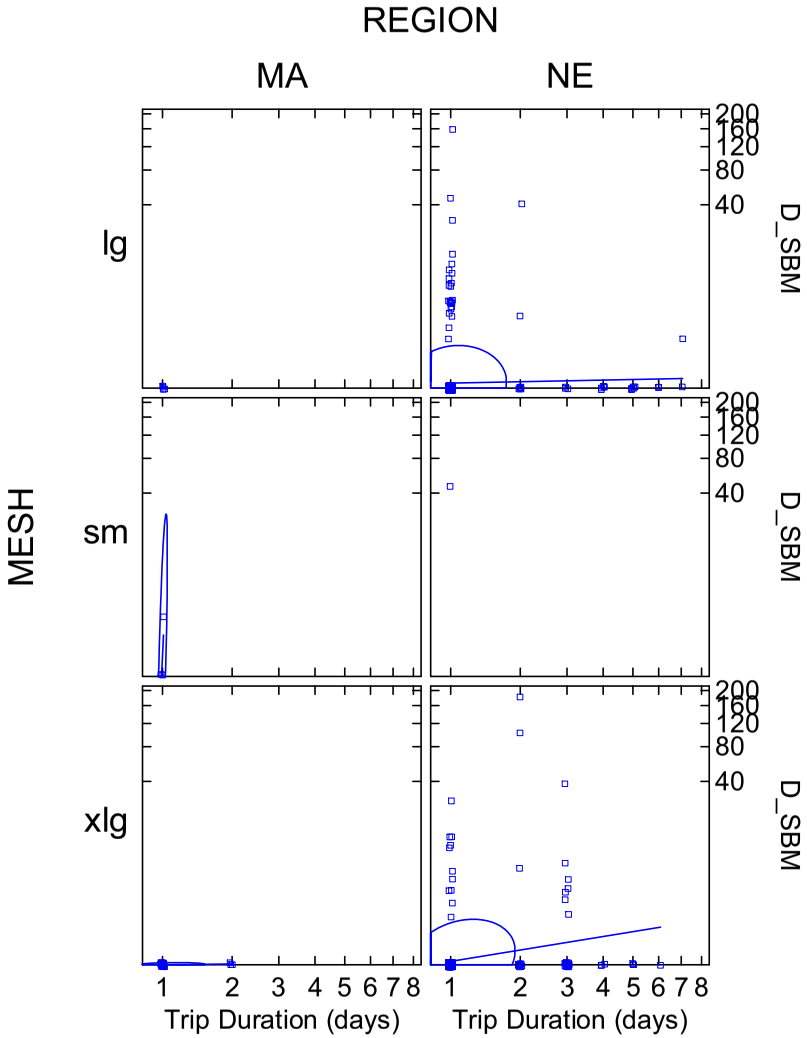


Figure 1u. Comparison of **squid-butterfish-mackerel discards** (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

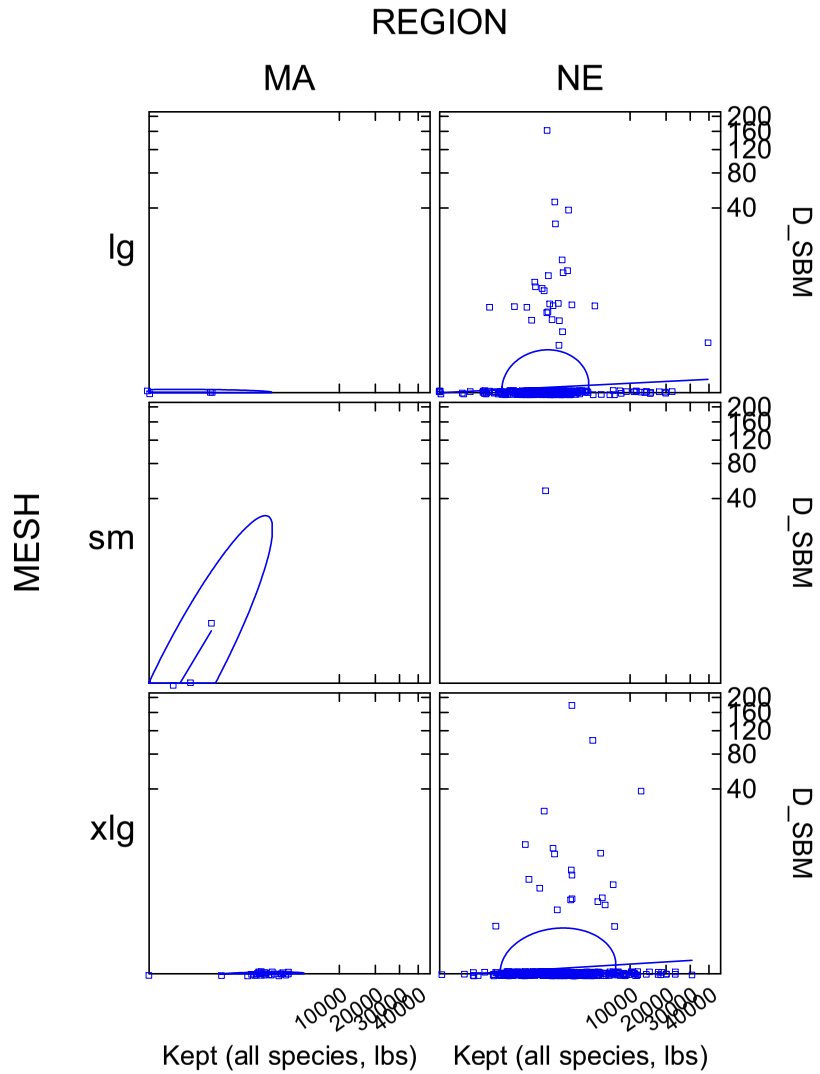


Figure 1v. Comparison of **squid-butterfish-mackerel discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

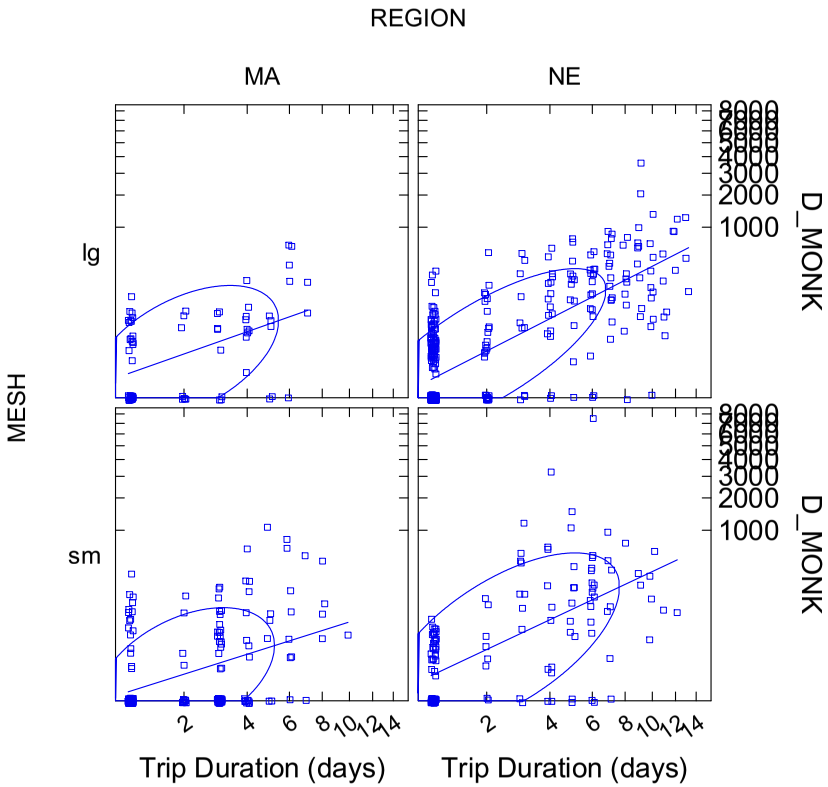


Figure 1w. Comparison of **monkfish discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

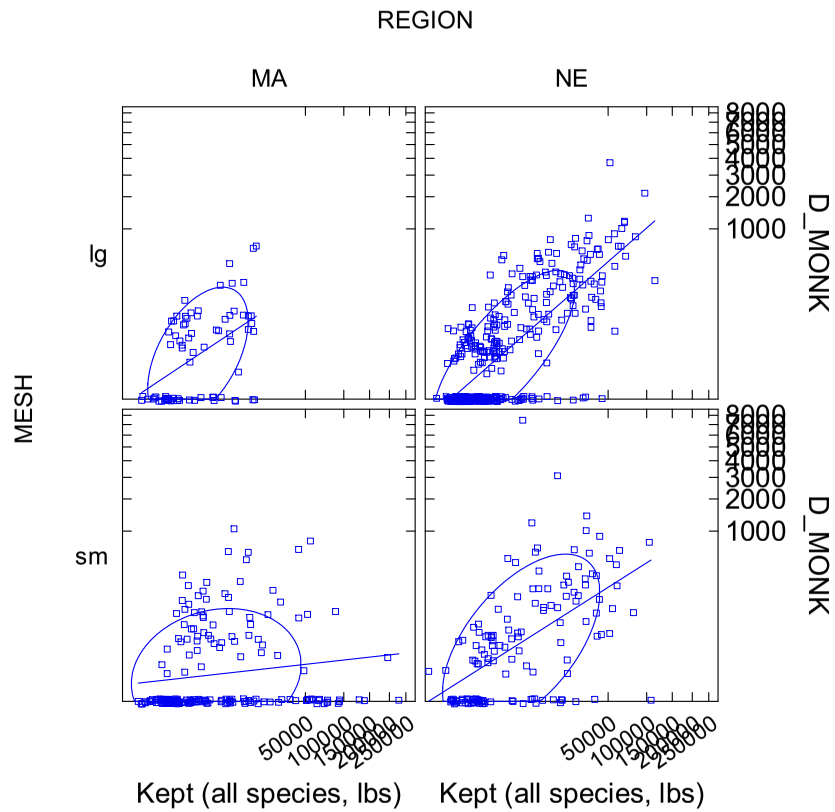


Figure 1x. Comparison of **monkfish discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

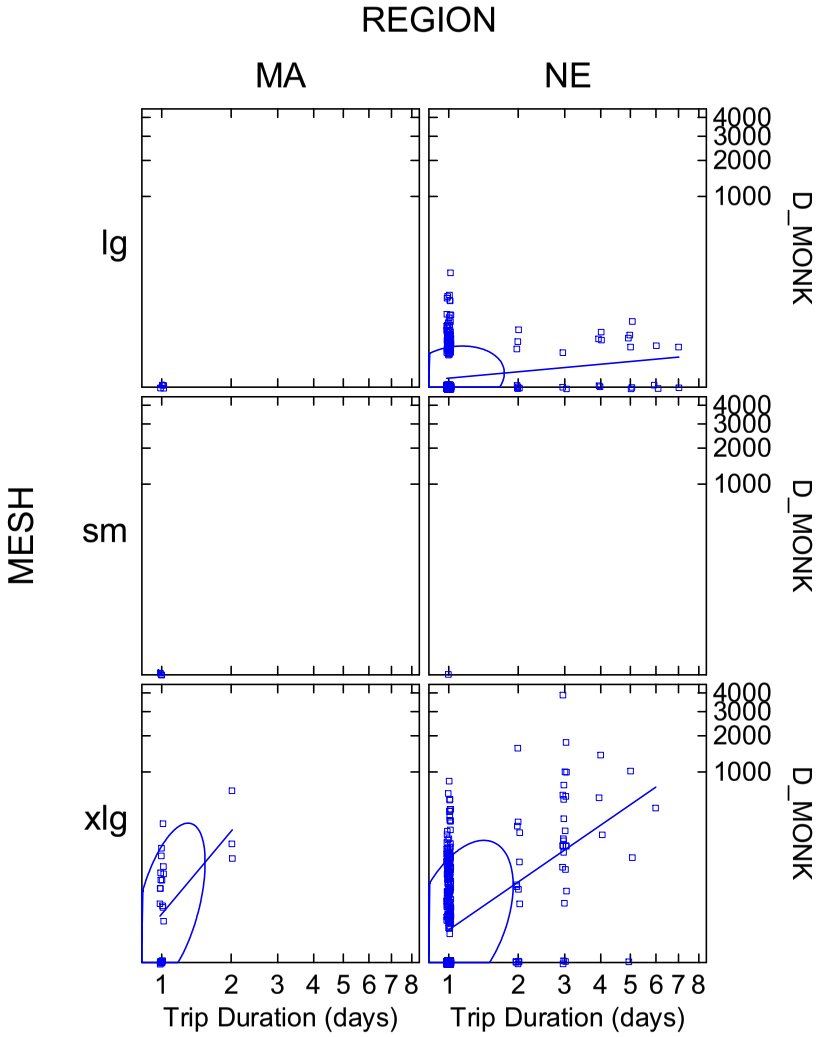


Figure 1y. Comparison of **monkfish** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

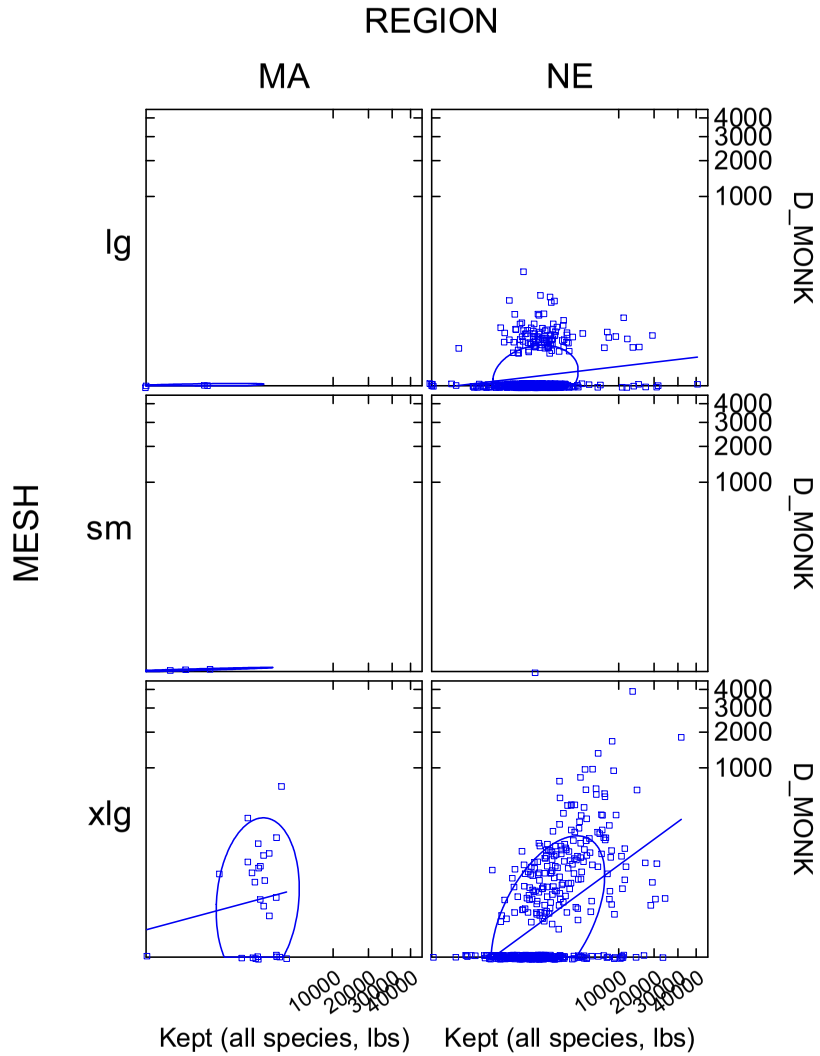


Figure 1z. Comparison of **monkfish** discards (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

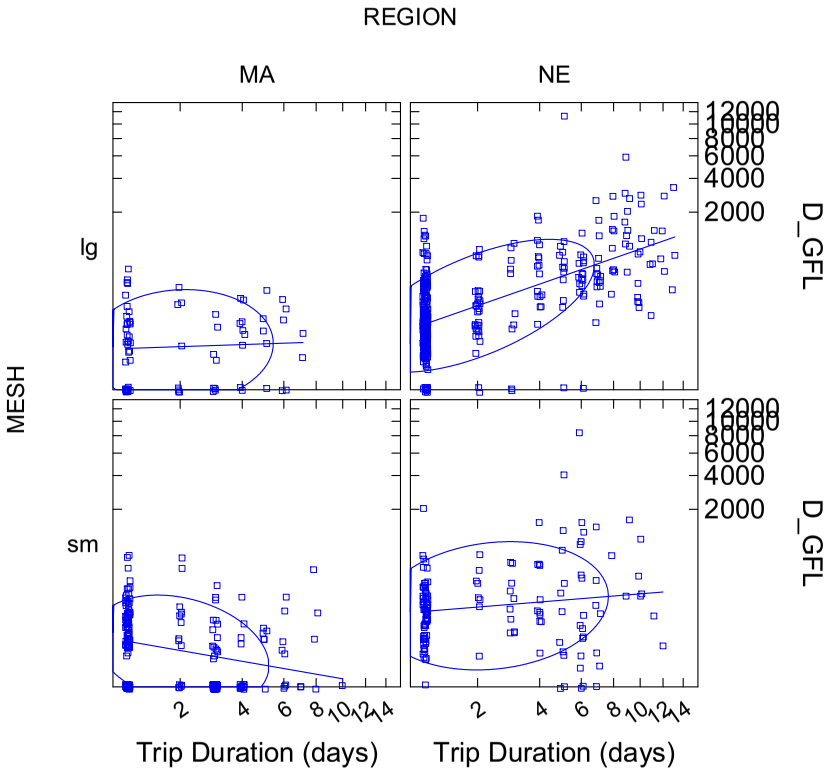


Figure 1aa. Comparison of **NE multispecies** (**large mesh) discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

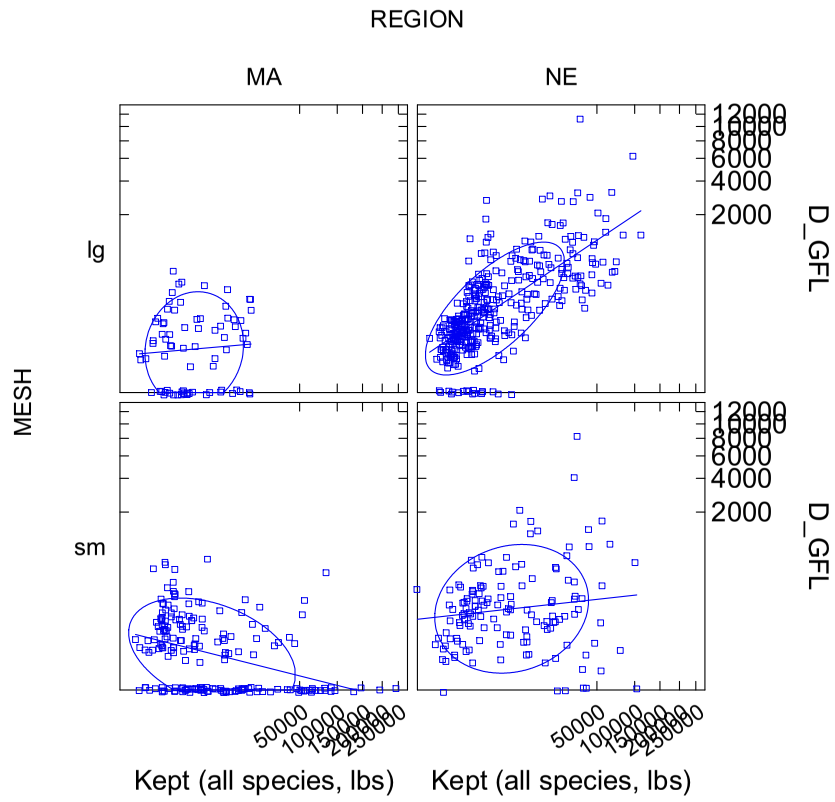


Figure 1bb. Comparison of **NE multispecies** (**large mesh) discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

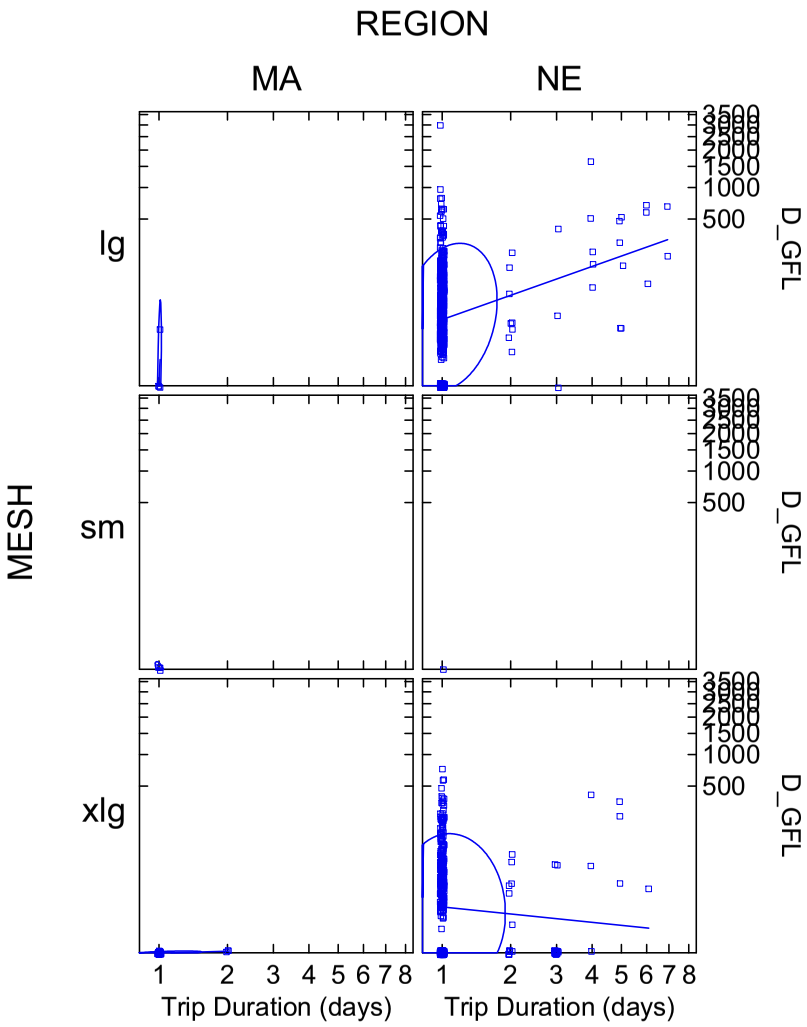


Figure 1cc. Comparison of **NE multispecies** (**large mesh) discards** (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

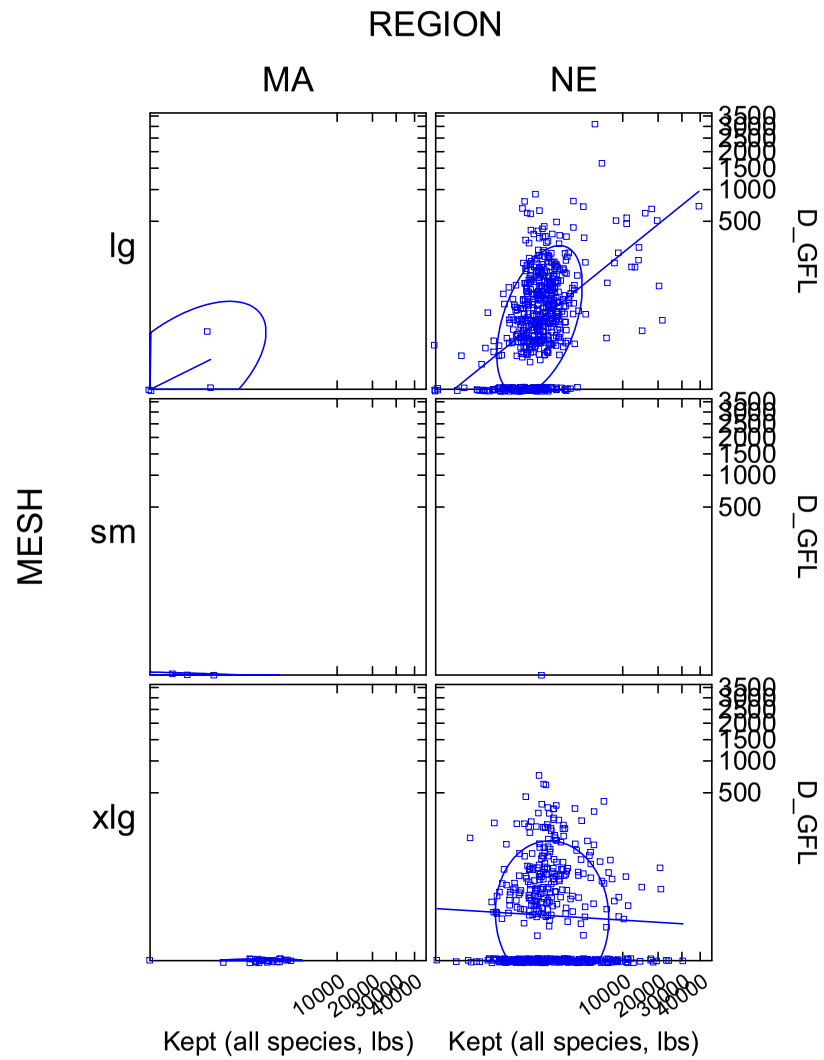


Figure 1dd. Comparison of **NE multispecies** (**large mesh) discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

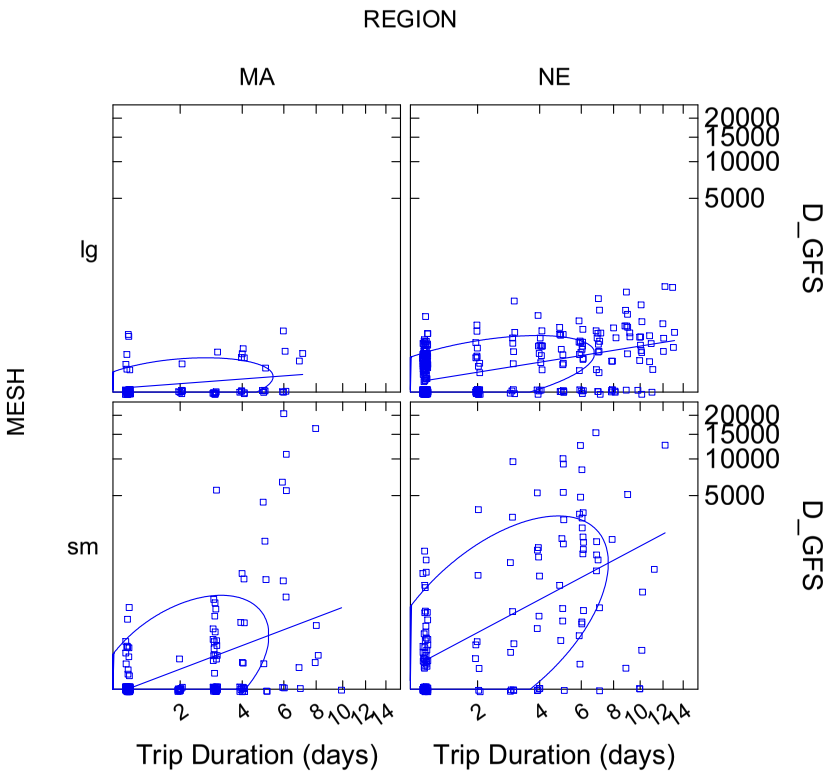


Figure 1ee. Comparison of **NE multispecies** (**small mesh) discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

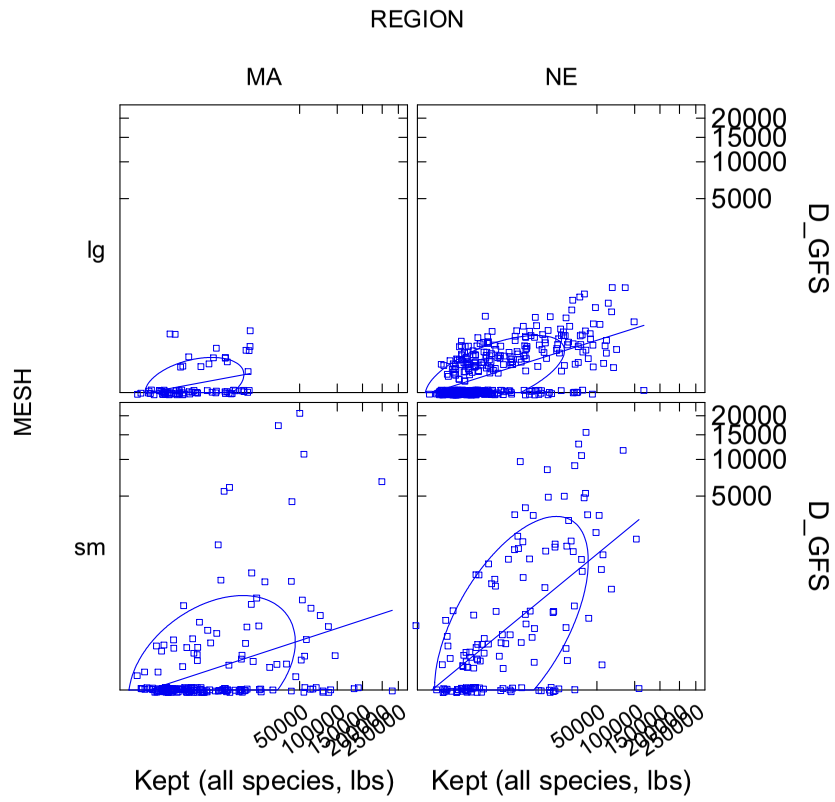


Figure 1ff. Comparison of **NE multispecies** (**small mesh) discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

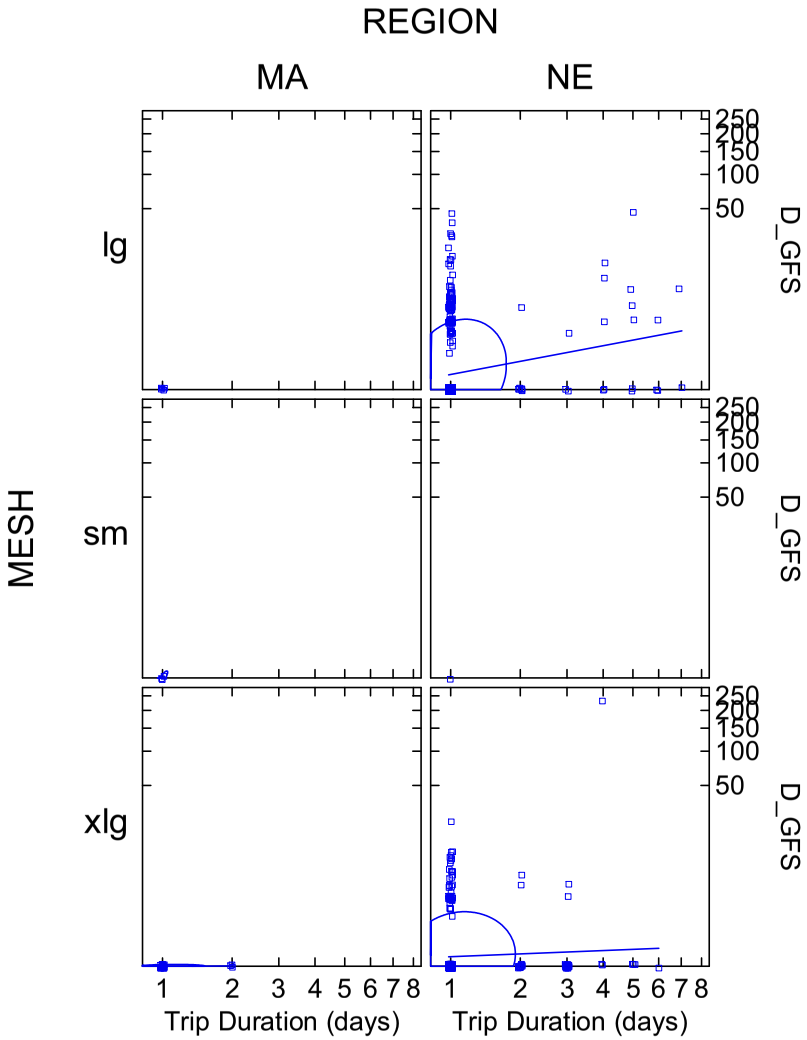


Figure 1gg. Comparison of **NE multispecies** (**small mesh**) **discards** (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

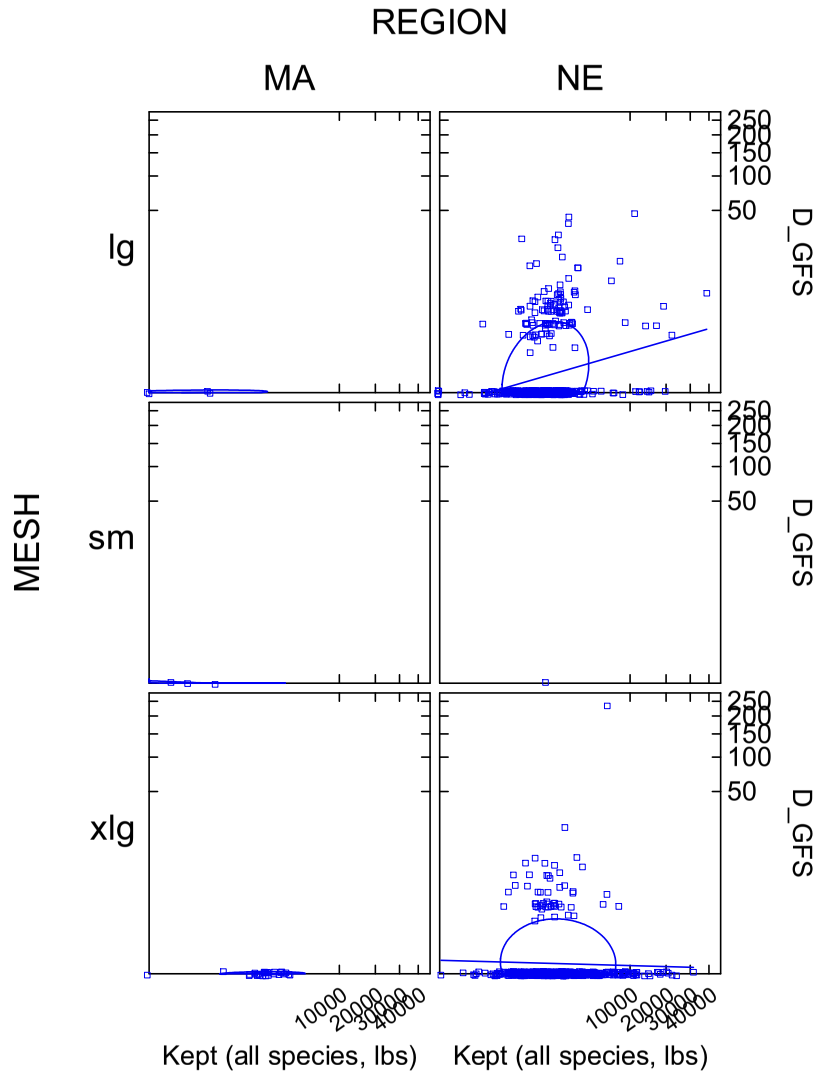


Figure 1hh. Comparison of **NE multispecies** (**small mesh**) **discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

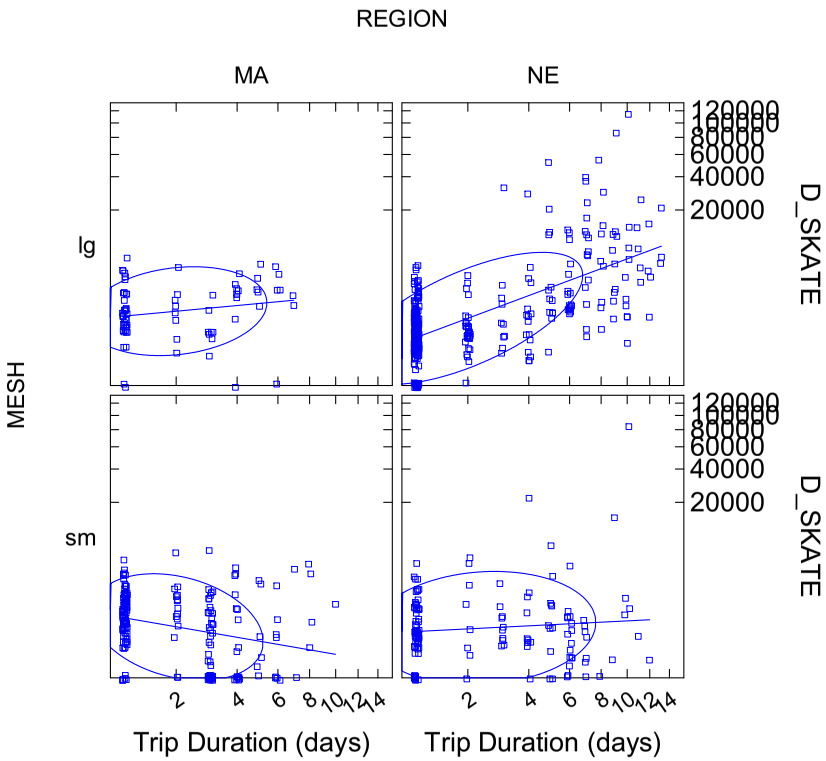


Figure 1ii. Comparison of **skate discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

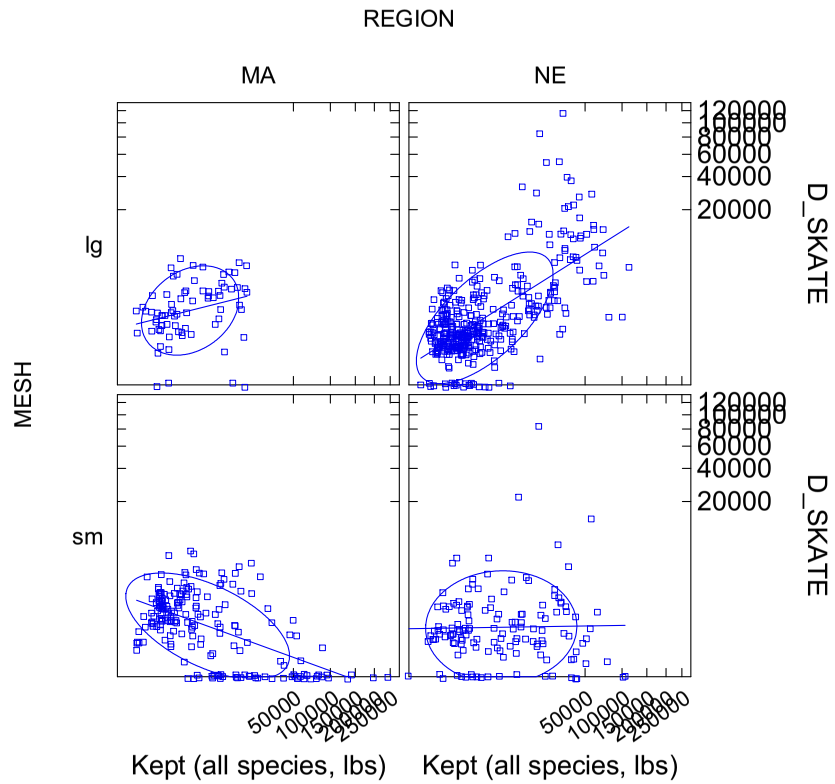


Figure 1jj. Comparison of **skate discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

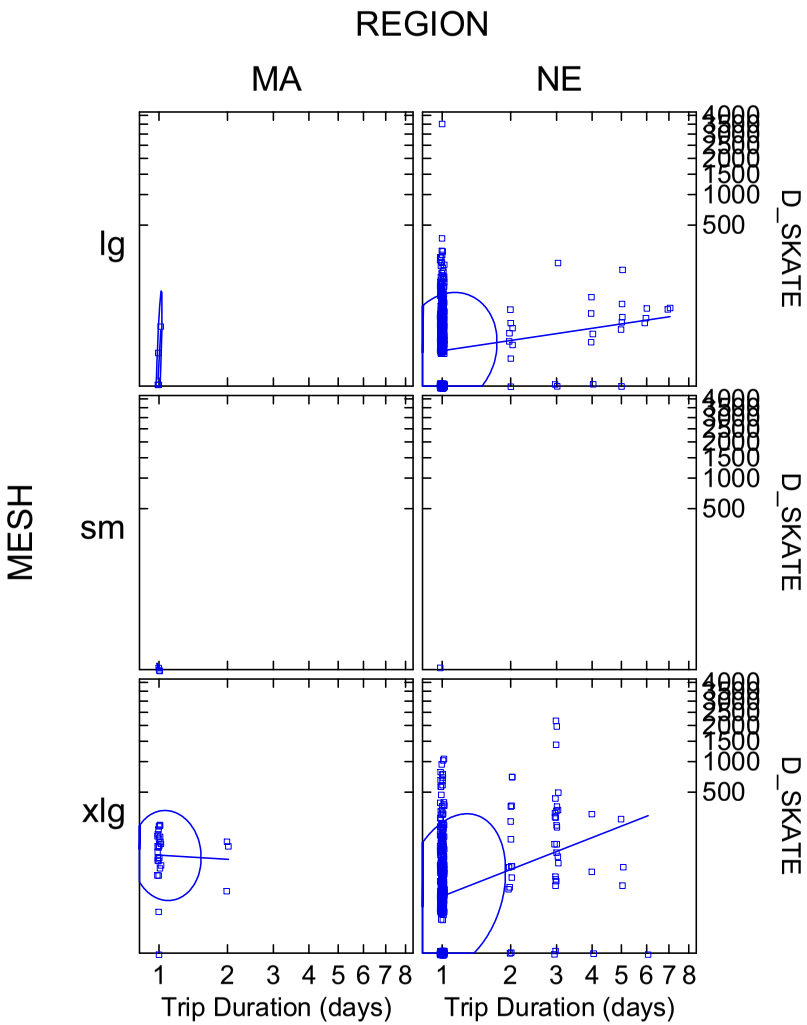


Figure 1kk. Comparison of **skate discards** (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

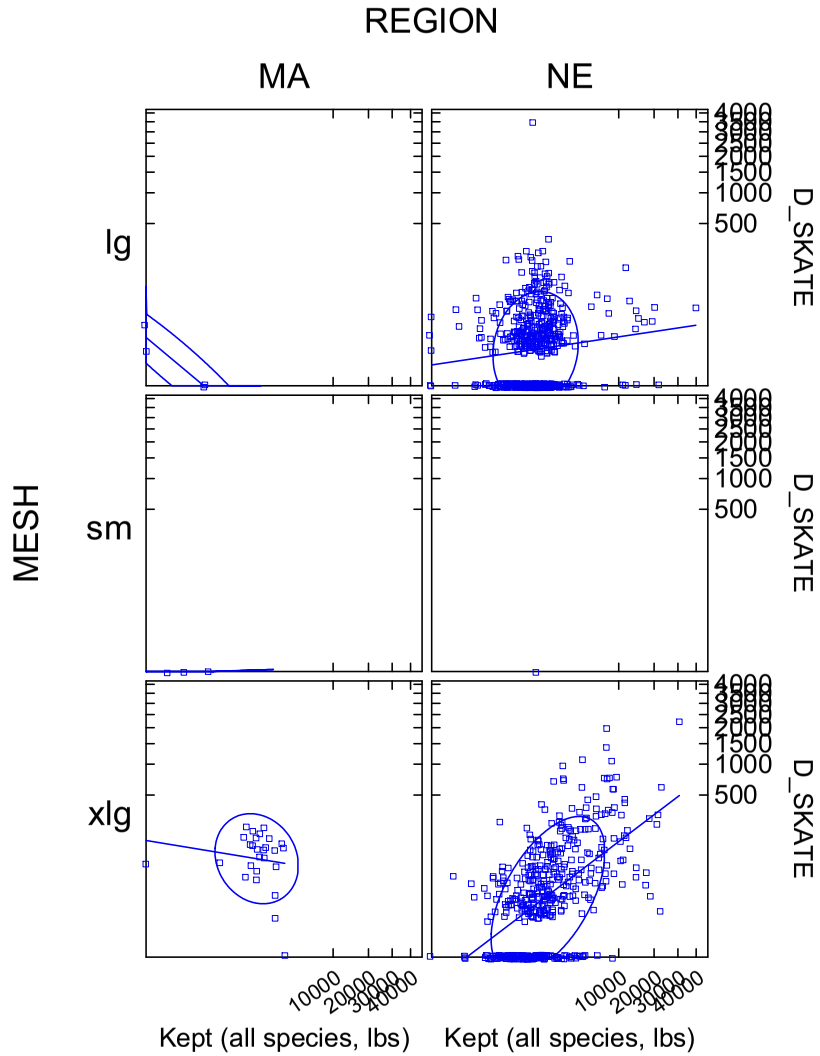


Figure 1ll. Comparison of **skate discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

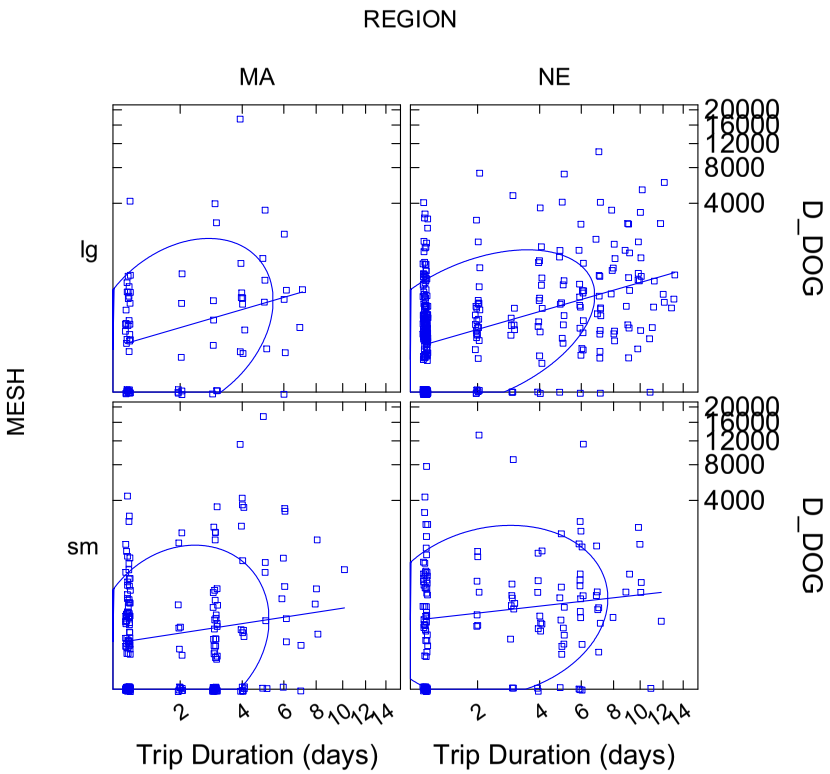


Figure 1mm. Comparison of **spiny dogfish discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

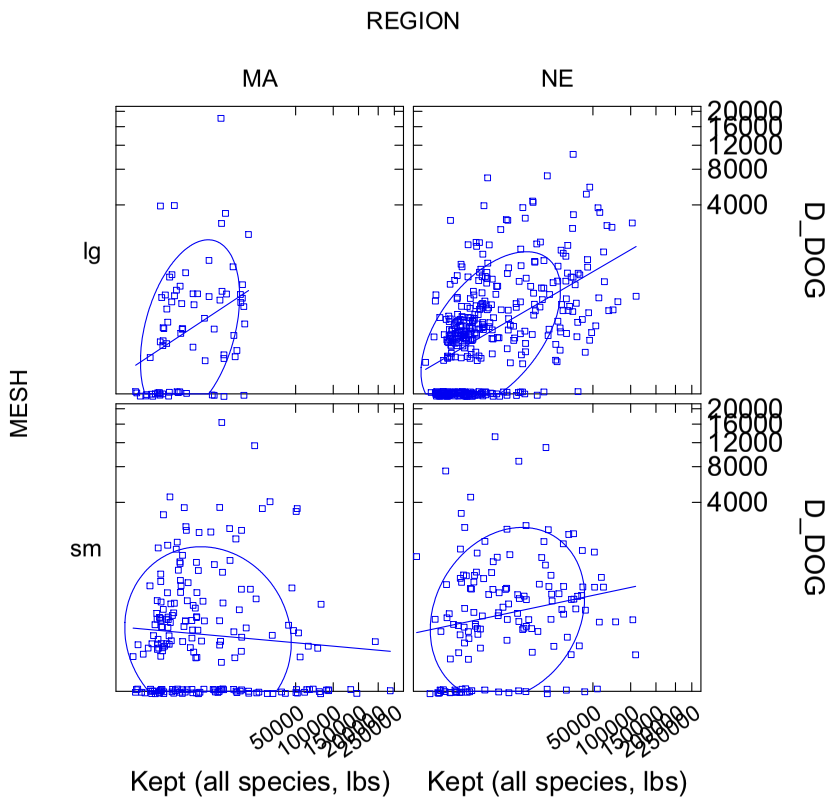


Figure 1nn. Comparison of **spiny dogfish discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

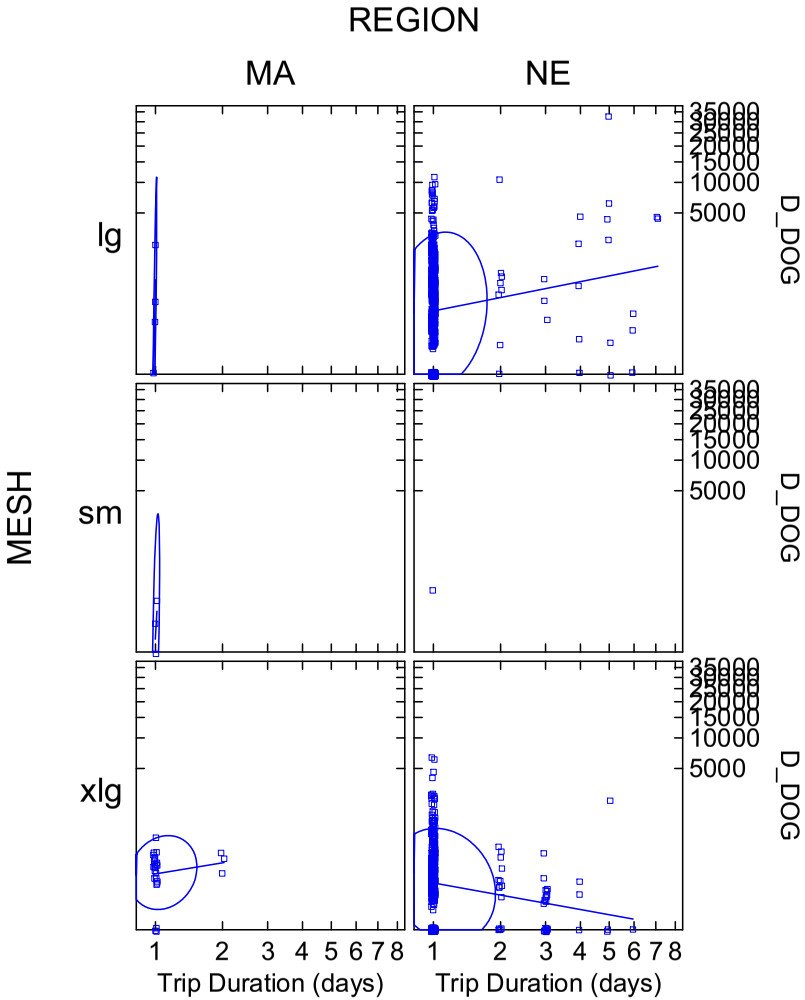


Figure 1oo. Comparison of **spiny dogfish discards** (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

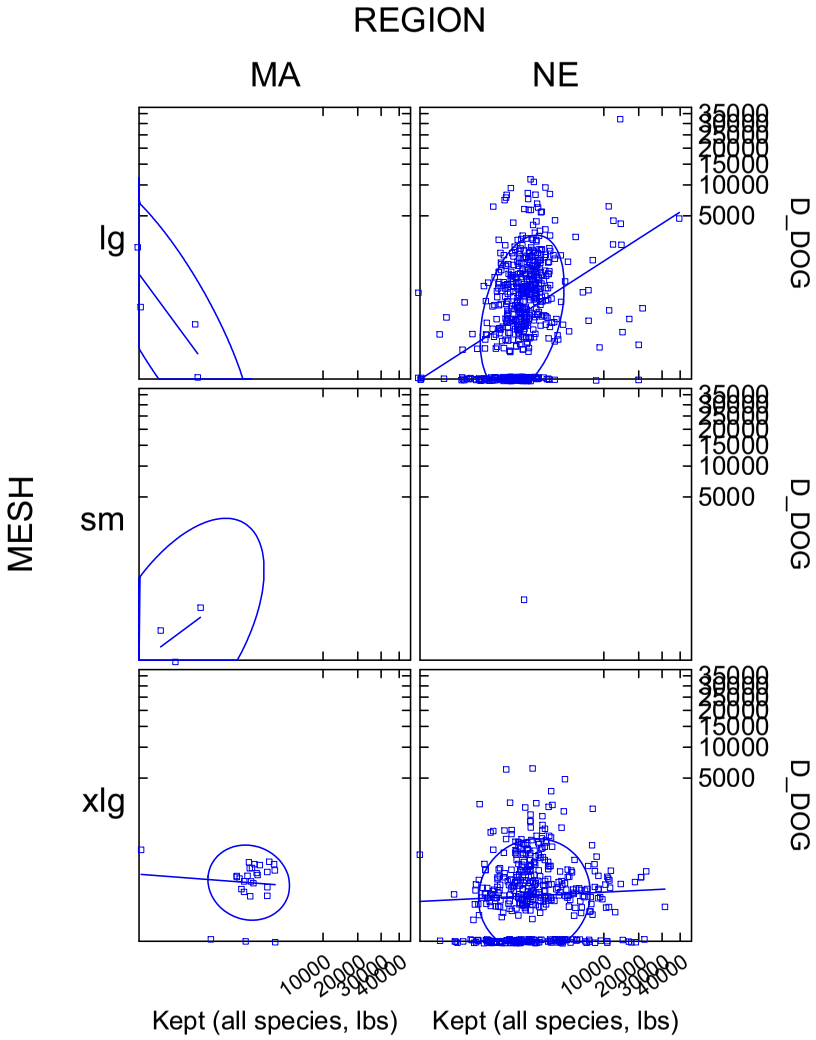


Figure 1pp. Comparison of **spiny dogfish discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

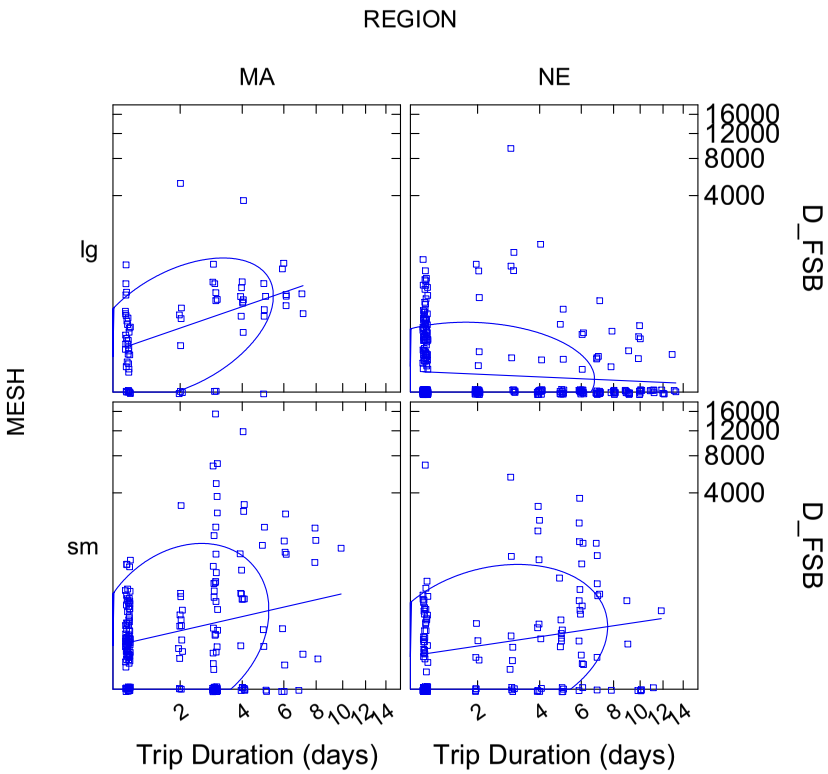


Figure 1qq. Comparison of **fluke-scup-black sea bass discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

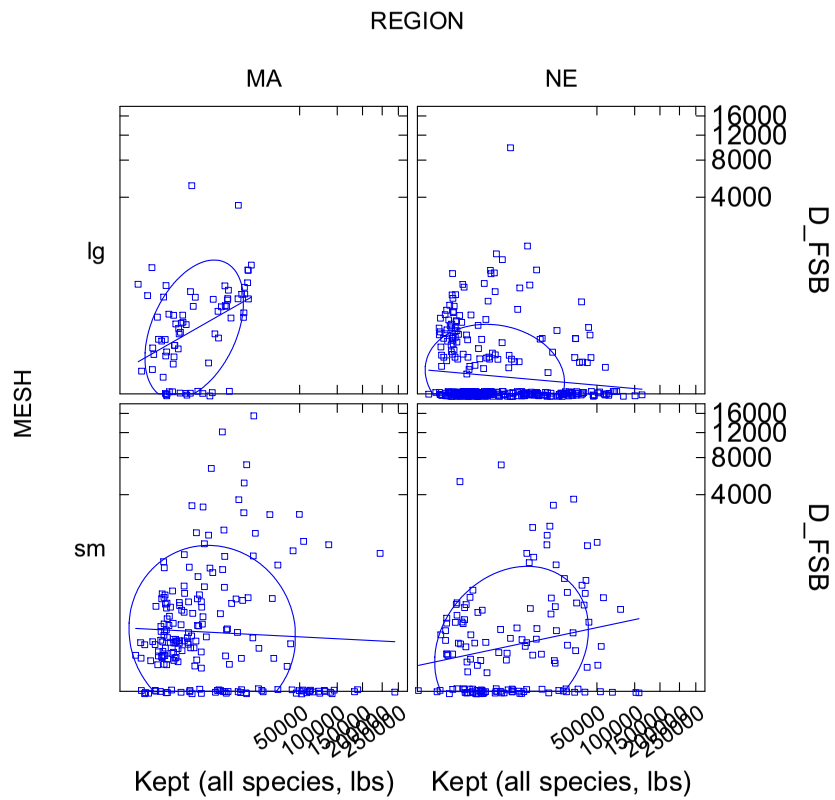


Figure 1rr. Comparison of **fluke-scup-black sea bass discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

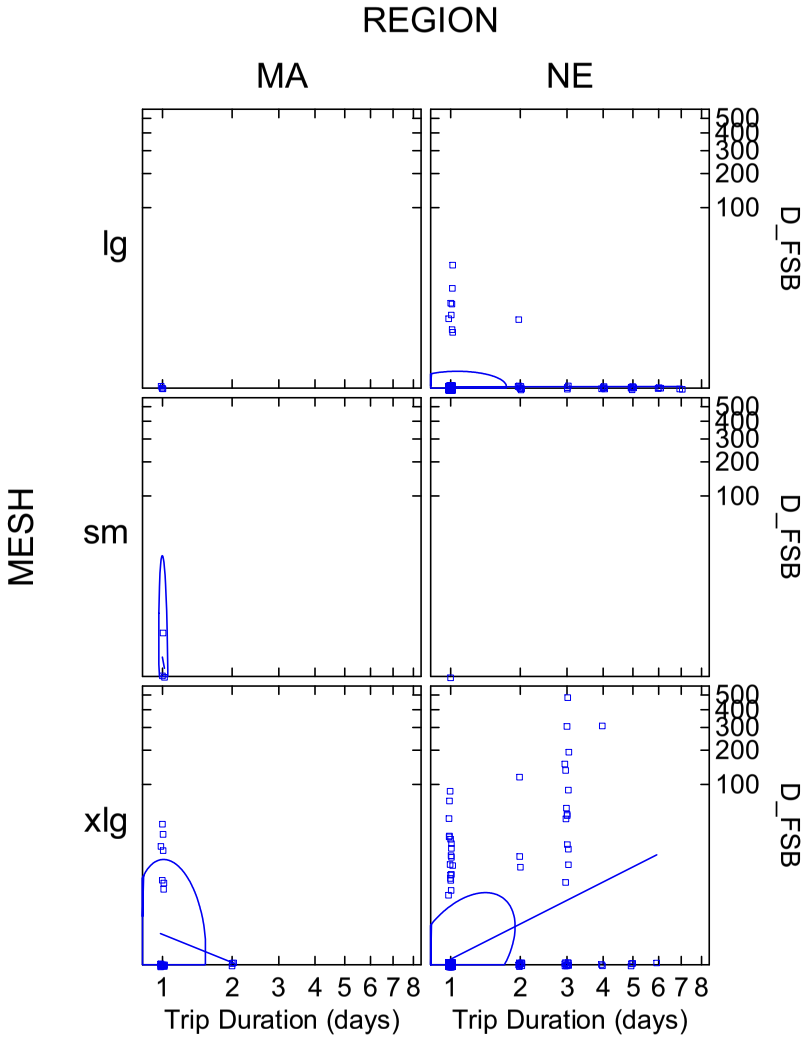


Figure 1ss. Comparison of **fluke-scup-black sea bass discards** (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

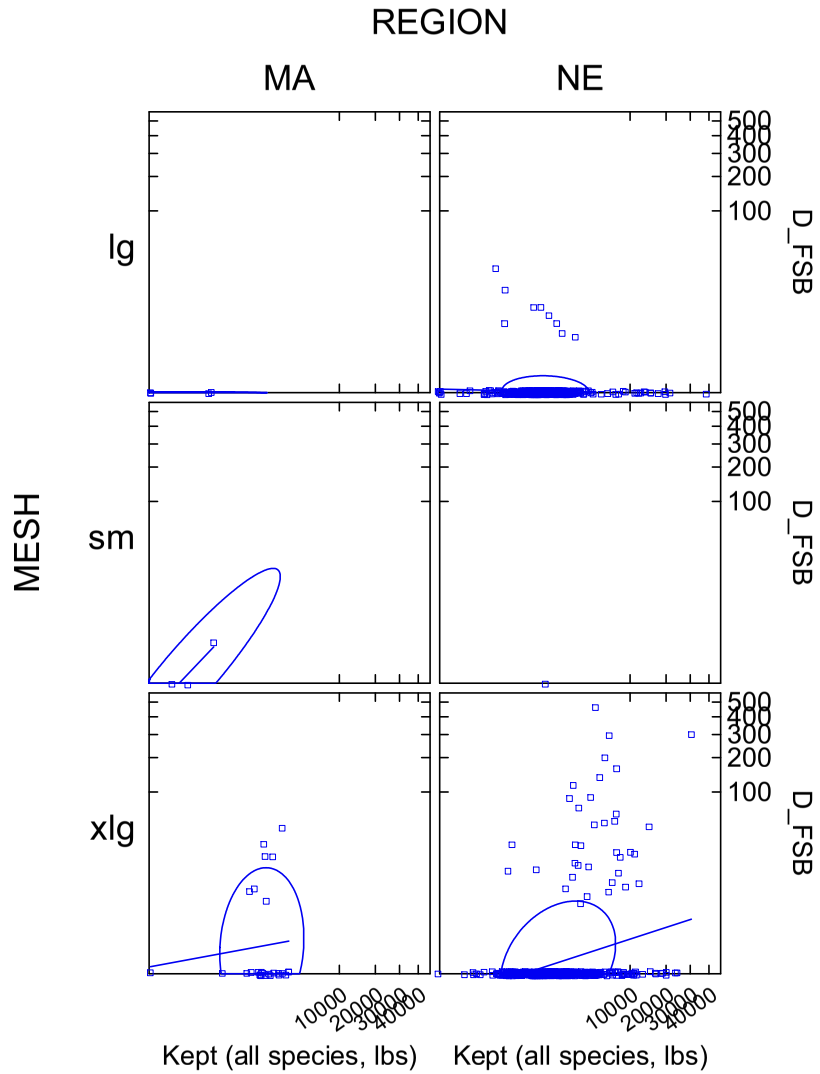


Figure 1tt. Comparison of **fluke-scup-black sea bass discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

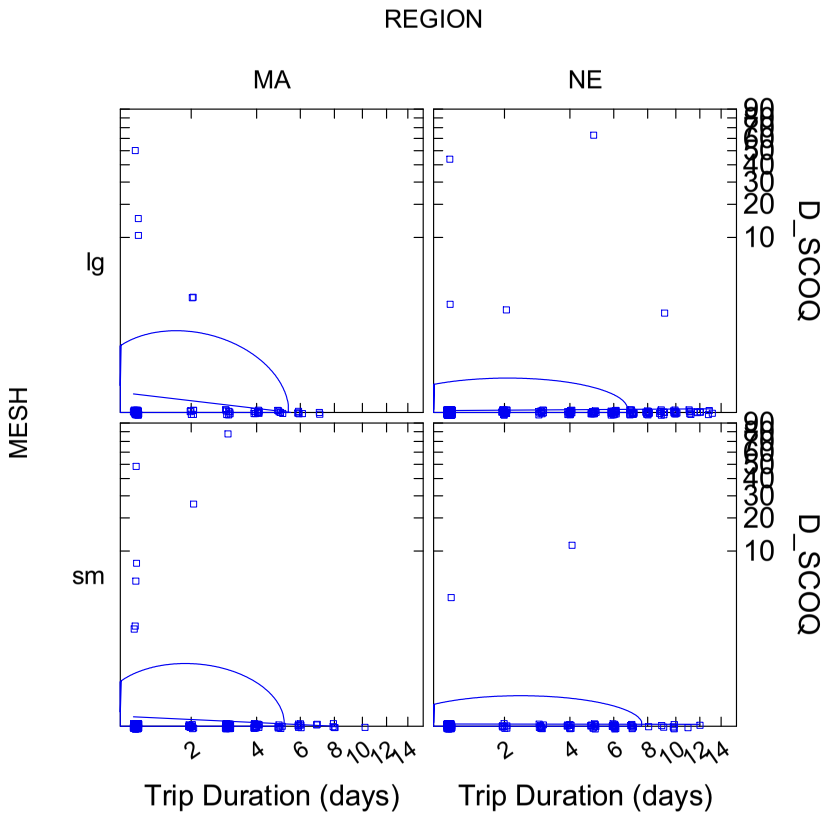


Figure 1uu. Comparison of **surf clam/quahog discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

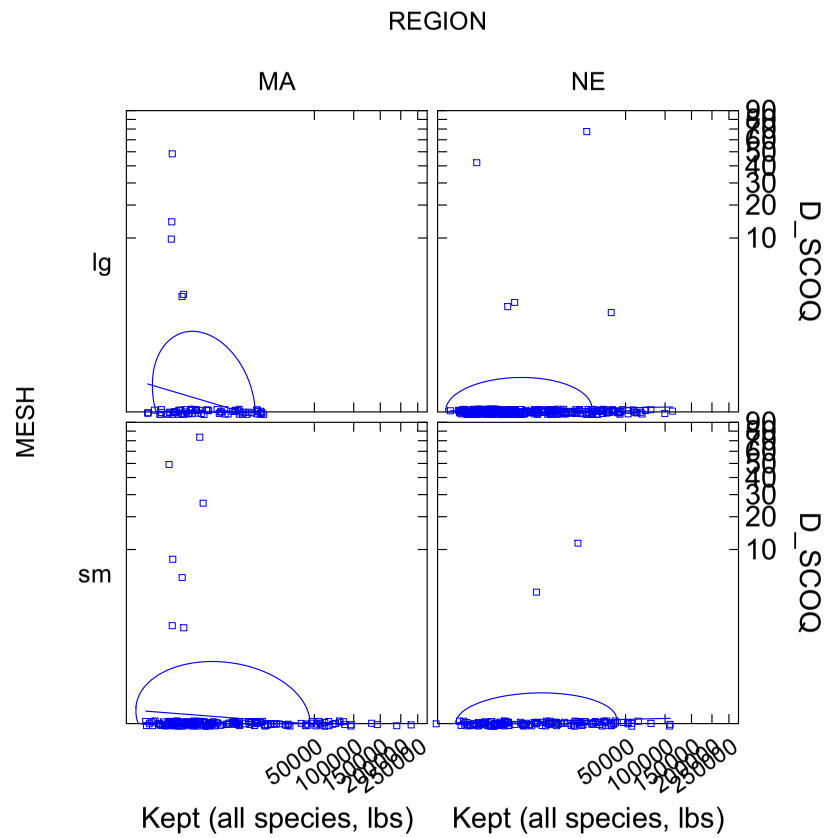


Figure 1vv. Comparison of **surf clam/quahog discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

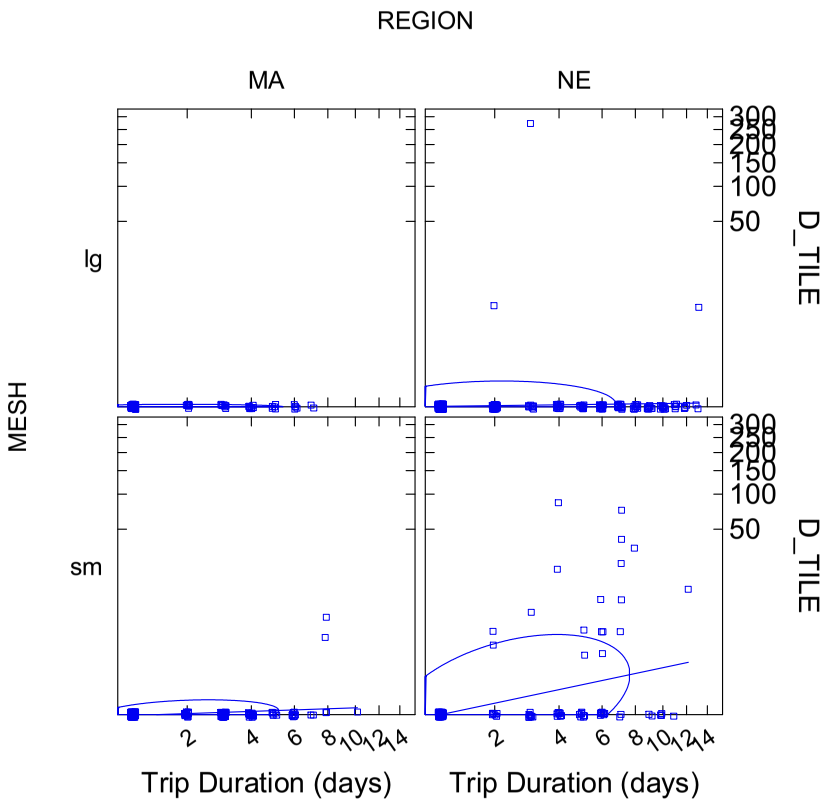


Figure 1ww. Comparison of **tilefish discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

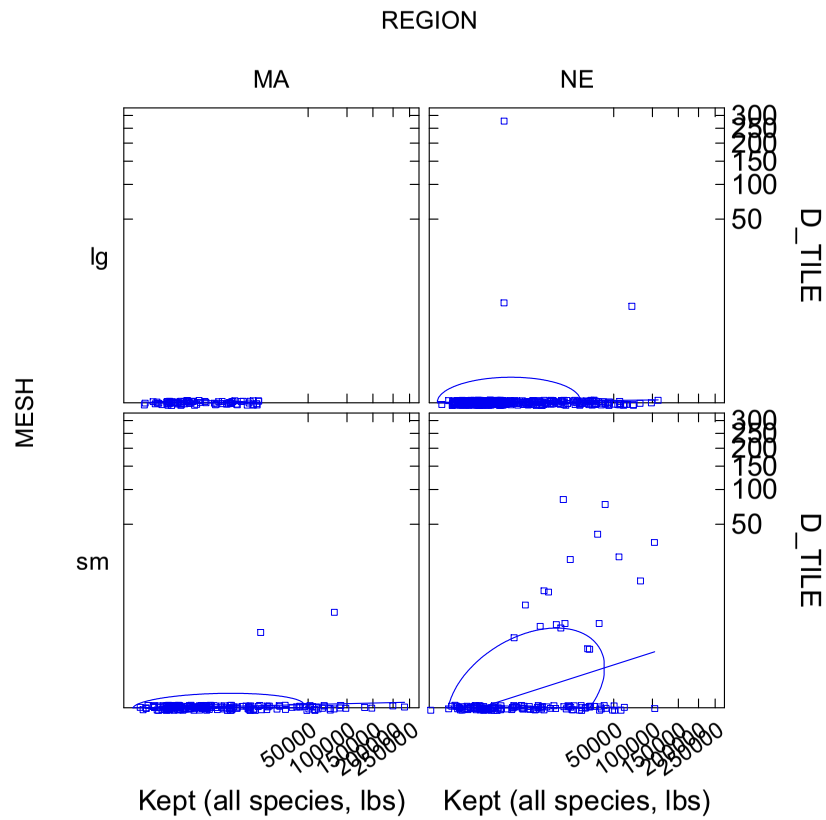


Figure 1xx. Comparison of **tilefish discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip.

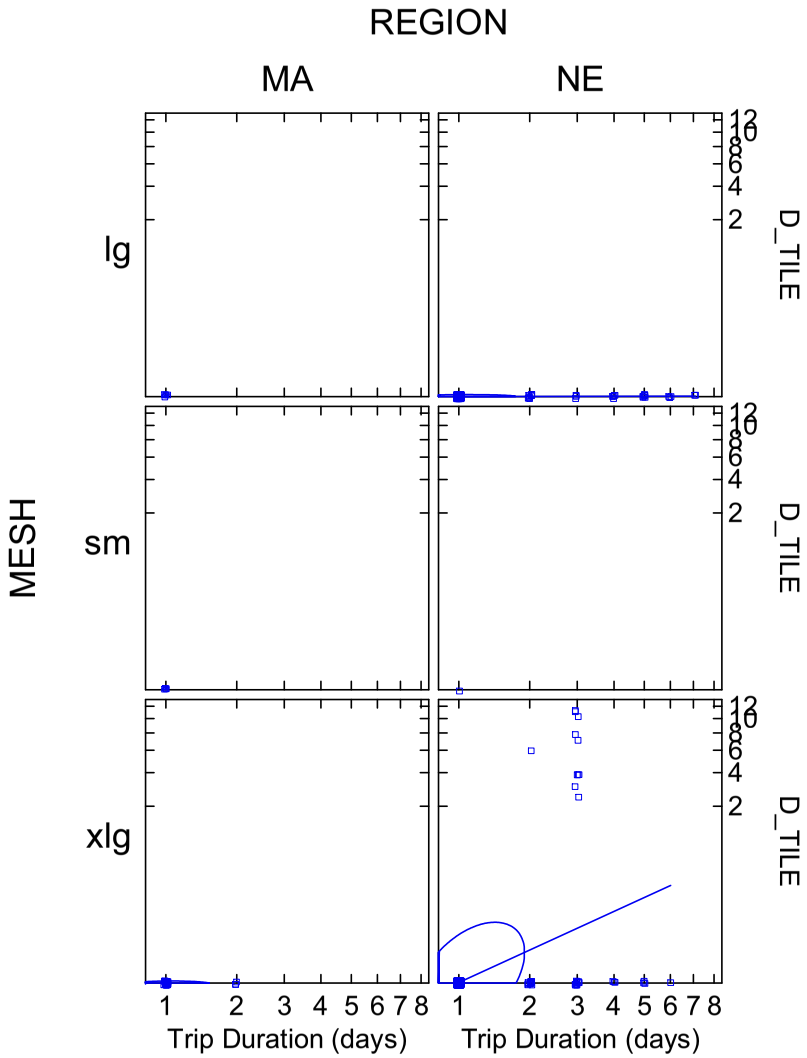


Figure 1yy. Comparison of **tilefish discards** (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

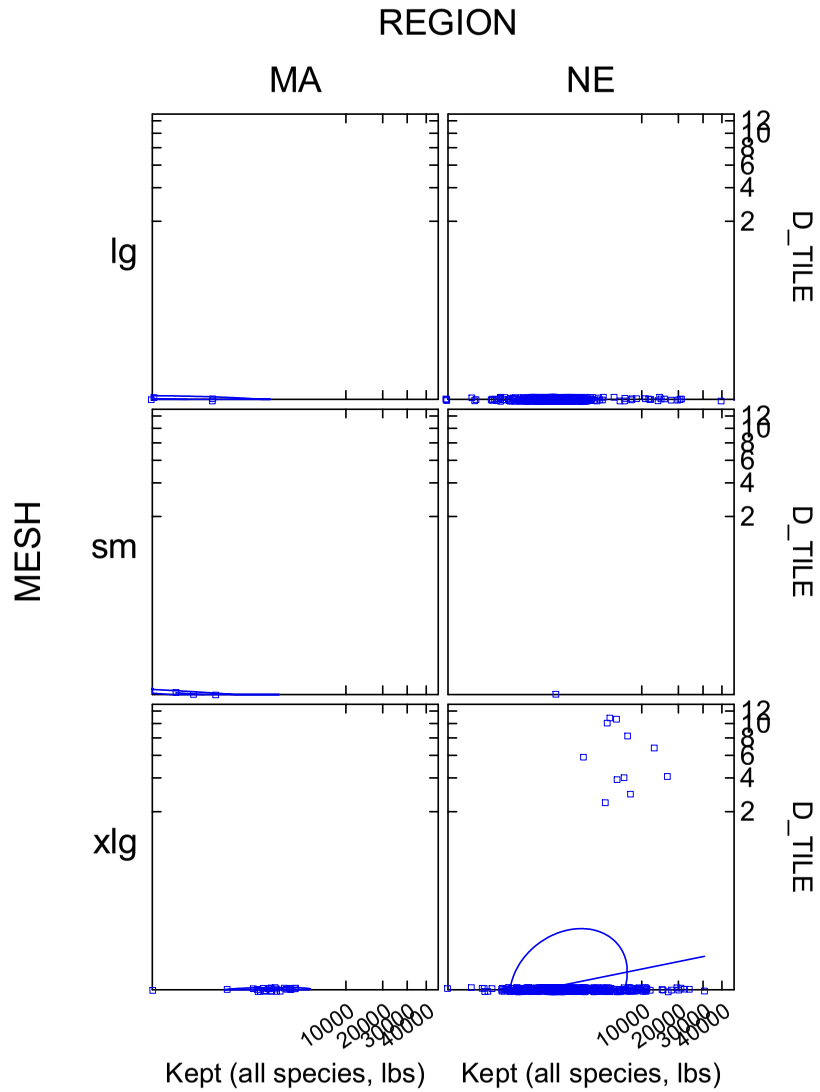


Figure 1zz. Comparison of **tilefish discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip.

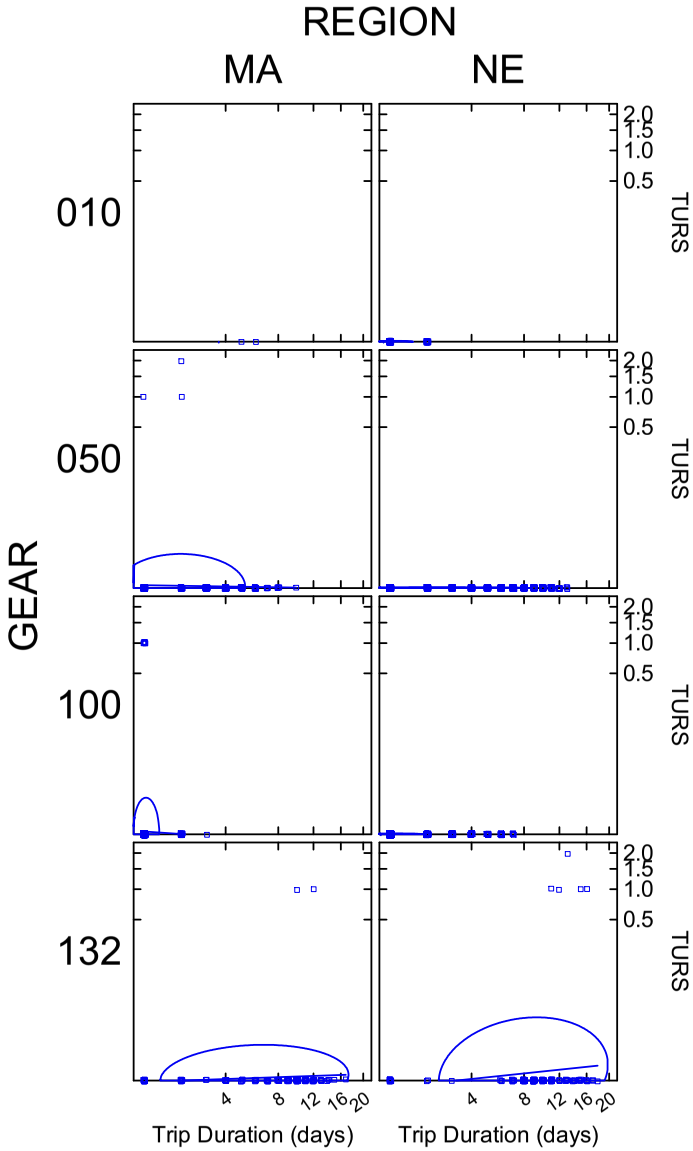


Figure 2a. Comparison of **turtles** and **trip duration** (days) from 2004 observed longline (010), otter trawl (050), gillnet (100), and scallop dredge (132) trips, by region; each dot represents a trip.

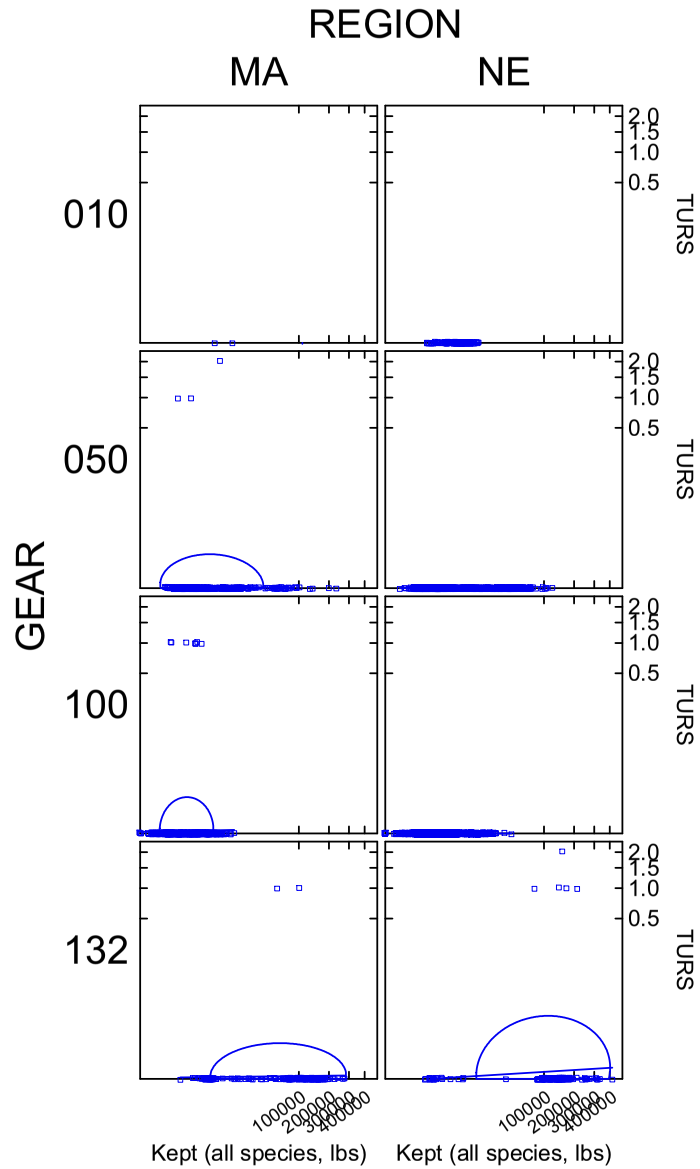


Figure 2b. Comparison of **turtles** and **kept weight** of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100), and scallop dredge (132) trips, by region; each dot represents a trip.

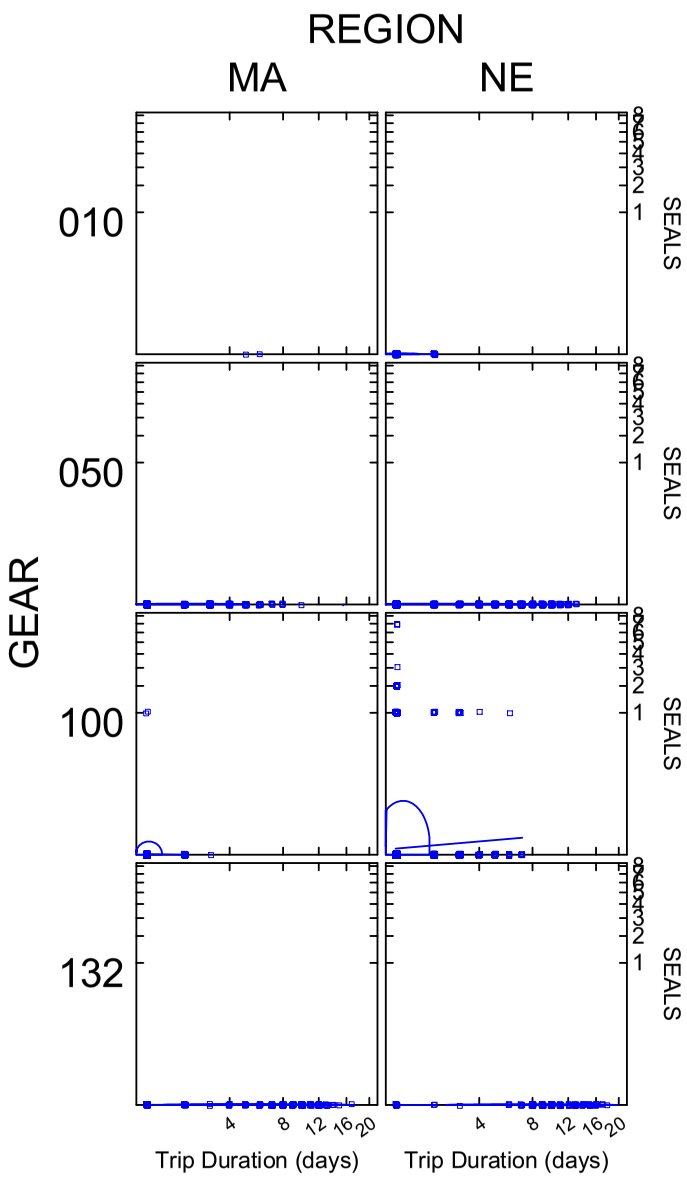


Figure 2c. Comparison of **seals** and **trip duration** (days) from 2004 observed longline (010), otter trawl (050), gillnet (100), and scallop dredge (132) trips, by region; each dot represents a trip.

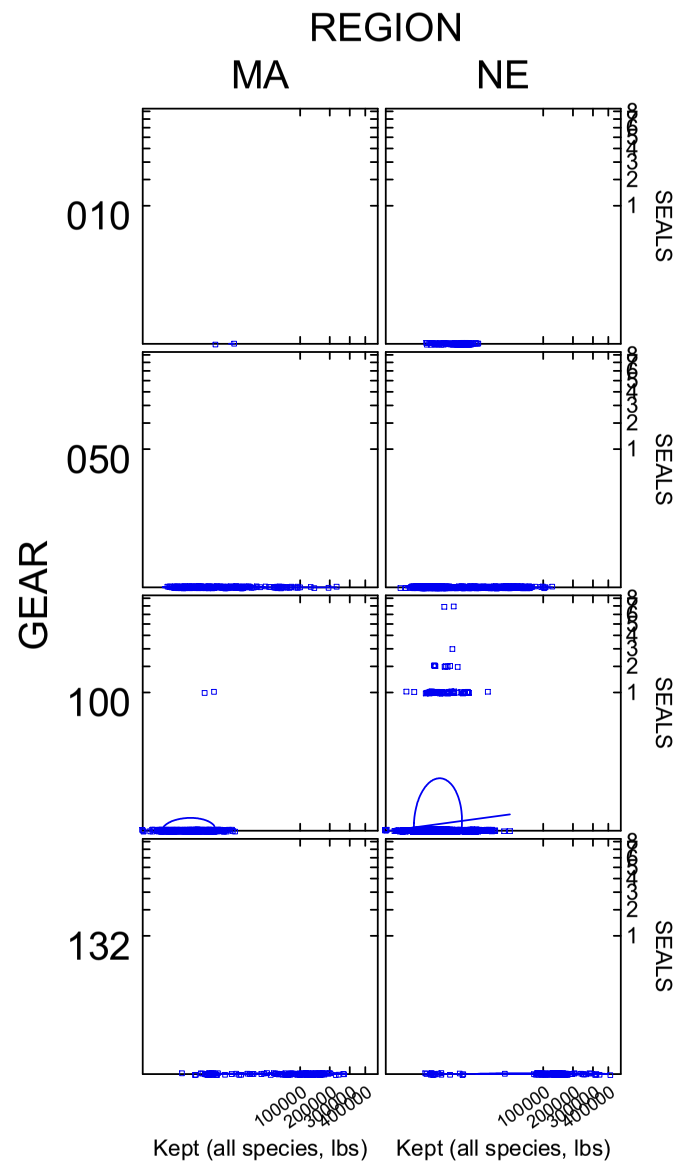


Figure 2d. Comparison of **seals** and **kept weight** of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100), and scallop dredge (132) trips, by region; each dot represents a trip.

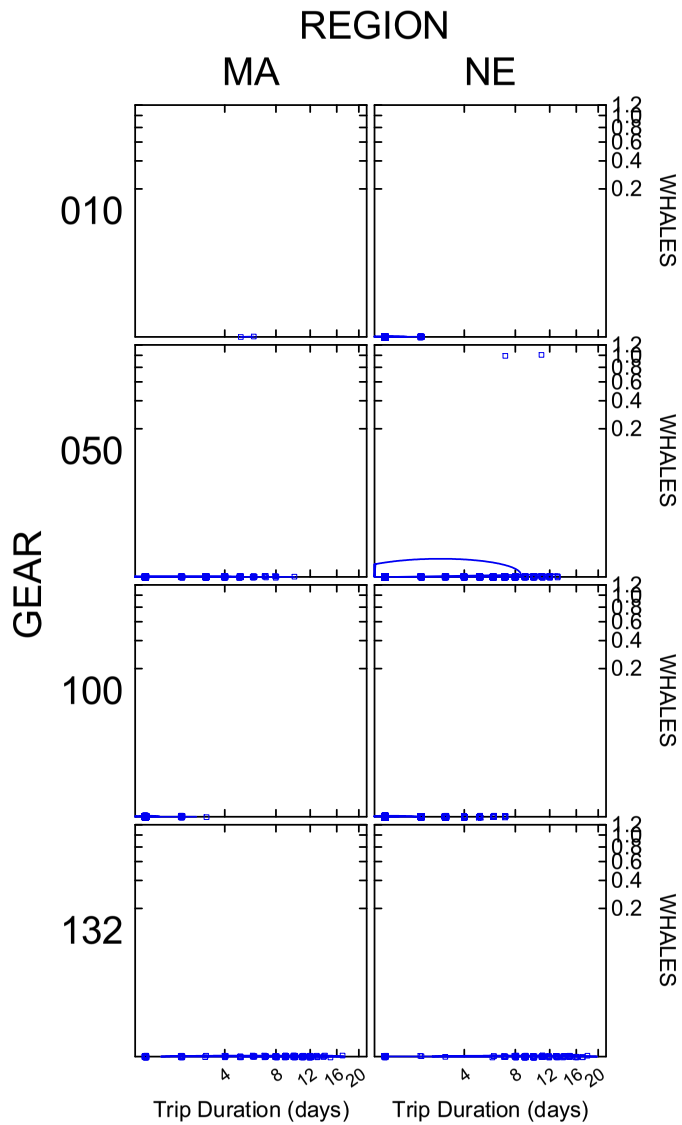


Figure 2e. Comparison of **whales** and **trip duration** (days) from 2004 observed longline (010), otter trawl (050), gillnet (100), and scallop dredge (132) trips, by region; each dot represents a trip.

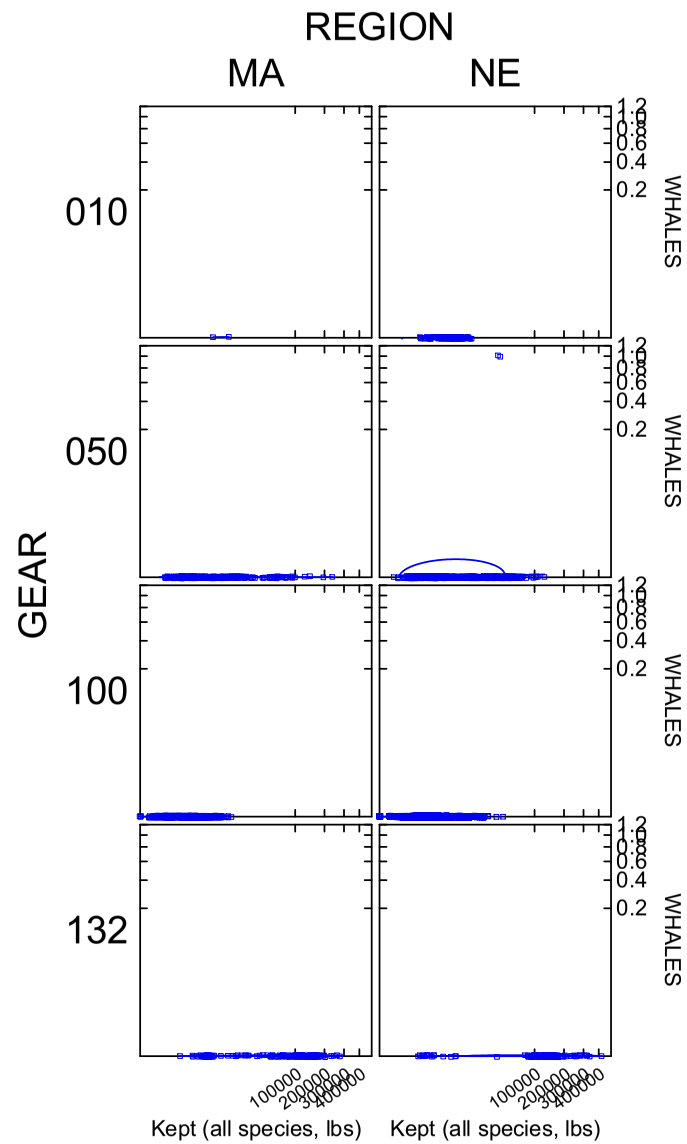


Figure 2f. Comparison of **whales** and **kept weight** of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100), and scallop dredge (132) trips, by region; each dot represents a trip.

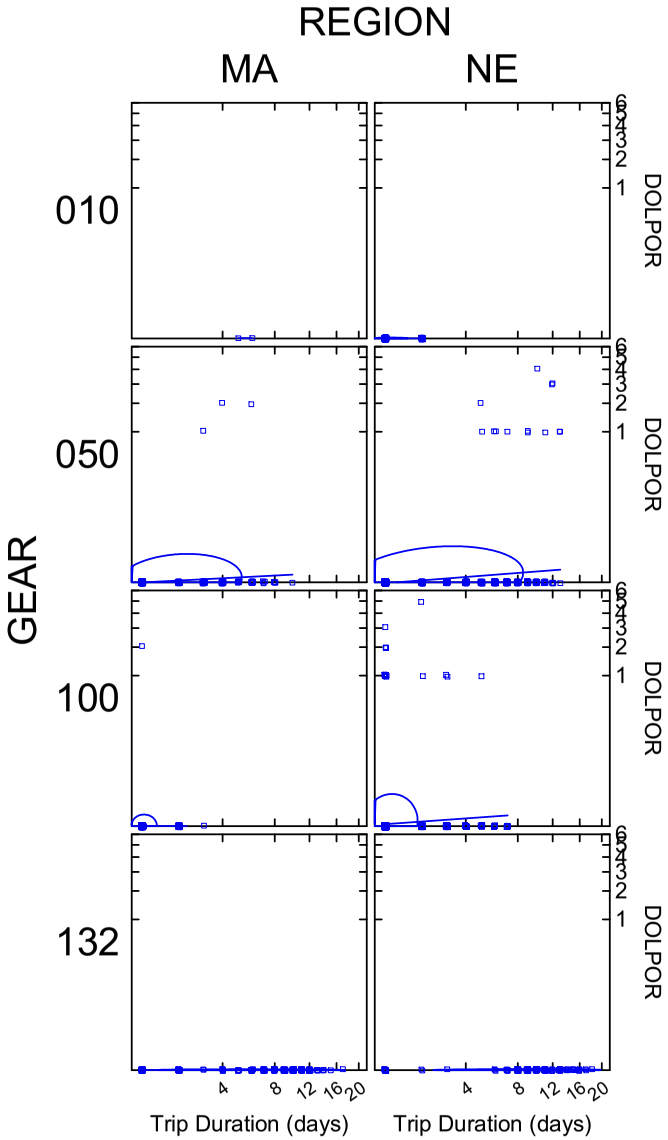


Figure 2g. Comparison of **dolphins/porpoises** and **trip duration** (days) from 2004 observed longline (010), otter trawl (050), gillnet (100), and scallop dredge (132) trips, by region; each dot represents a trip.

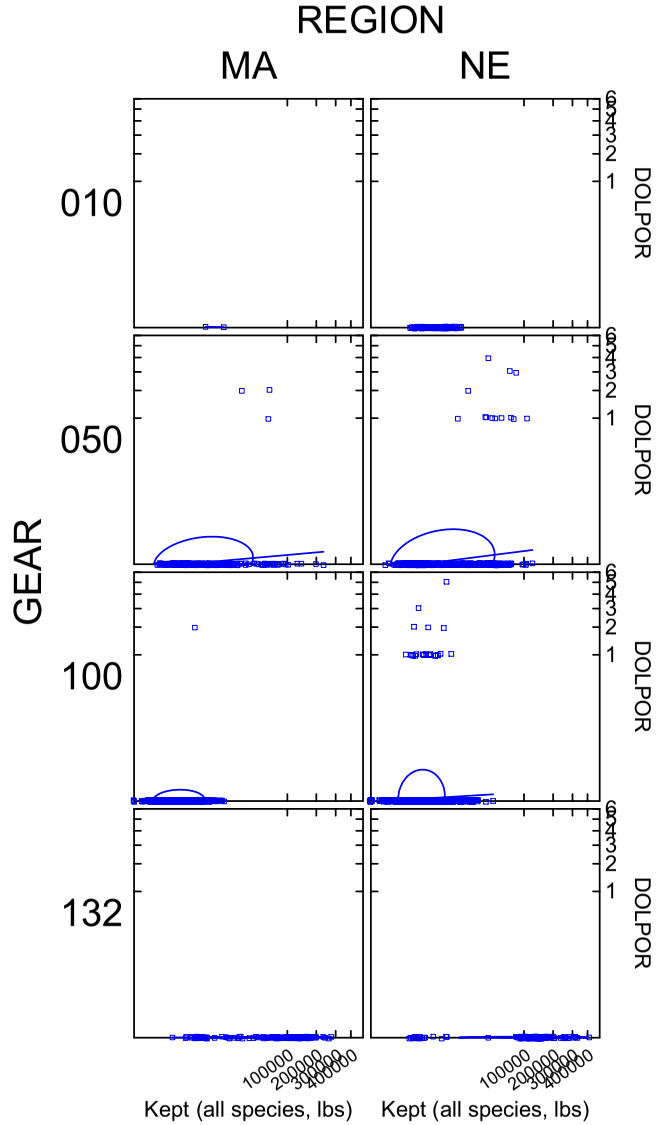


Figure 2h. Comparison of **dolphins/porpoises** and **kept weight** of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100), and scallop dredge (132) trips, by region; each dot represents a trip.

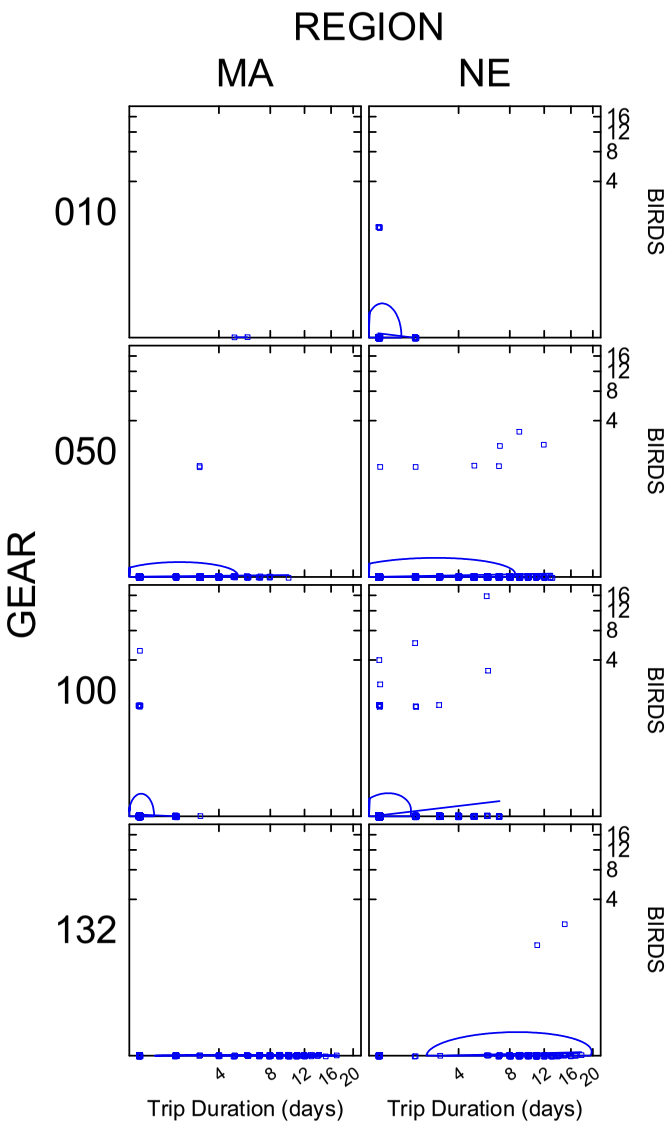


Figure 2i. Comparison of **birds** and **trip duration** (days) from 2004 observed longline (010), otter trawl (050), gillnet (100), and scallop dredge (132) trips, by region; each dot represents a trip.

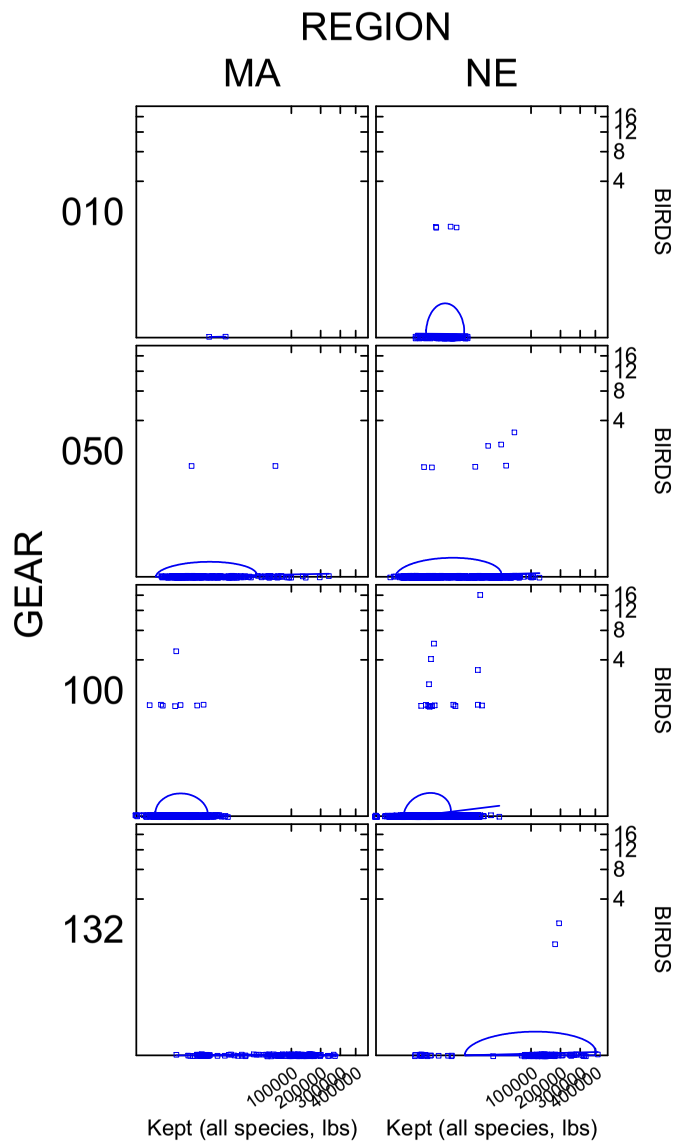


Figure 2j. Comparison of **birds** and **kept weight** of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100), and scallop dredge (132) trips, by region; each dot represents a trip.

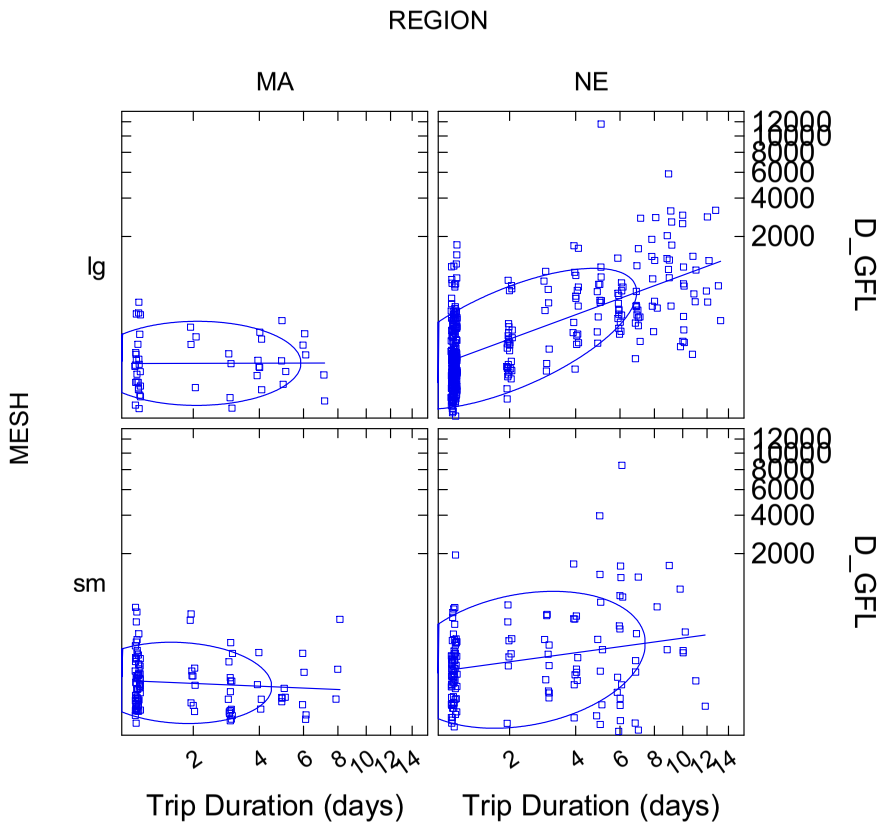


Figure 3a. Comparison of **NE multispecies (large mesh) discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip. **Trips with zero discards of NE multispecies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

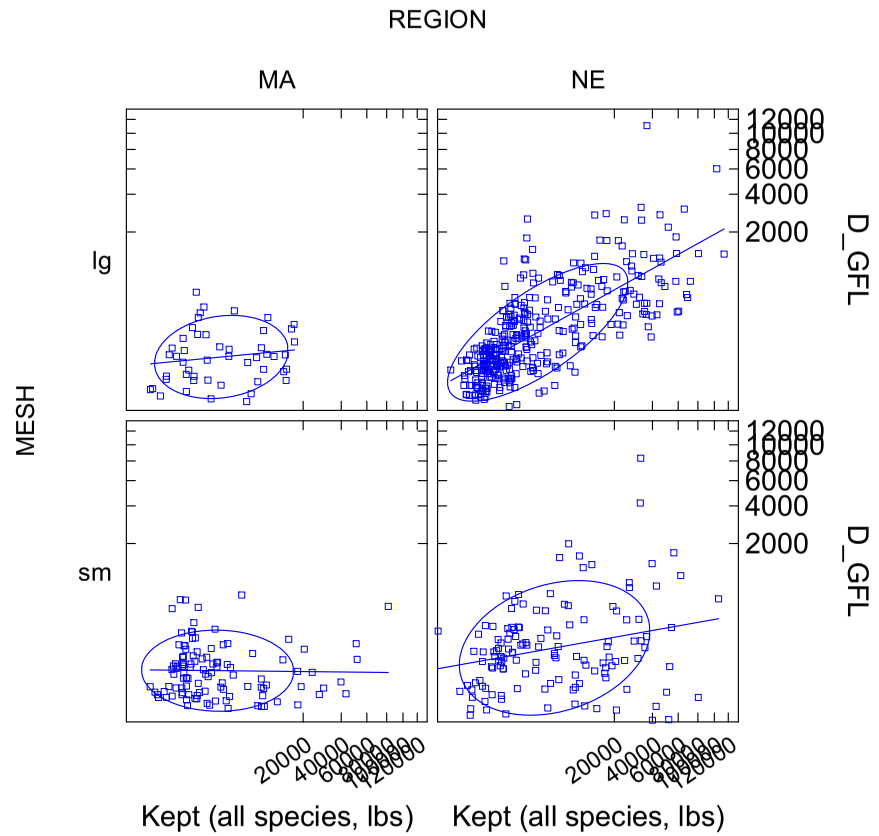


Figure 3b. Comparison of **NE multispecies (large mesh) discards** (pounds) and **kept weight of all** species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm <5.5 in; lg =>5.5 in); fourth root transformation used, each dot represents a trip. **Trips with zero discards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

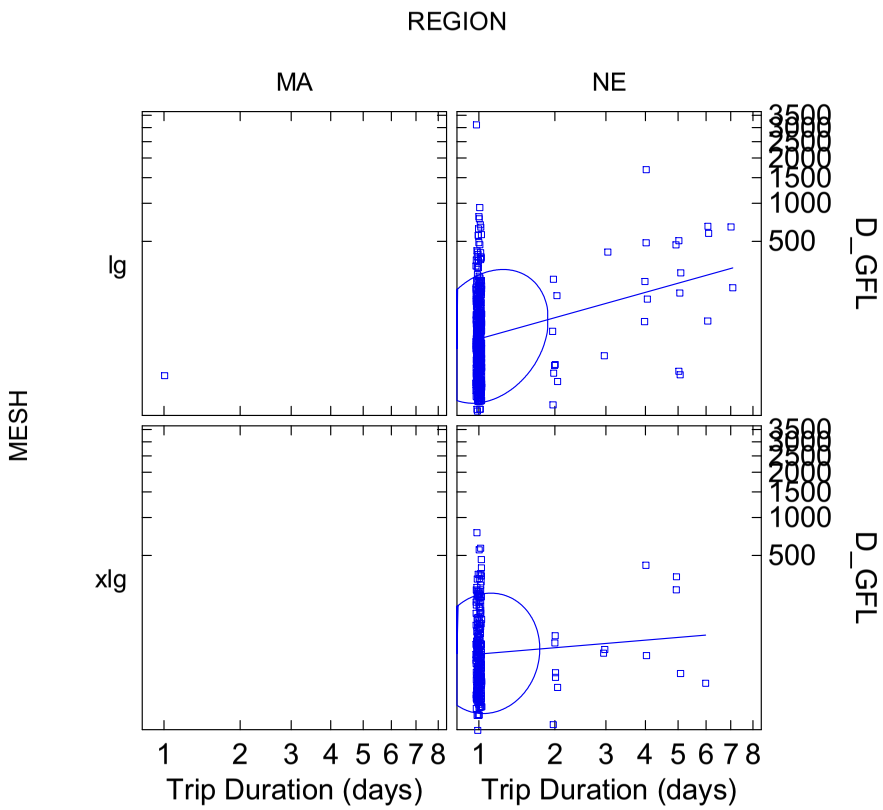


Figure 3c. Comparison of **NE multispecies (large mesh) discards** (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip. **Trips with zero discards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

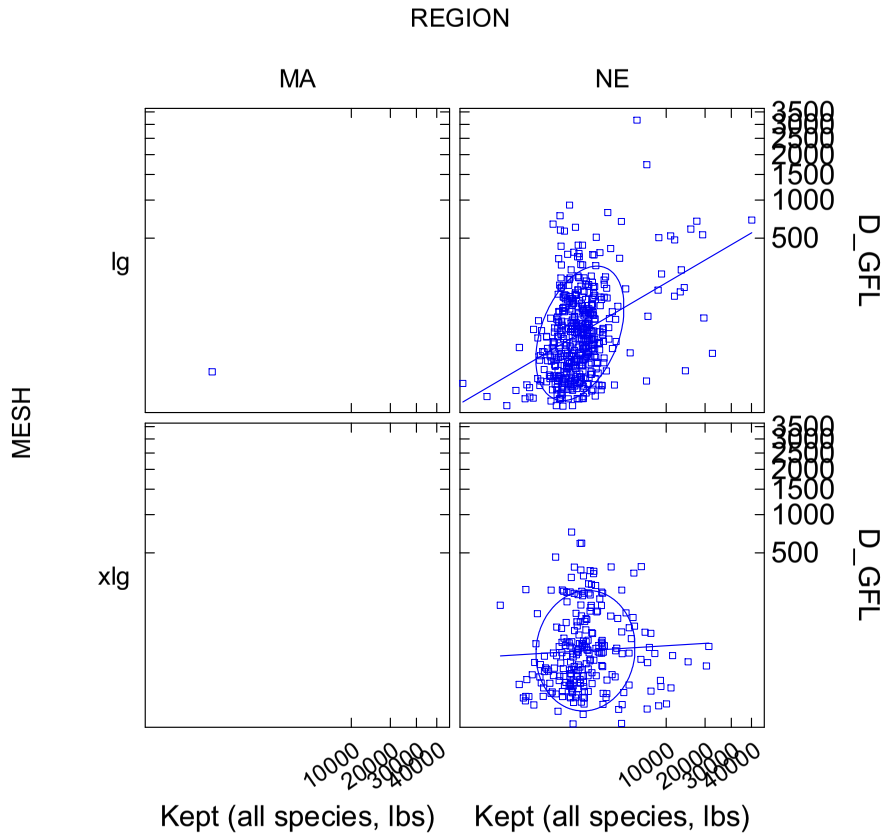


Figure 3d. Comparison of **NE multispecies (large mesh) discards** (pounds) and **kept weight of all** species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 in; sm <5.5 in; xlg >8 in); fourth root transformation used, each dot represents a trip. **Trips with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

010,NE

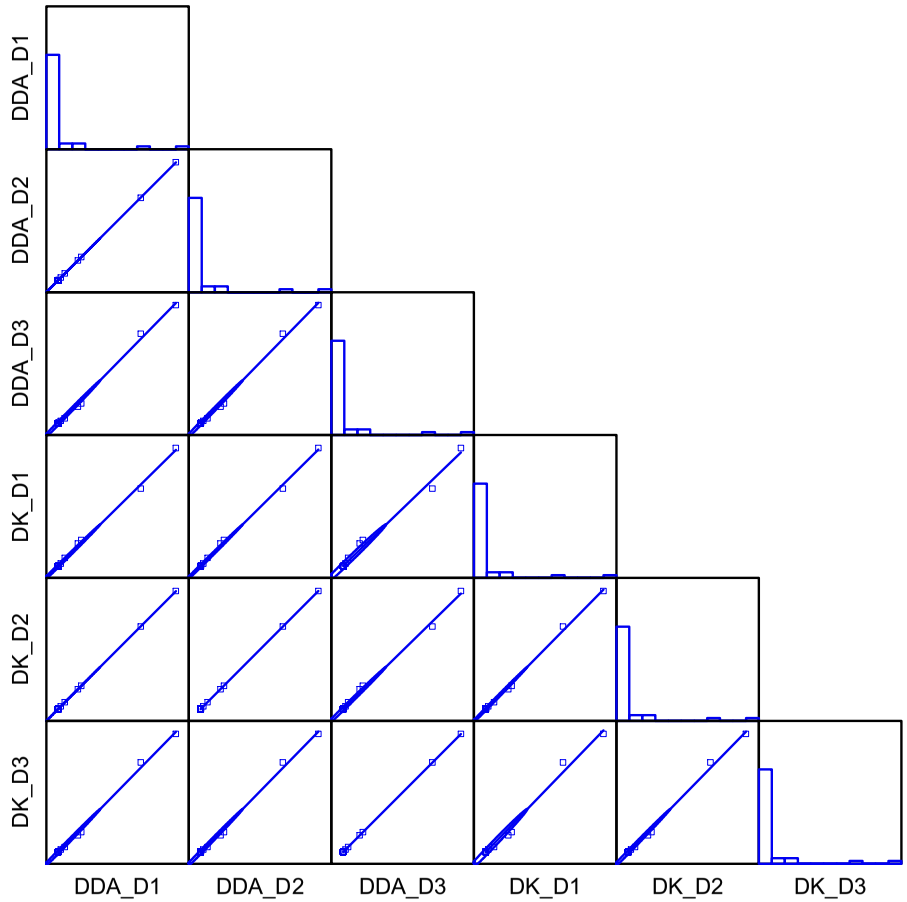


Figure 4a. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **NE longline;** each dot represents a species group and mesh size.

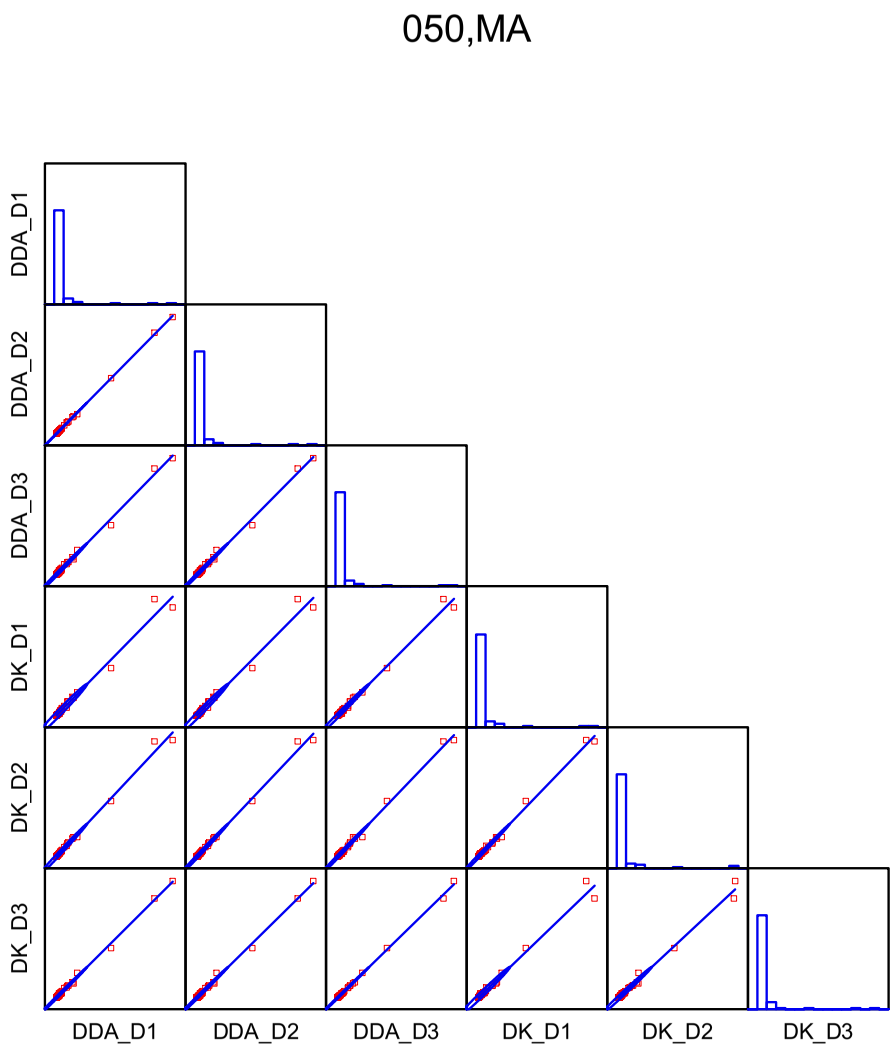


Figure 4b. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **MA otter trawl;** each dot represents a species group and mesh size.

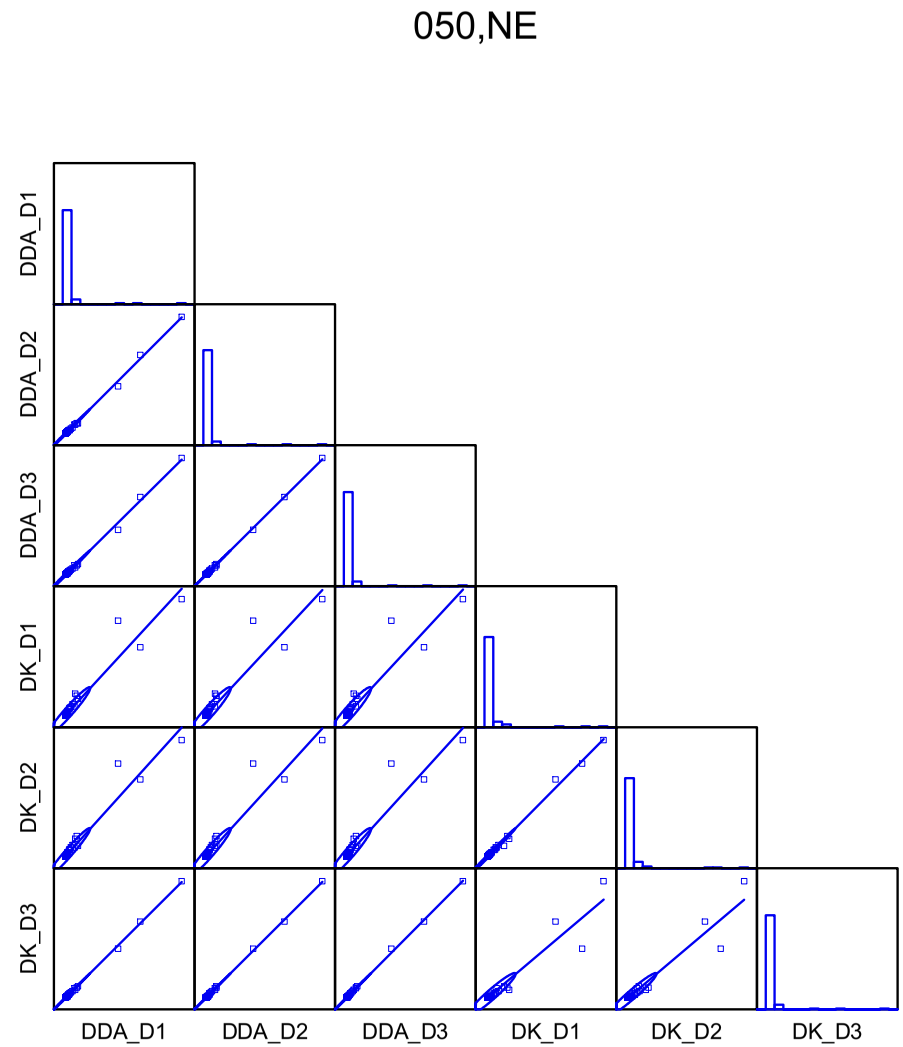


Figure 4c. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **NE otter trawl;** each dot represents a species group and mesh size.

132,MA

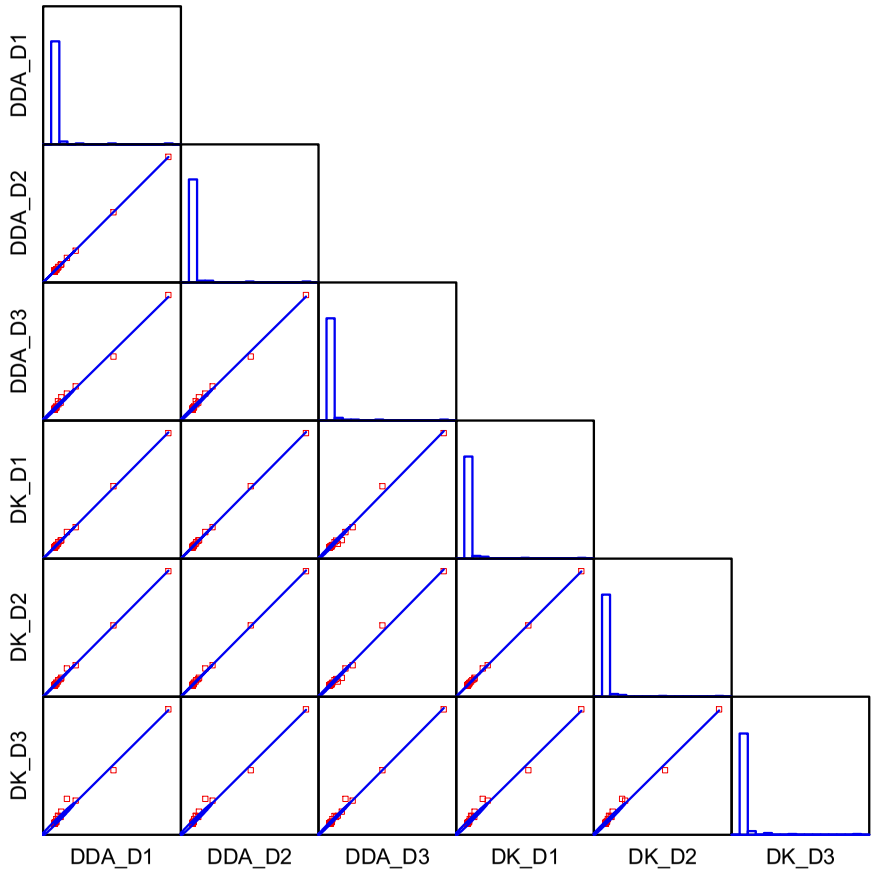


Figure 4d. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **MA scallop dredge;** each dot represents a species group and mesh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

132,NE

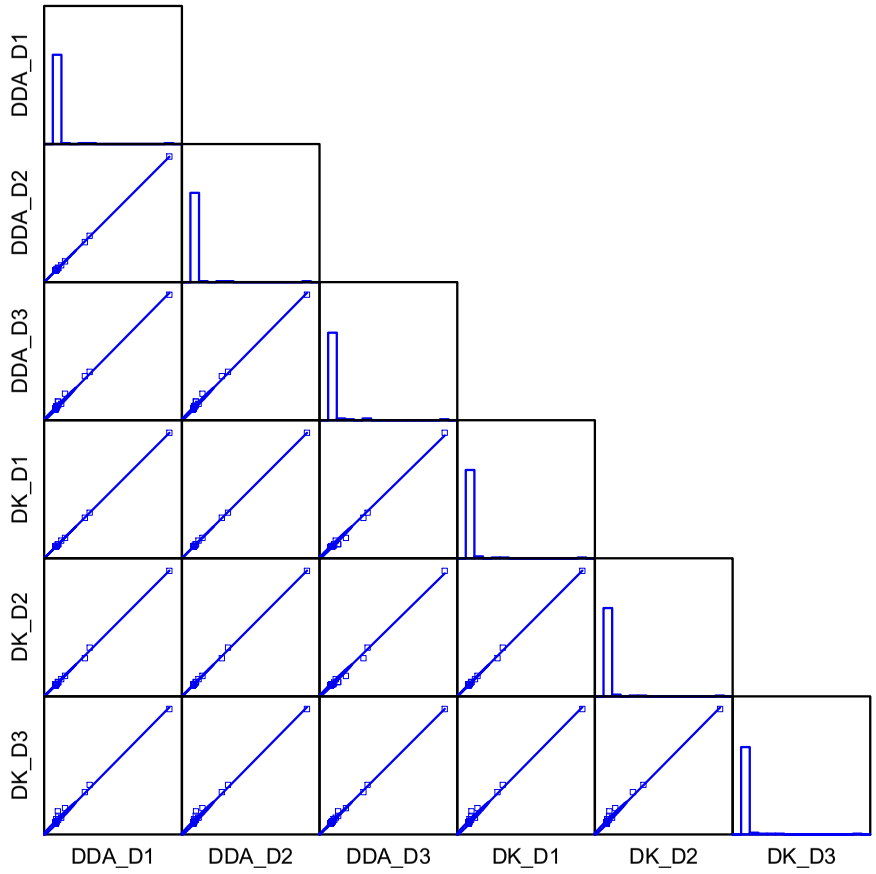


Figure 4e. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **NE scallop dredge;** each dot represents a species group and mesh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

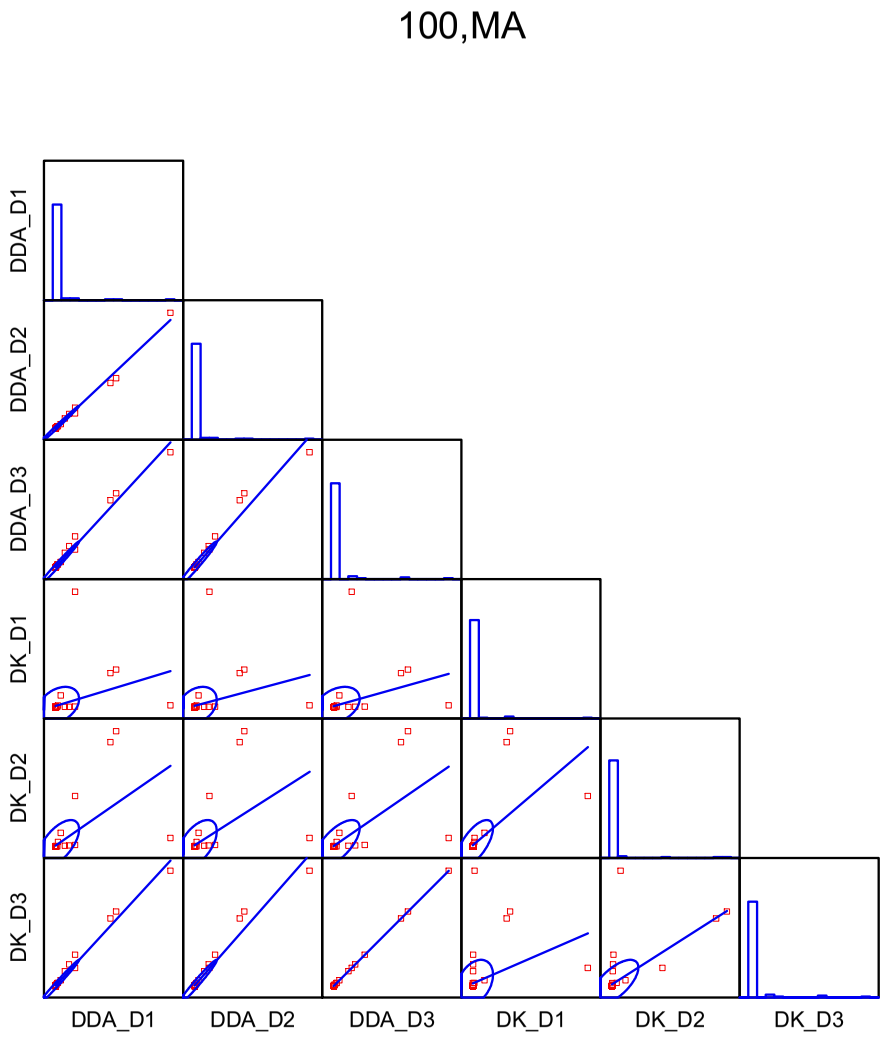


Figure 4f. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **MA gillnet;** each dot represents a species group and mesh size.

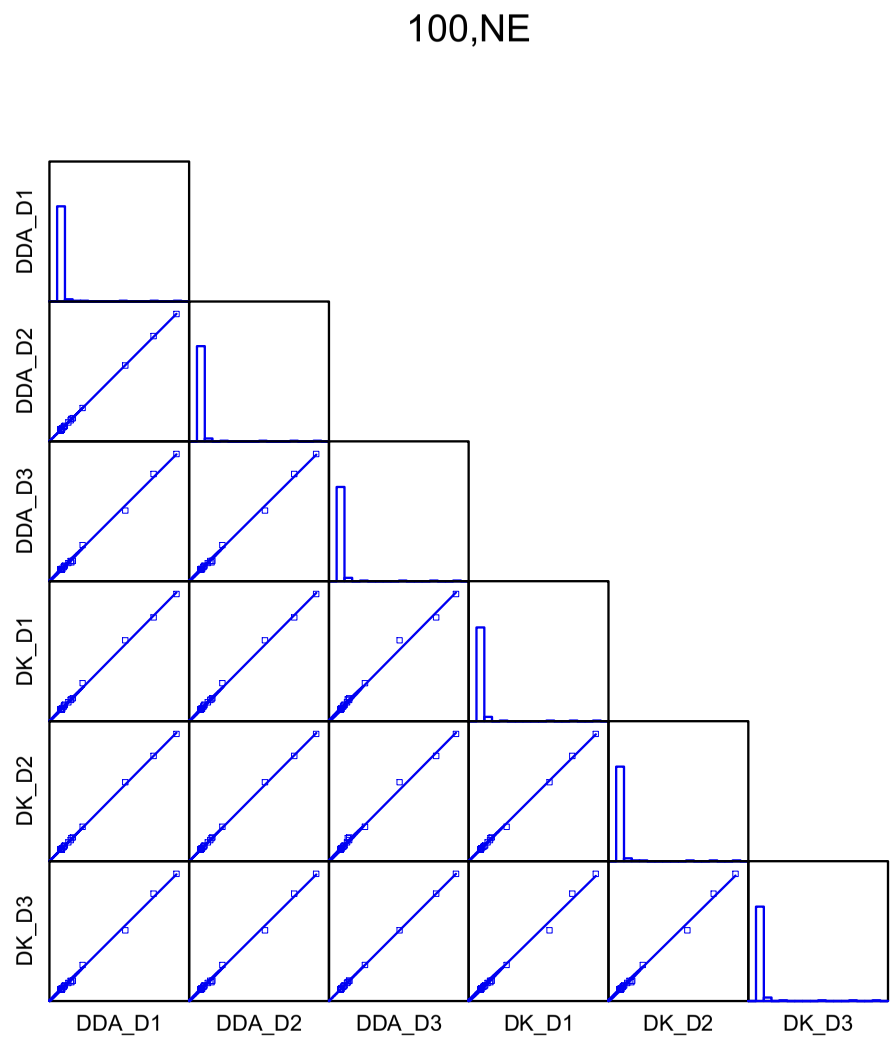


Figure 4g. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **NE gillnet**; each dot represents a species group and mesh size.

010,NE

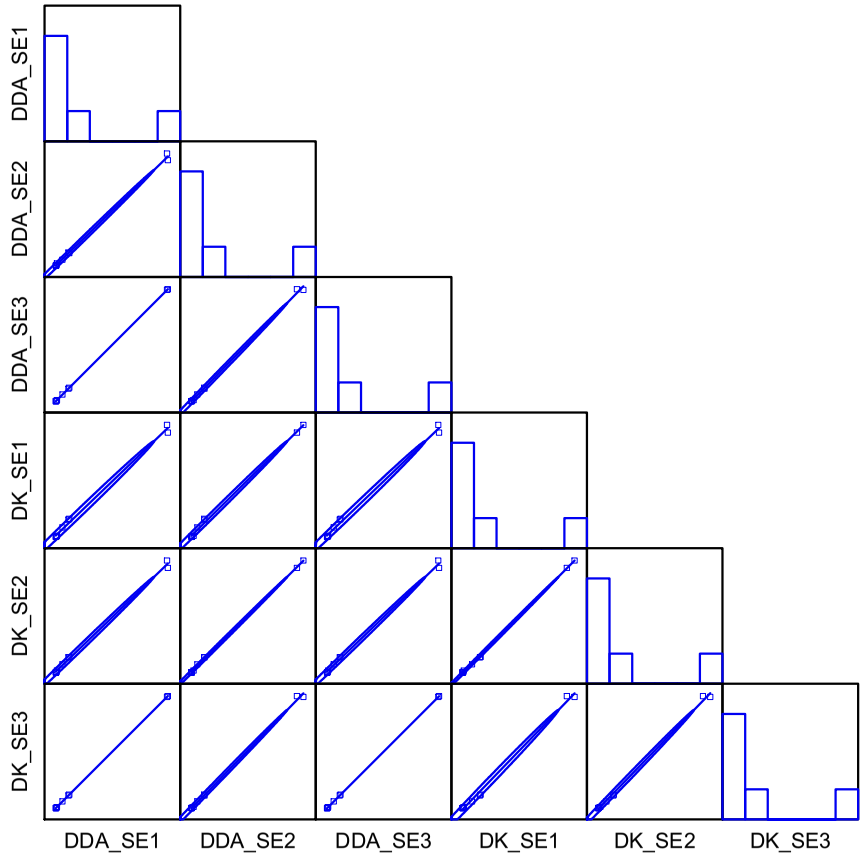


Figure 5a. Comparisons of the **standard error (SE)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **NE longline**; each dot represents a species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

050,MA

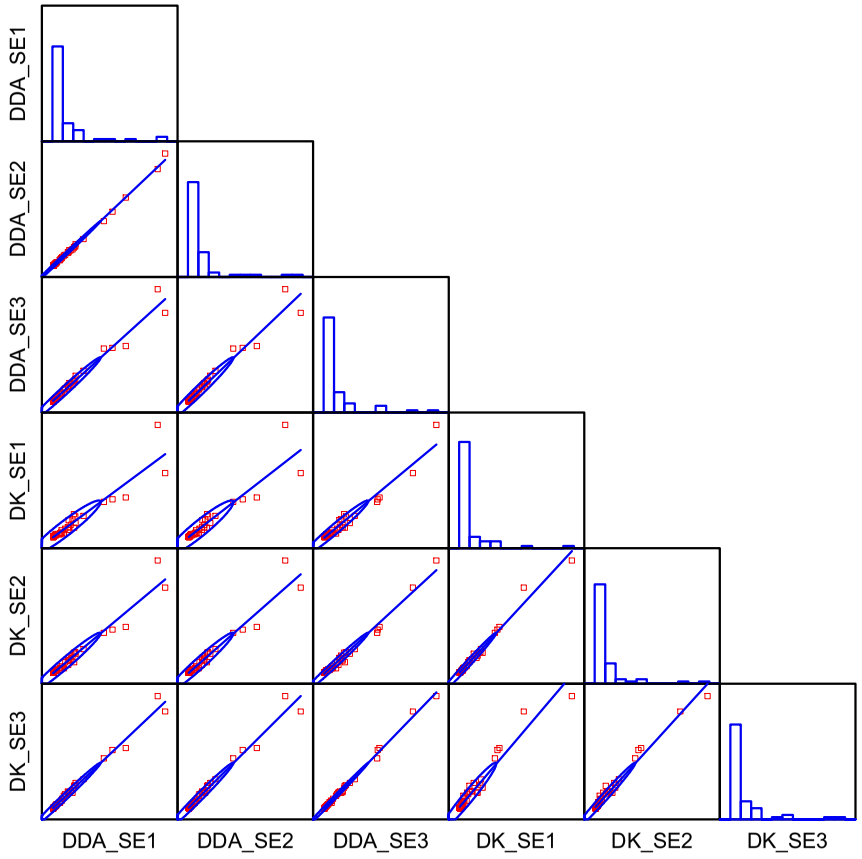


Figure 5b. Comparisons of the **SE** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **MA otter trawl**; each dot represents a species group and mesh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

050,NE

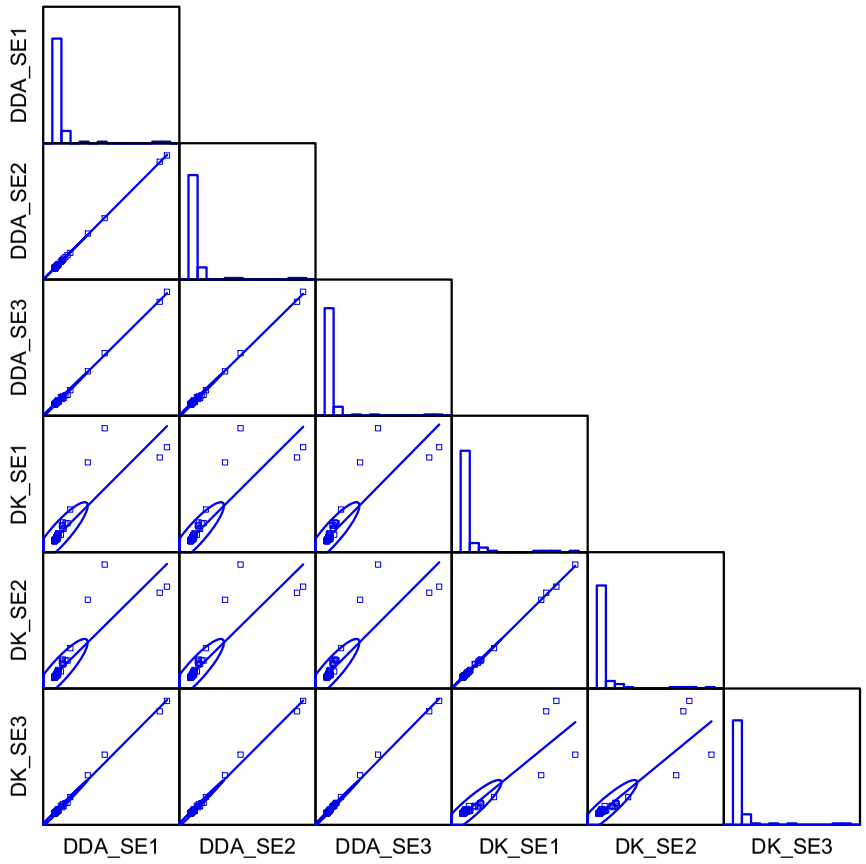


Figure 5c. Comparisons of the **SE** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **NE otter trawl**; each dot represents a species group and mesh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

132,MA

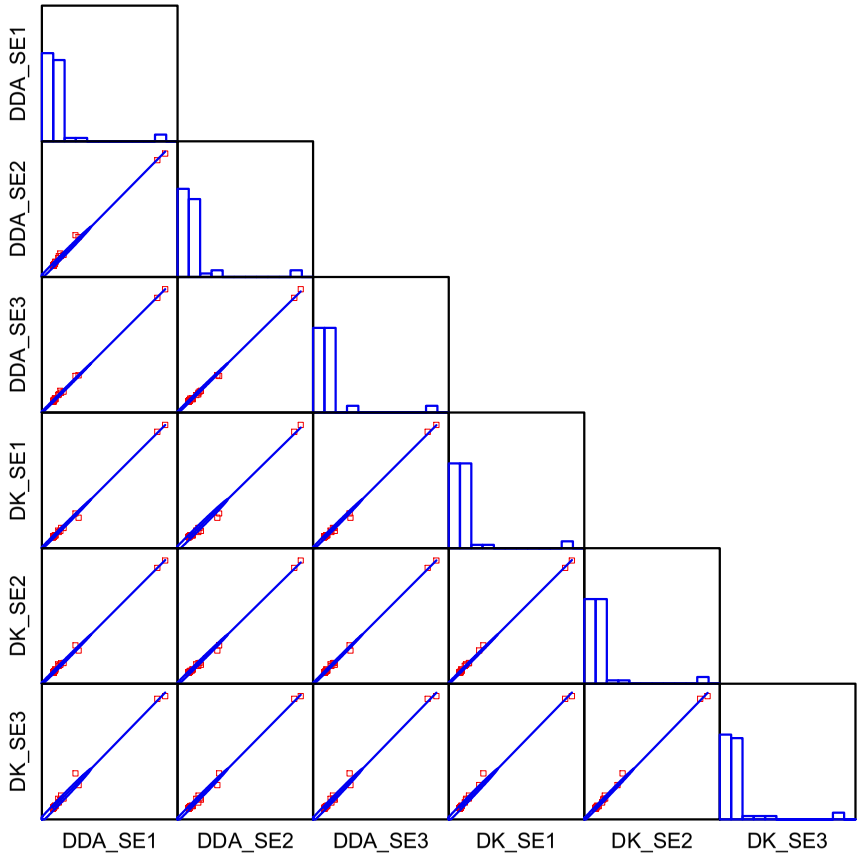


Figure 5d. Comparisons of the **SE** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **MA scallop dredge**; each dot represents a species group and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

132,NE

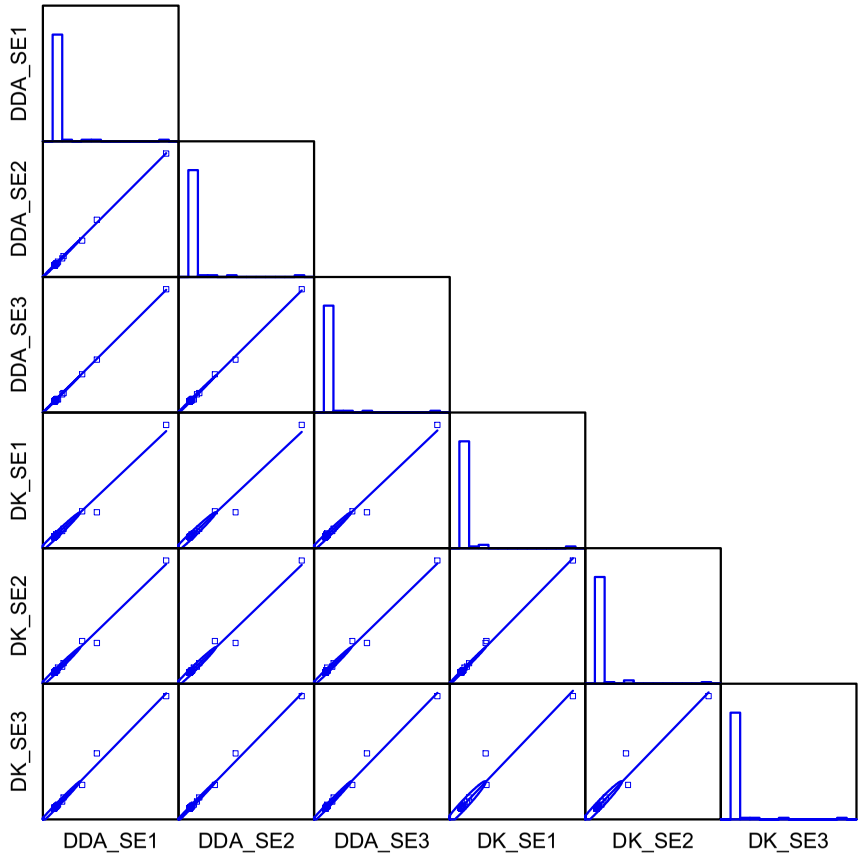


Figure 5e. Comparisons of the **SE** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **NE scallop dredge**; each dot represents a species group and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

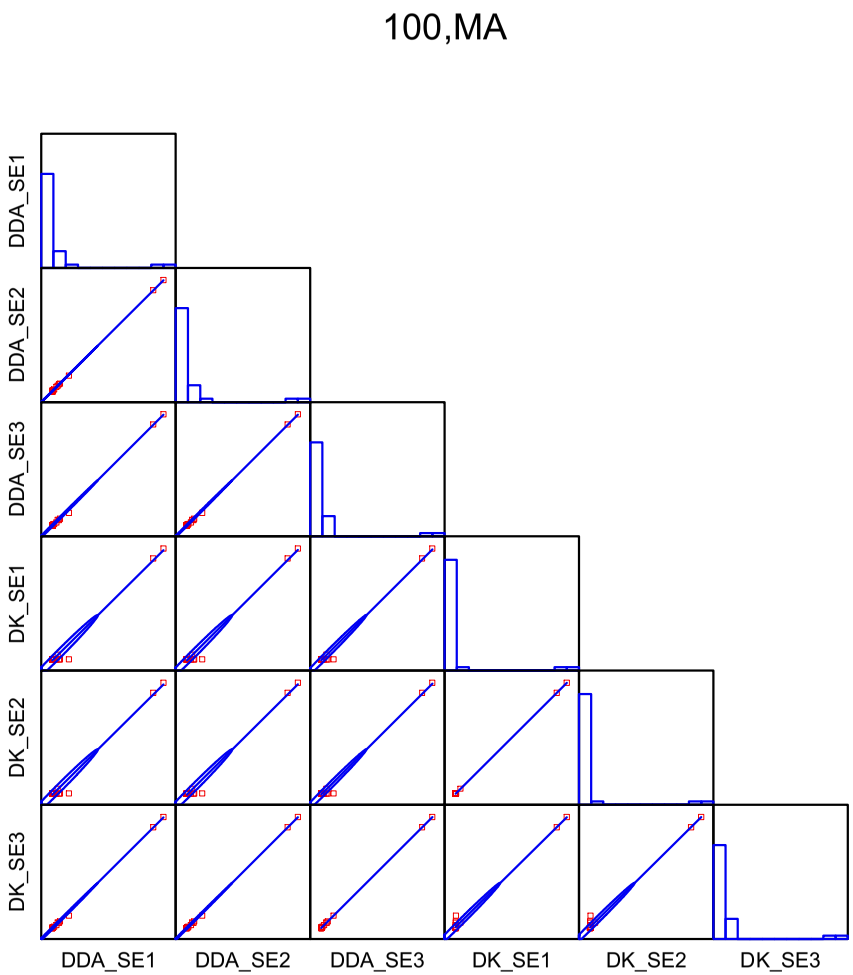


Figure 5f. Comparisons of the **SE** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **MA gillnet**; each dot represents a species group and mesh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

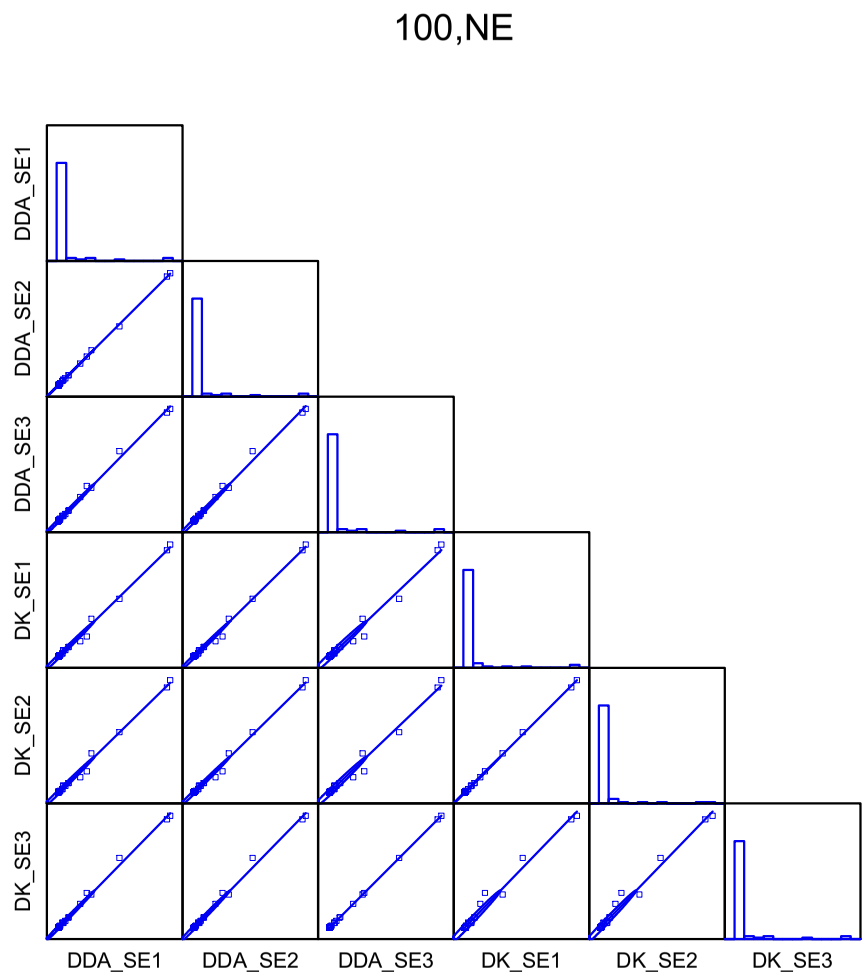


Figure 5g. Comparisons of the **SE** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **NE gillnet**; each dot represents a species group and mesh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

010,NE

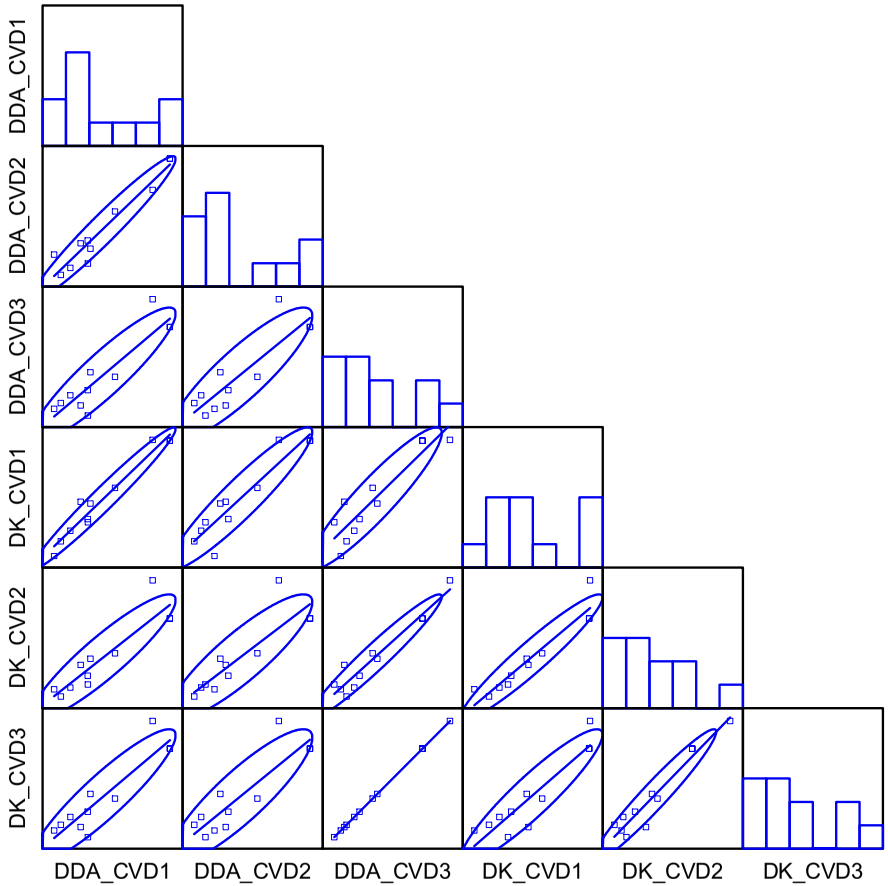


Figure 5h. Comparisons of the **coefficient of variation (CV)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **NE longline**; each dot represents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

050,MA

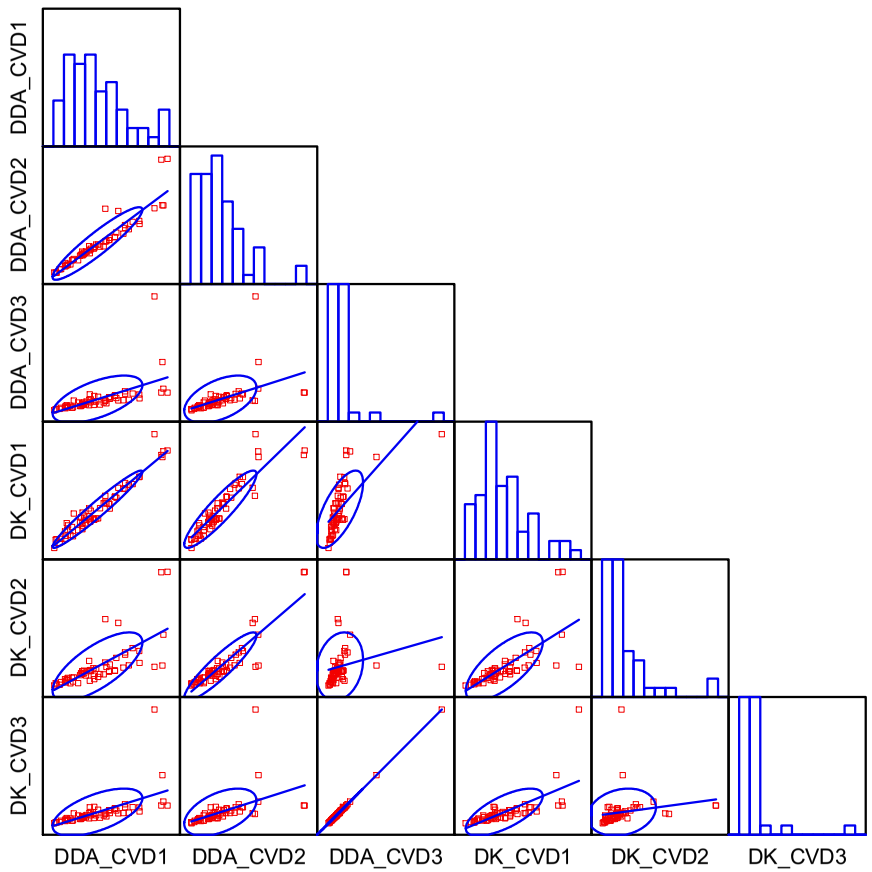


Figure 5i. Comparisons of the **CV** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **MA otter trawl**; each dot represents a species group and mesh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

050,NE

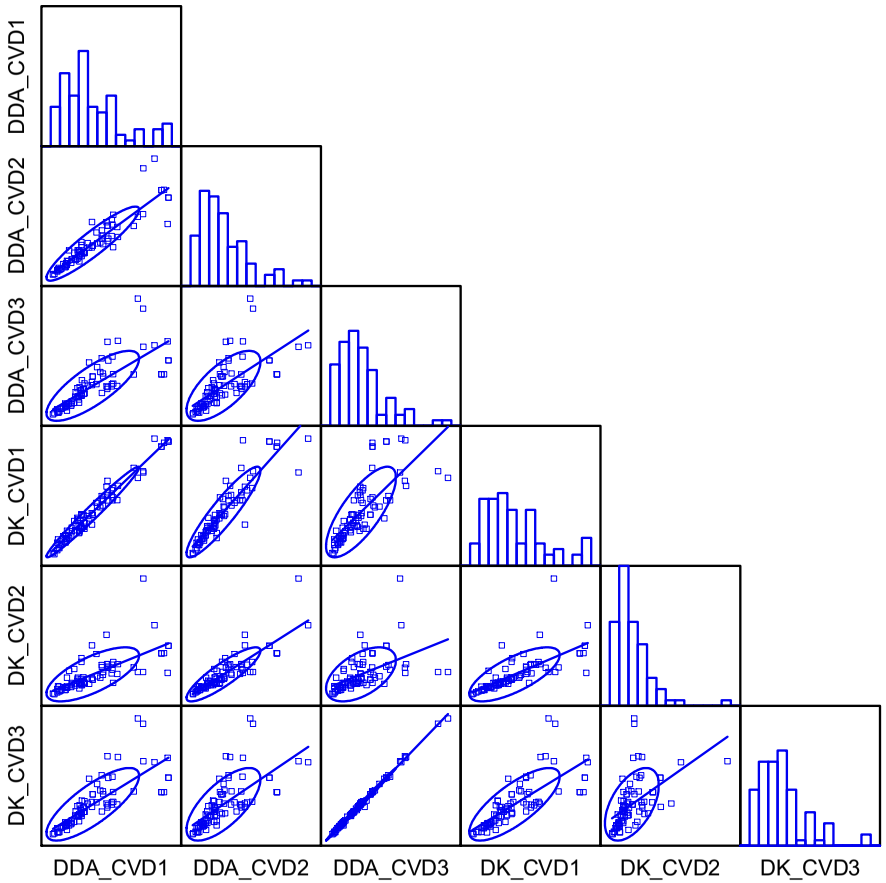


Figure 5j. Comparisons of the **CV** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **NE otter trawl**; each dot represents a species group and mesh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

132,MA

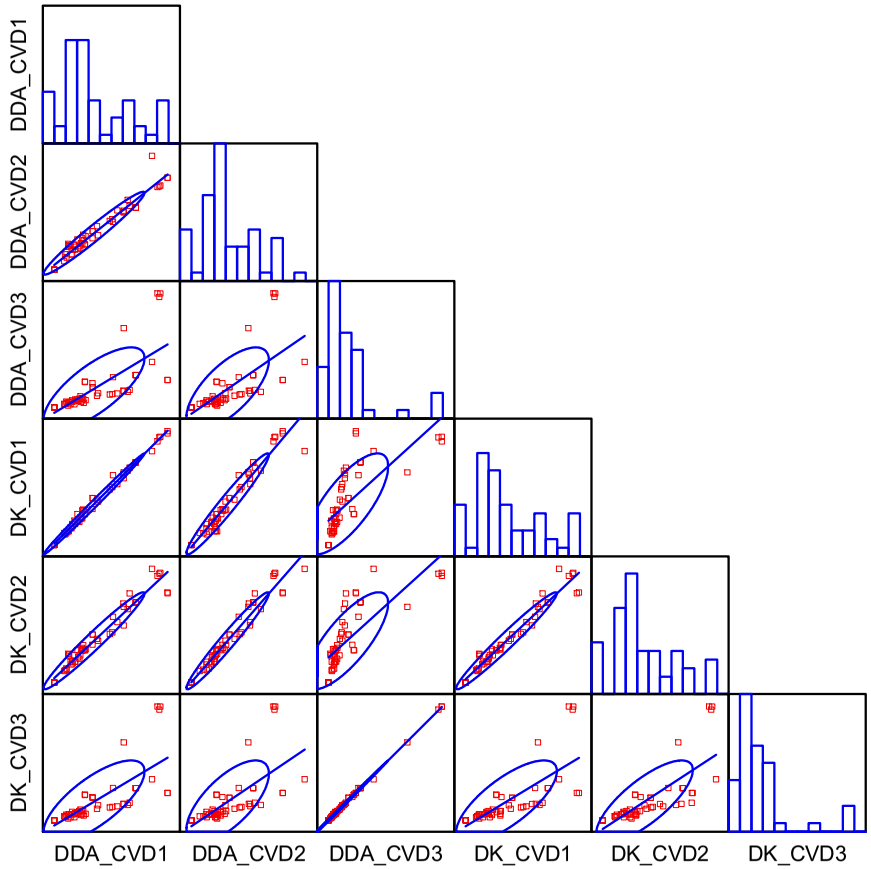


Figure 5k. Comparisons of the **CV** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **MA scallop dredge**; each dot represents a species group and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

132,NE

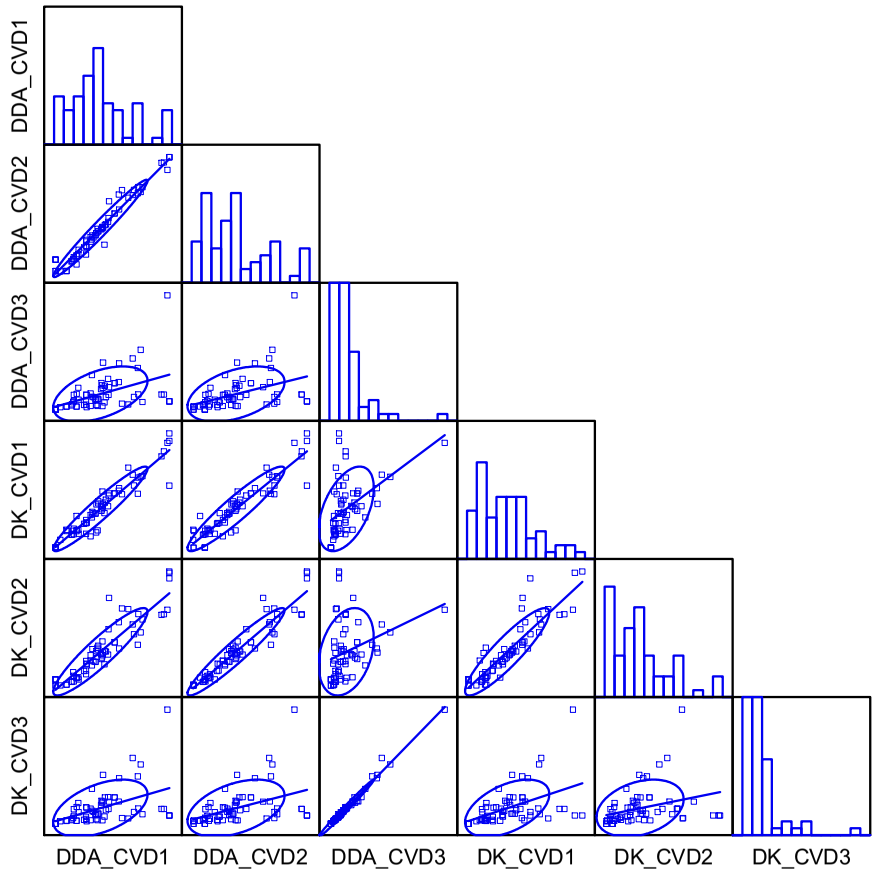


Figure 5l. Comparisons of the **CV** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **NE scallop dredge**; each dot represents a species group and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

100,MA

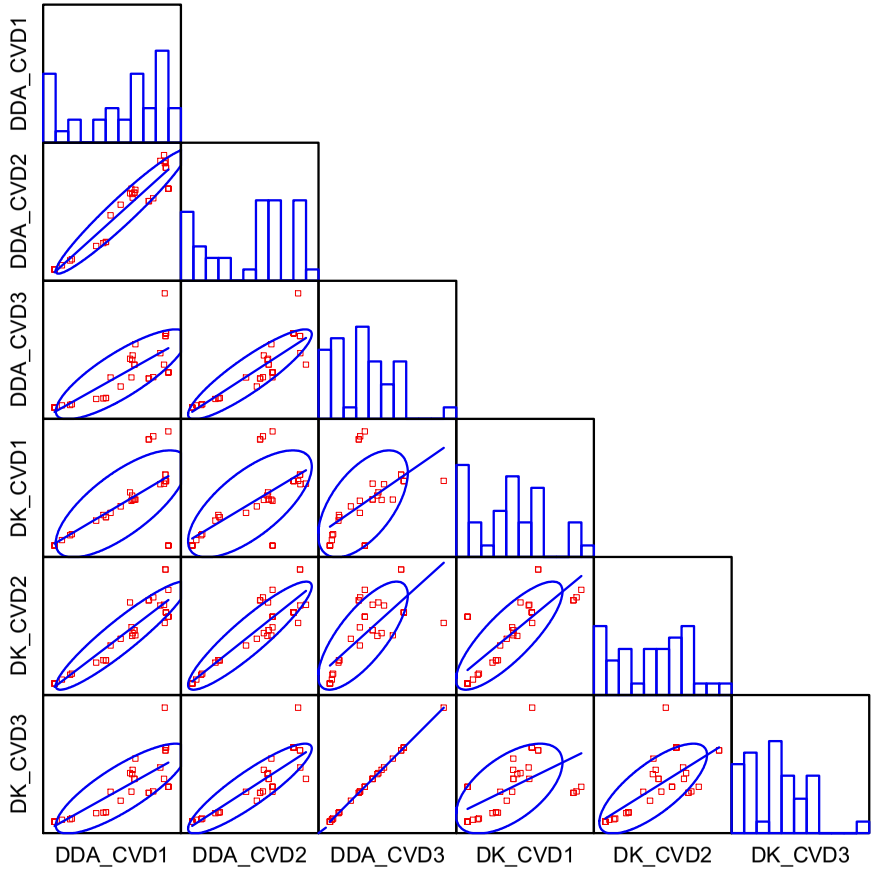


Figure 5m. Comparisons of the **CV** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **MA gillnet**; each dot represents a species group and mesh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

100,NE

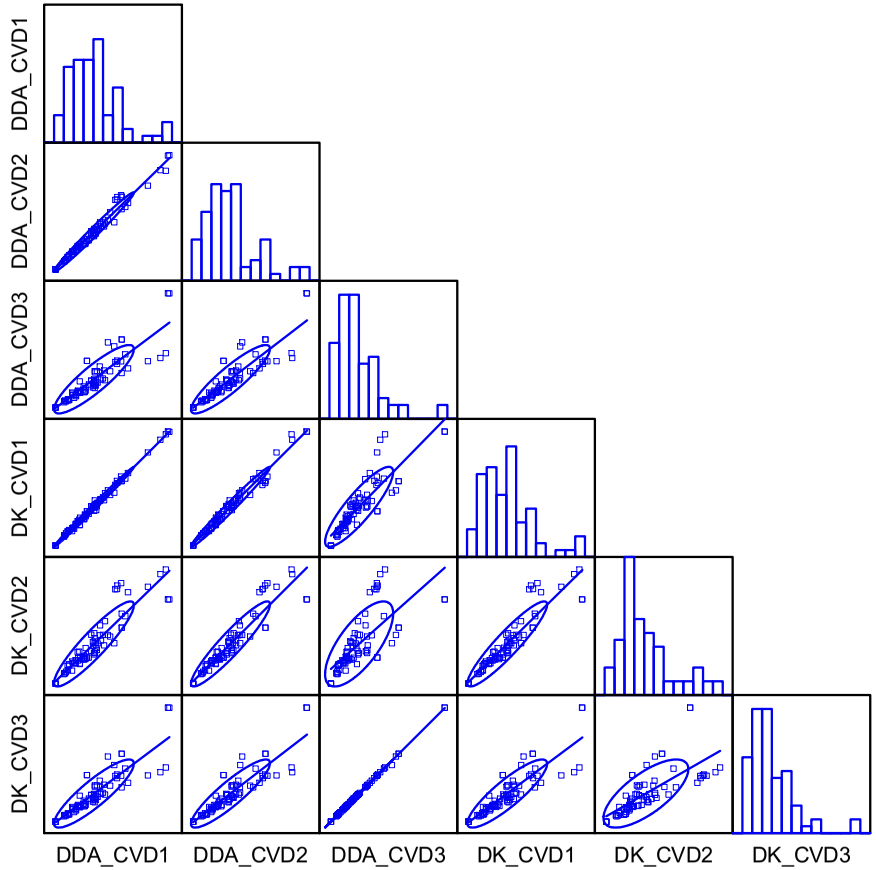
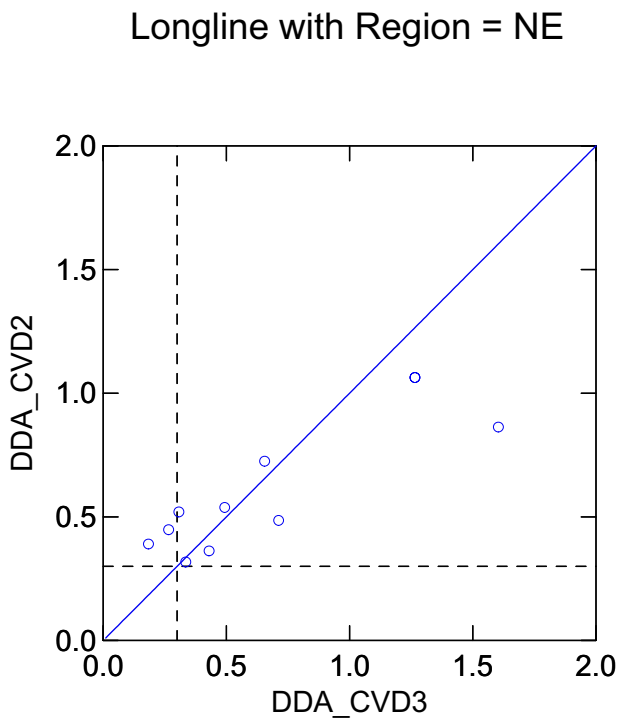


Figure 5n. Comparisons of the **CV** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **NE gillnet**; each dot represents a species group and mesh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



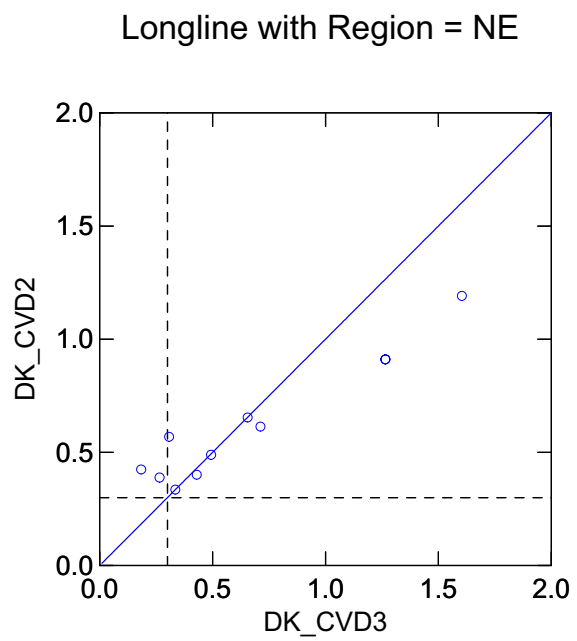


Figure 6a. Comparisons of **CV** of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard to days absent (DDA), top panel, and discard to kept (DK), bottom panel, for **NE longline**; each dot represents a species group and mesh size.

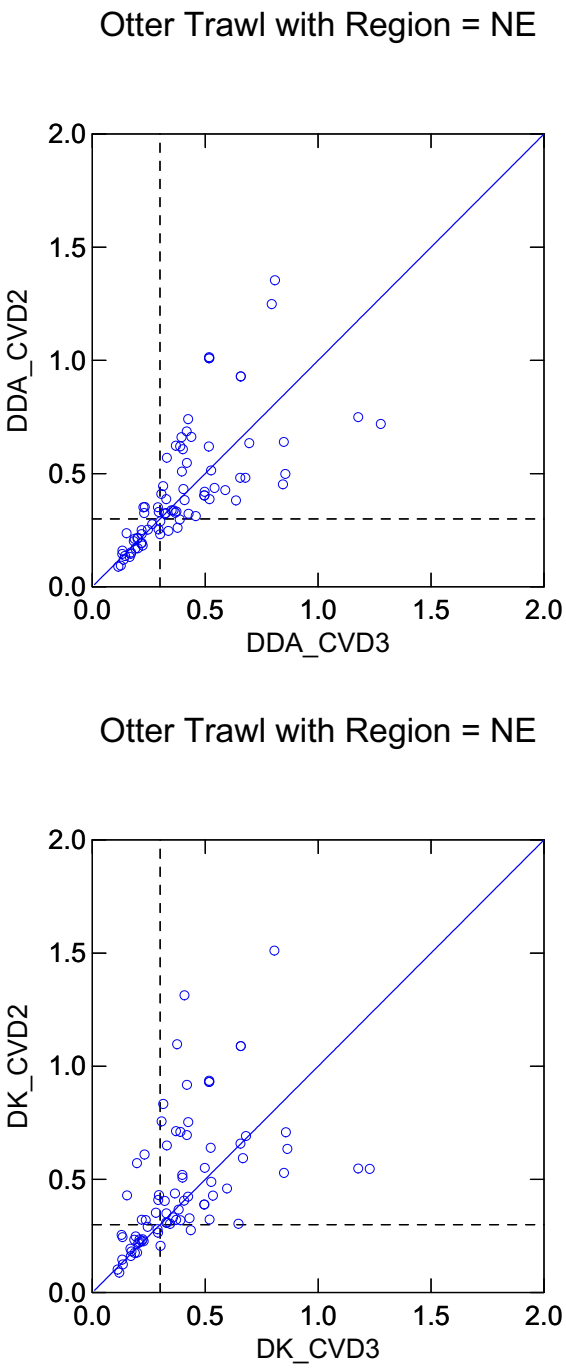


Figure 6b. Comparisons of **CV** of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard to days absent (DDA), top panel, and discard to kept (DK), bottom panel, for **NE otter trawl**; each dot represents a species group and mesh size.

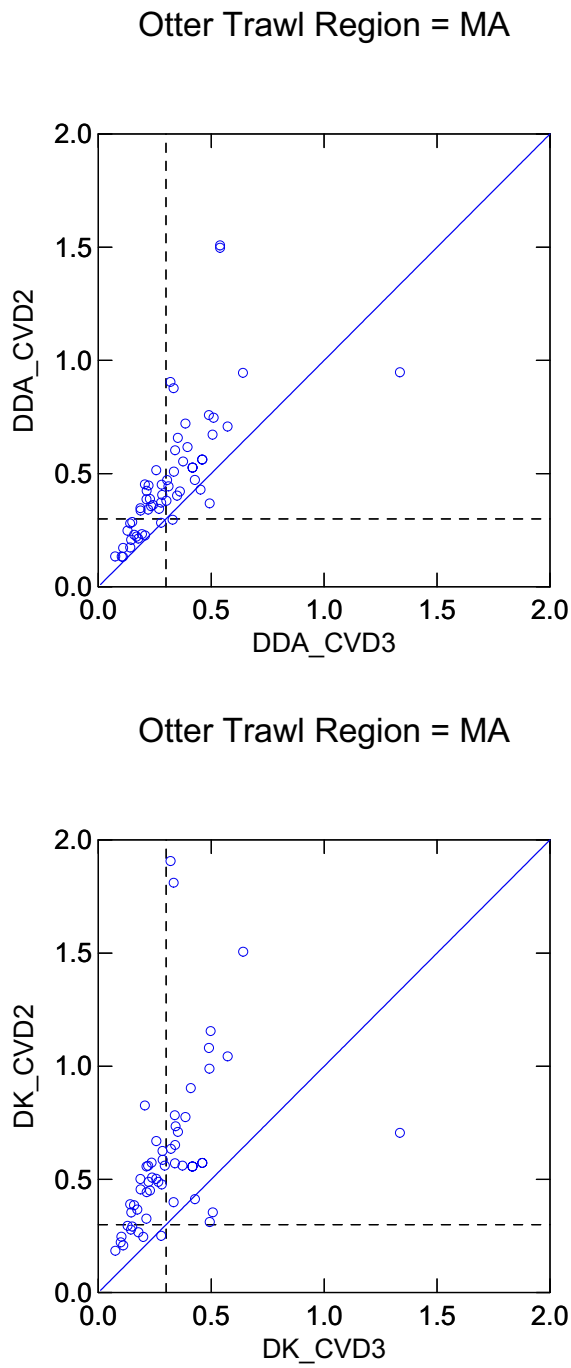
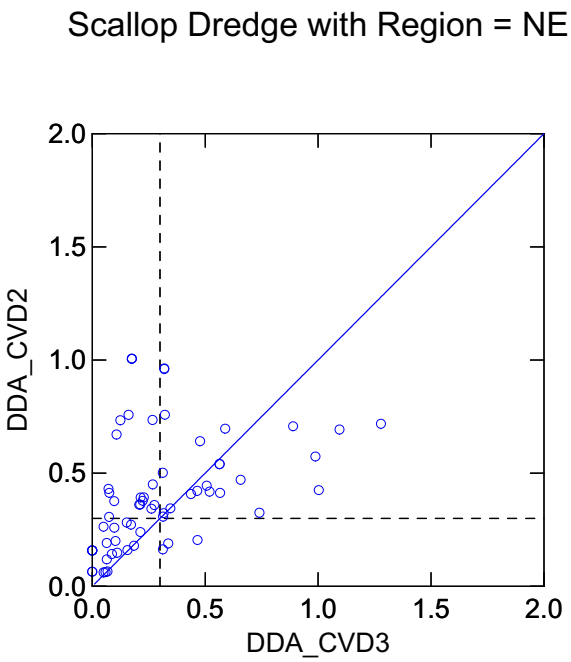
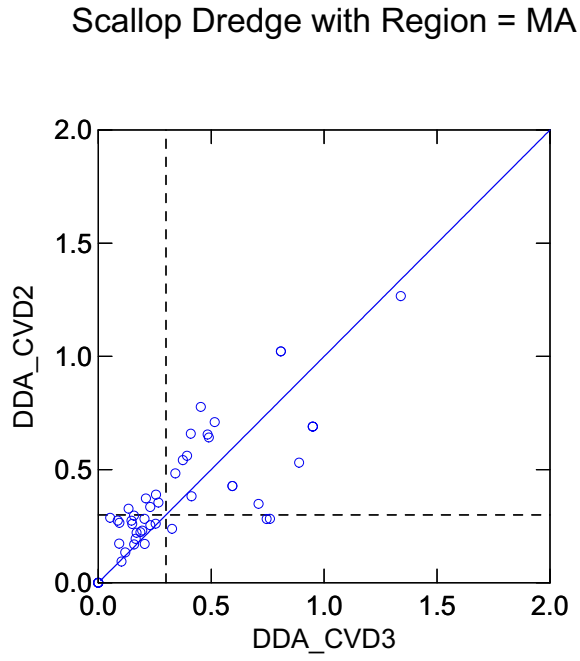


Figure 6c. Comparisons of **CV** of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard to days absent (DDA), top panel, and discard to kept (DK), bottom panel, for **MA otter trawl**; each dot represents a species group and mesh size.





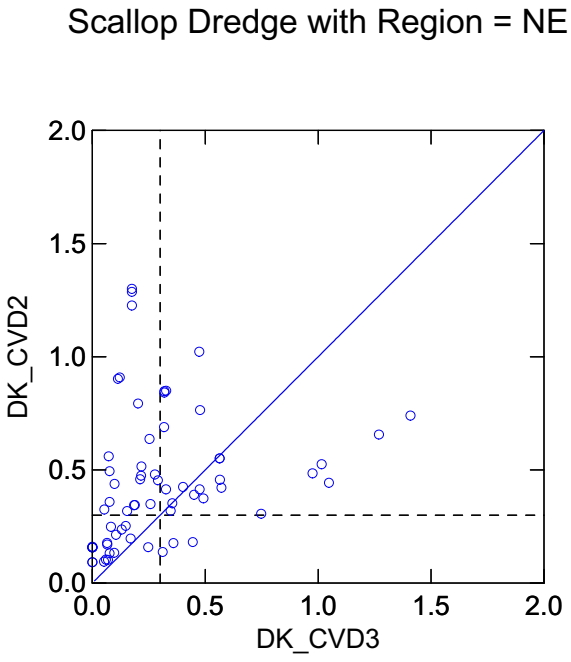


Figure 6d. Comparisons of **CV** of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard to days absent (DDA), top panel, and discard to kept (DK), bottom panel, for **NE scallop dredge**; each dot represents a species group and mesh size.

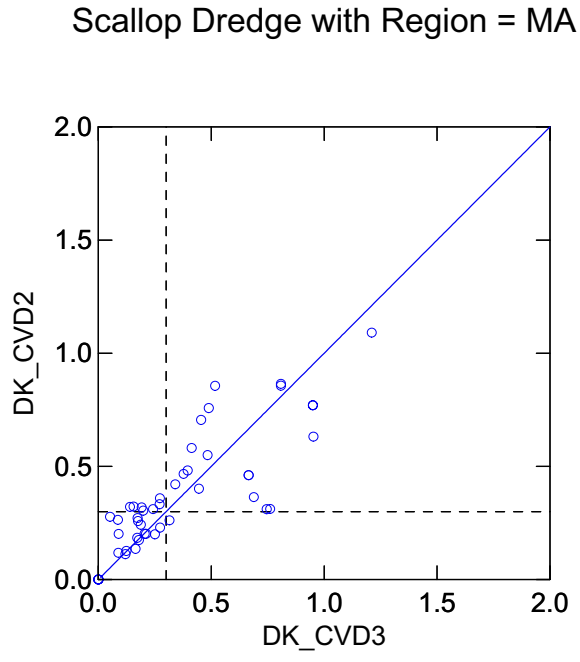


Figure 6e. Comparisons of **CV** of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard to days absent (DDA), top panel, and discard to kept (DK), bottom panel, for **MA otter trawl**; each dot represents a species group and mesh size.

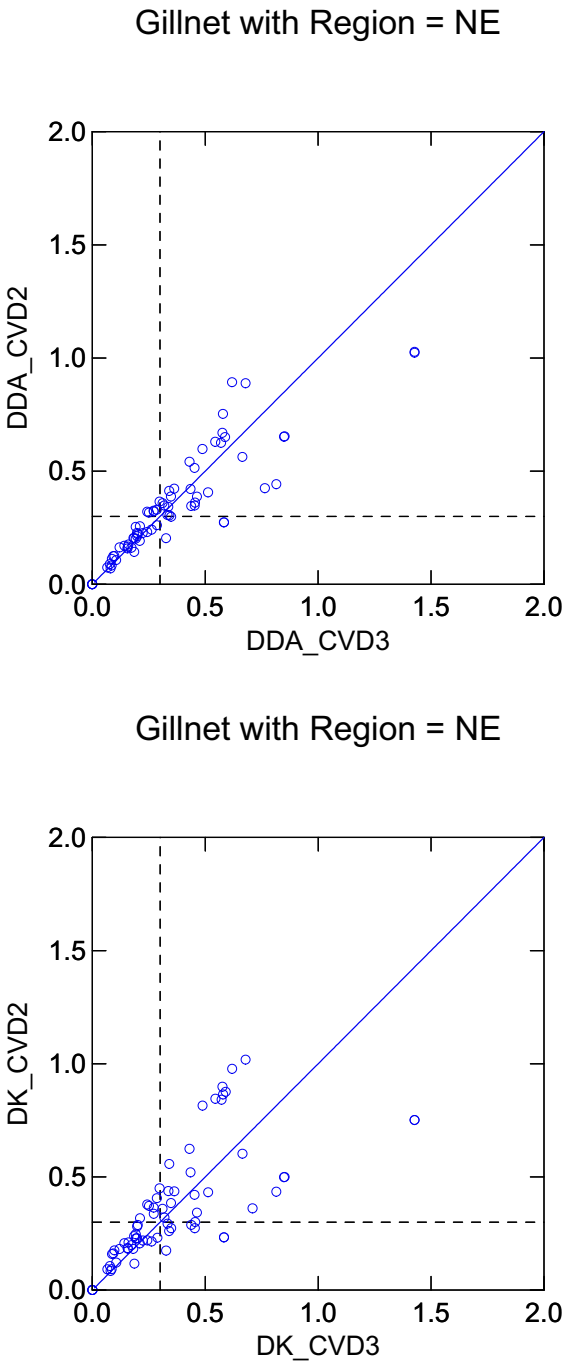


Figure 6f. Comparisons of **CV** of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard to days absent (DDA), top panel, and discard to kept (DK), bottom panel, for **NE gillnet**; each dot represents a species group and mesh size.

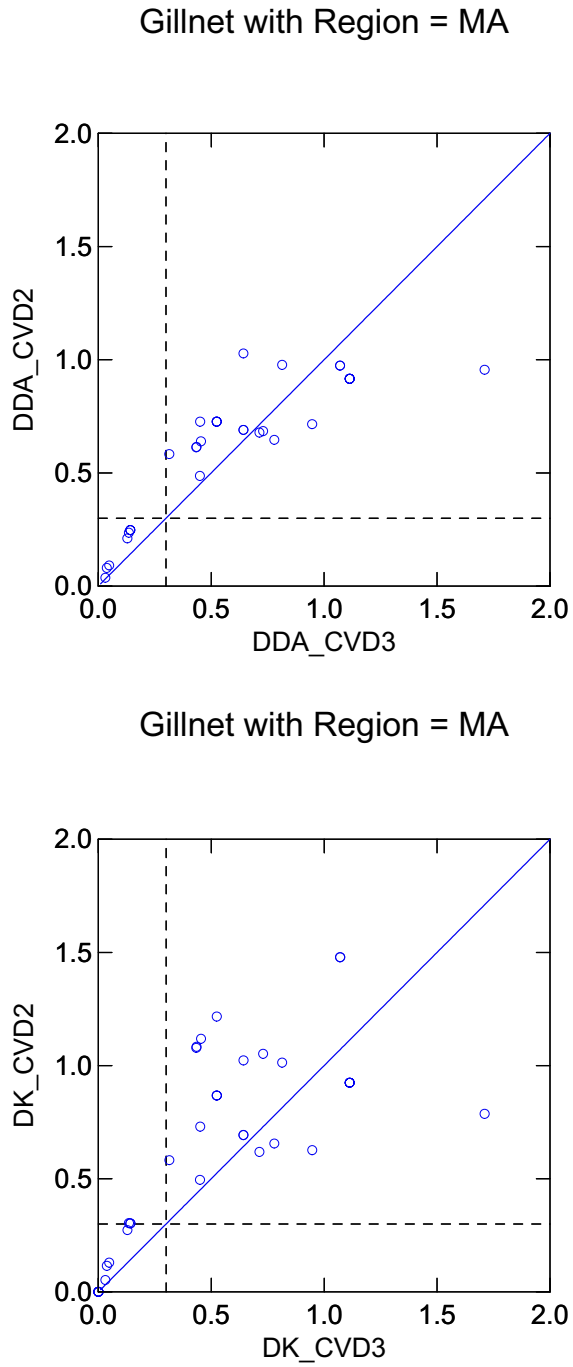
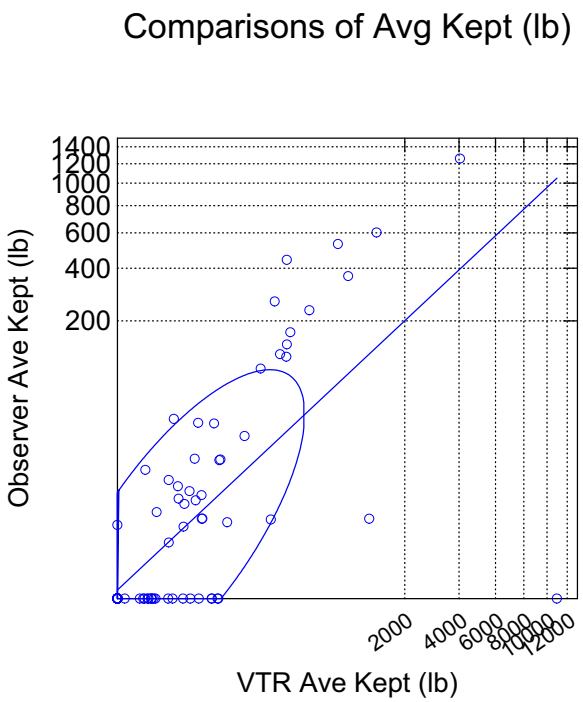
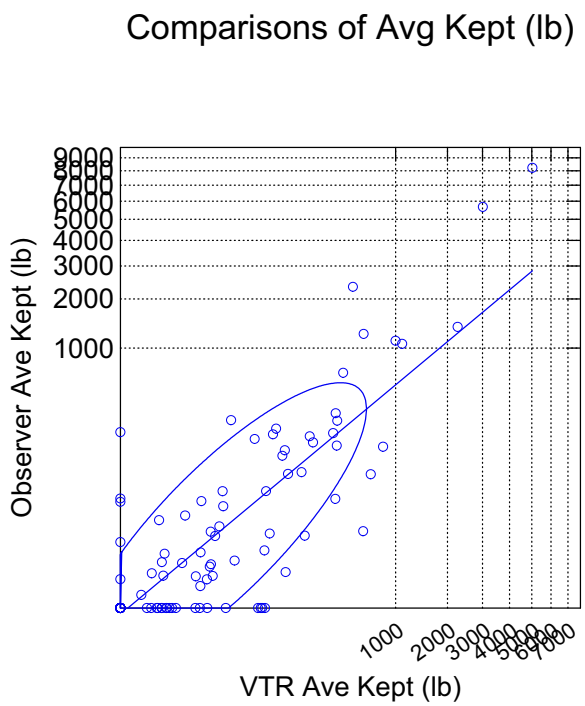


Figure 6g. Comparisons of **CV** of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard to days absent (DDA), top panel, and discard to kept (DK), bottom panel, for **MA gillnet**; each dot represents a species group and mesh size.

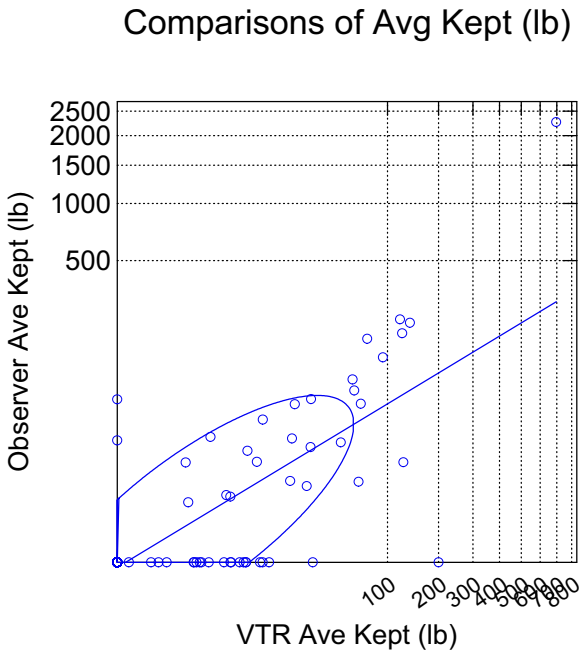
Bluefish



Fluke-Scup-Black Sea Bass



Spiny Dogfish



NE Multispecies (Large Mesh)

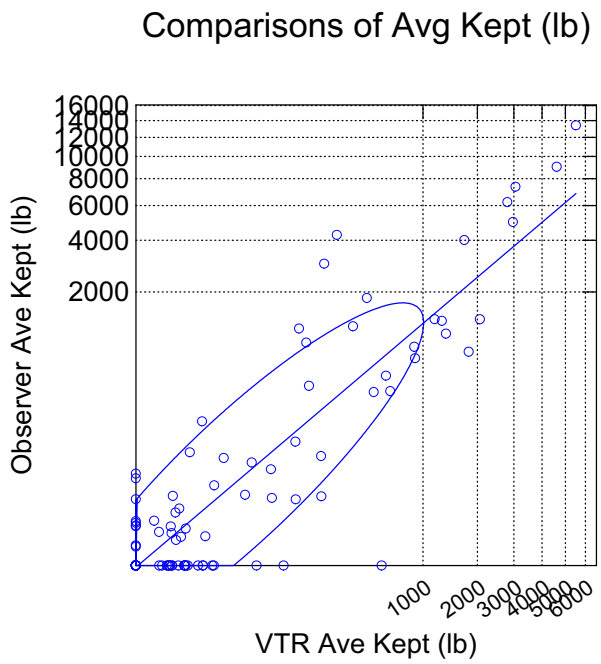
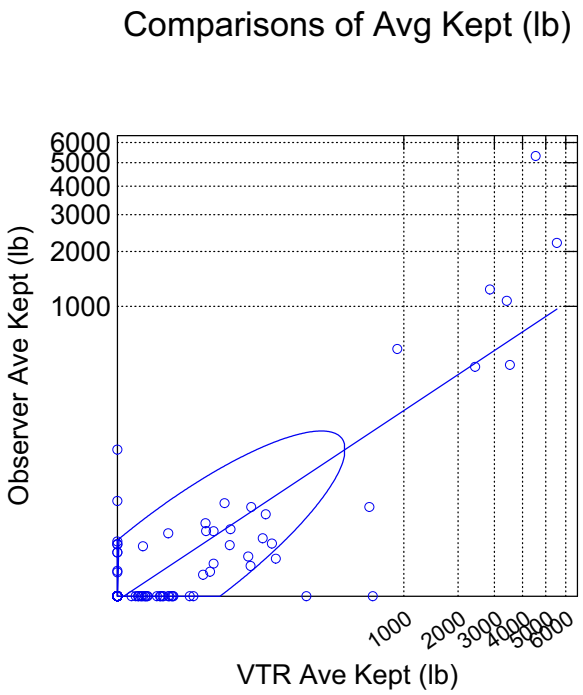
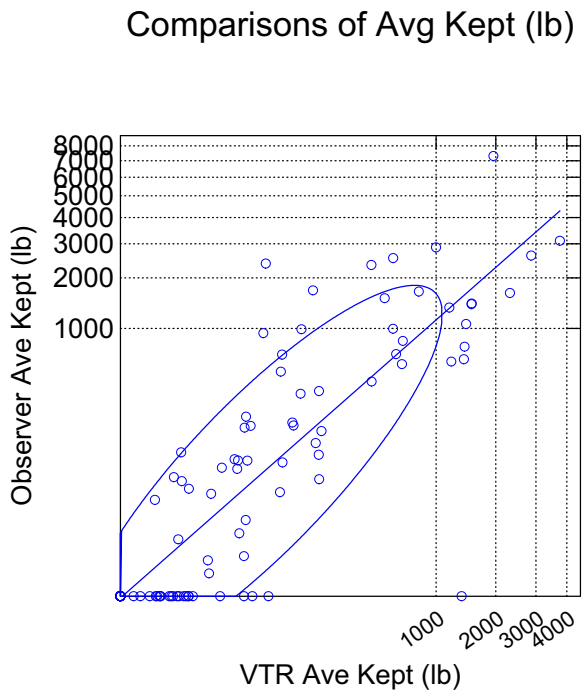


Figure 7. Comparisons of **average kept pounds** (fourth root transformation used), by species group, in the NEFOP and VTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

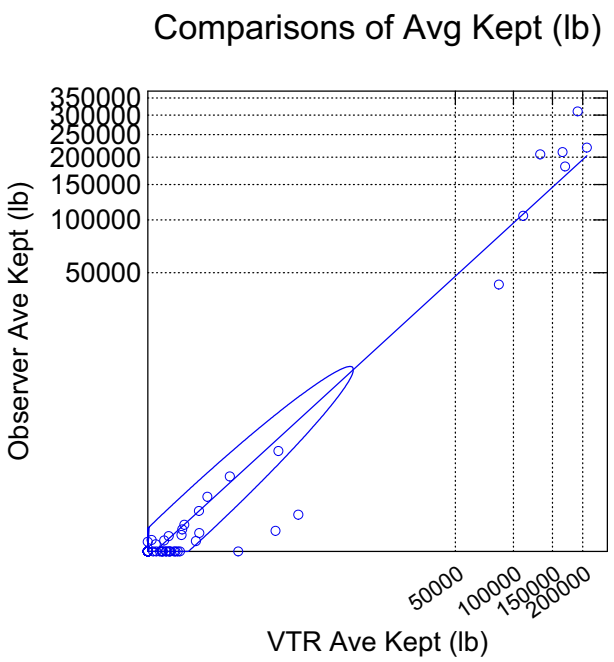
NE Multispecies (Small Mesh)



Monkfish



Herring



Red Crab

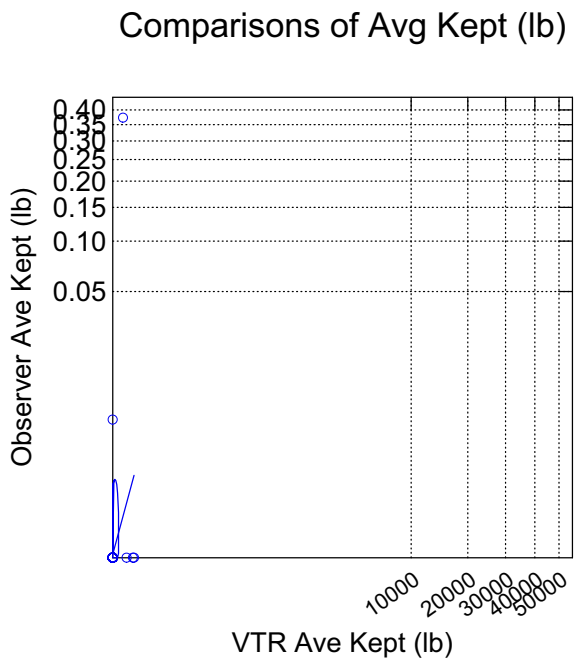
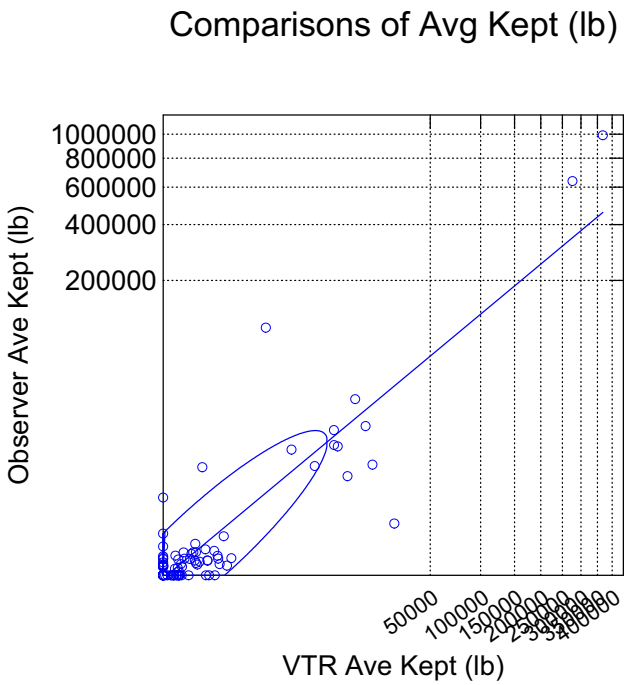
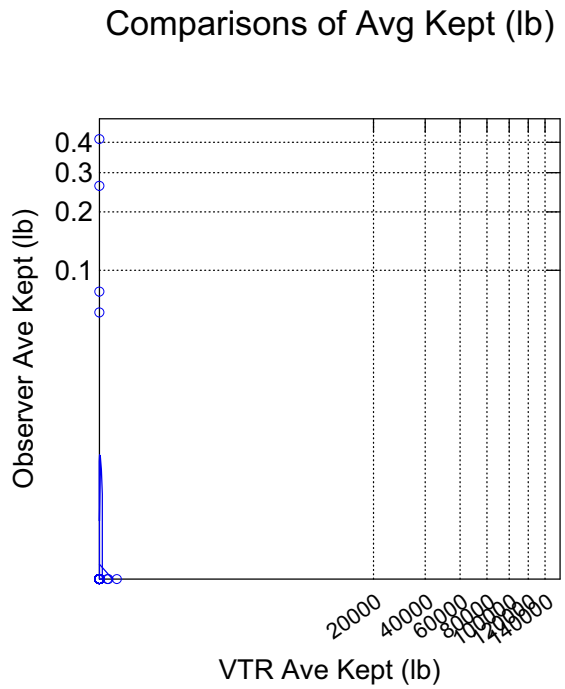


Figure 7 continued.

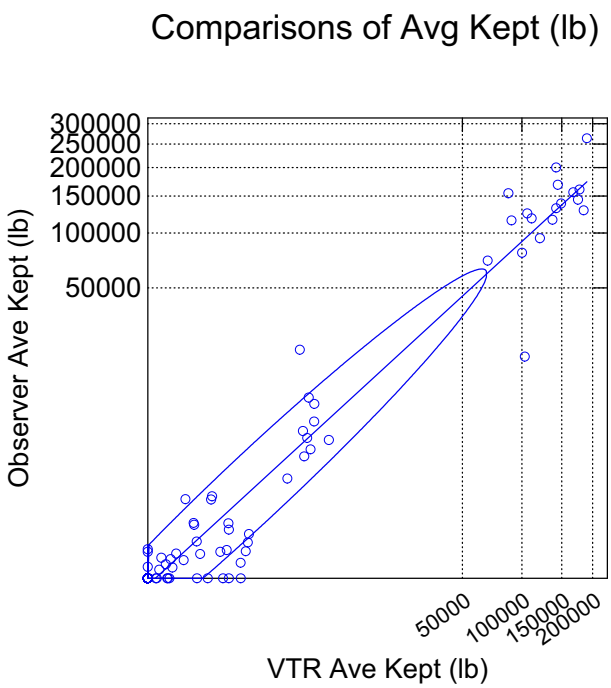
Mackerel-Squid-Butterfish



Surf Clam – Ocean Quahog



Scallops



Skate Complex

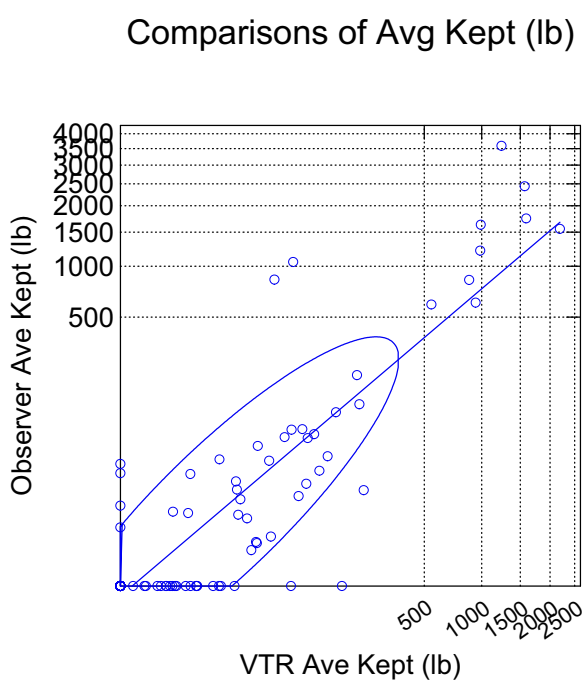
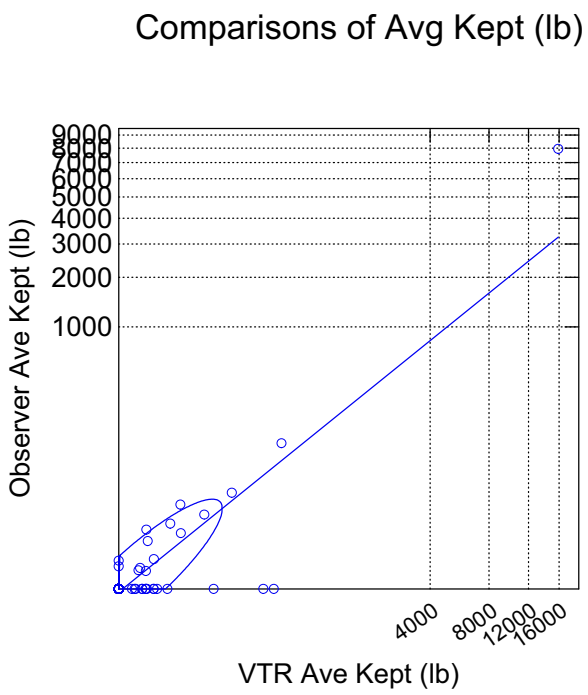


Figure 7 continued.

Tilefish



All Species

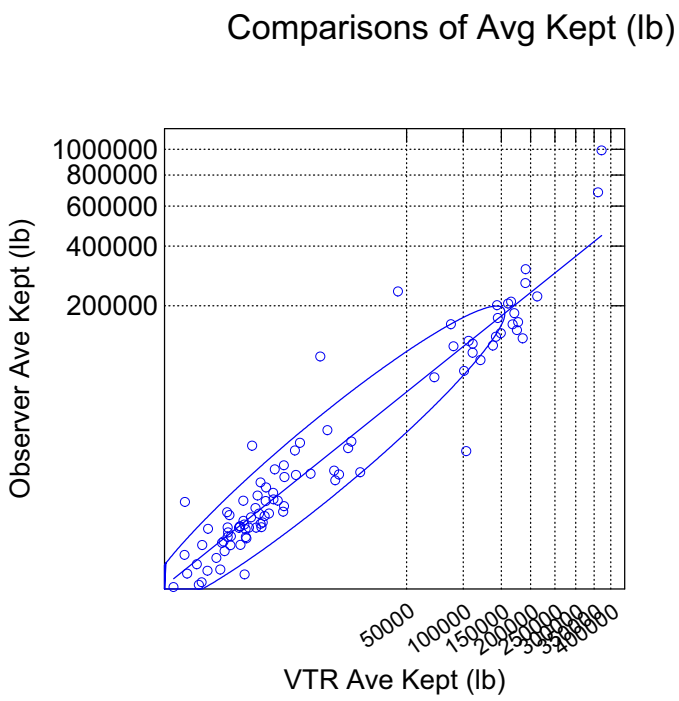
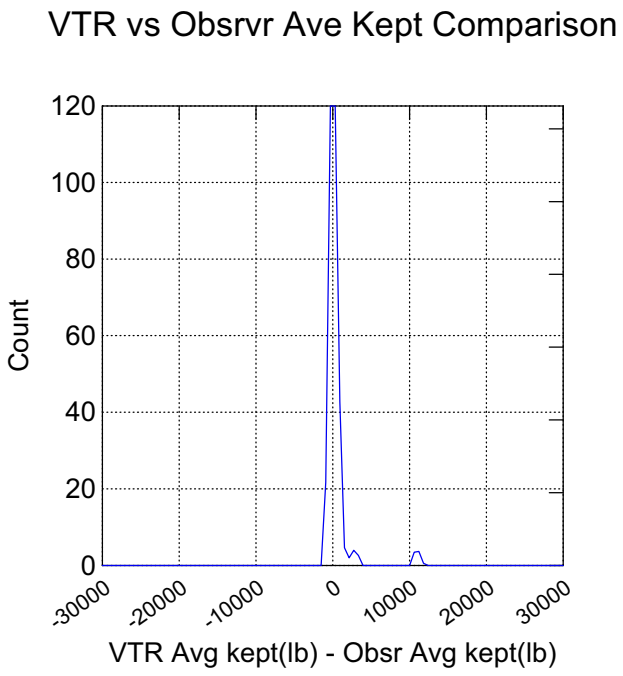
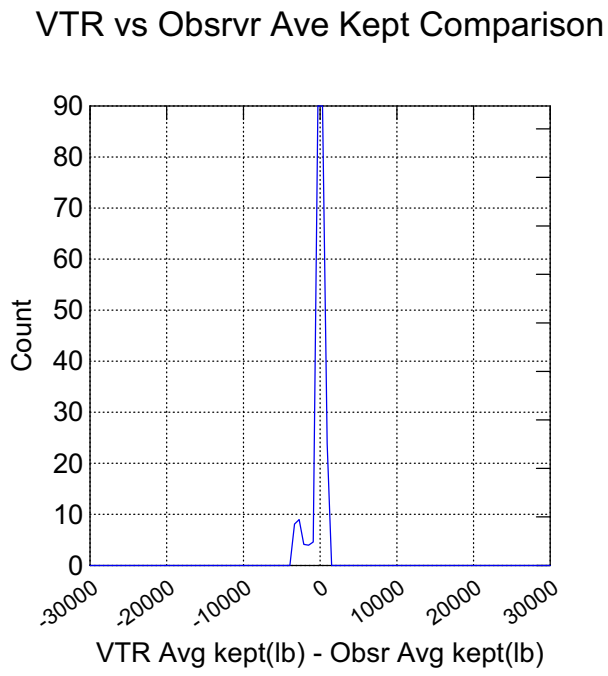


Figure 7 continued.

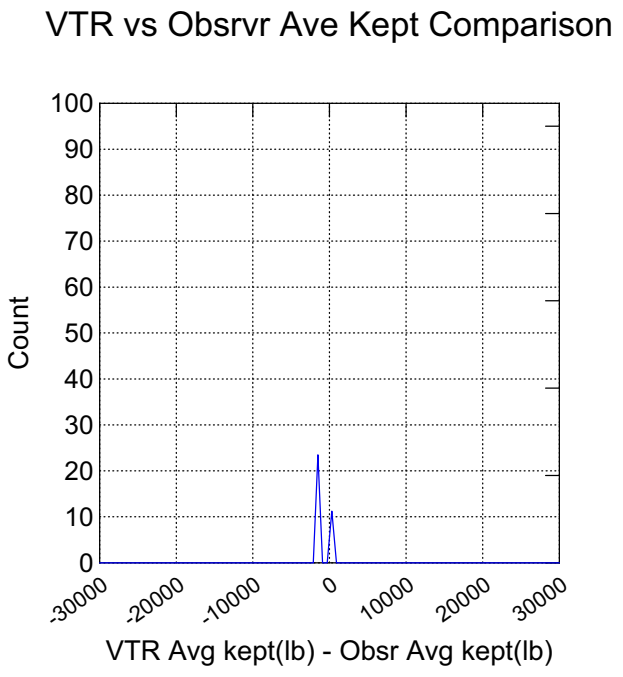
Bluefish



Fluke-Scup-Black Sea Bass



Spiny Dogfish



NE Multispecies (Large Mesh)

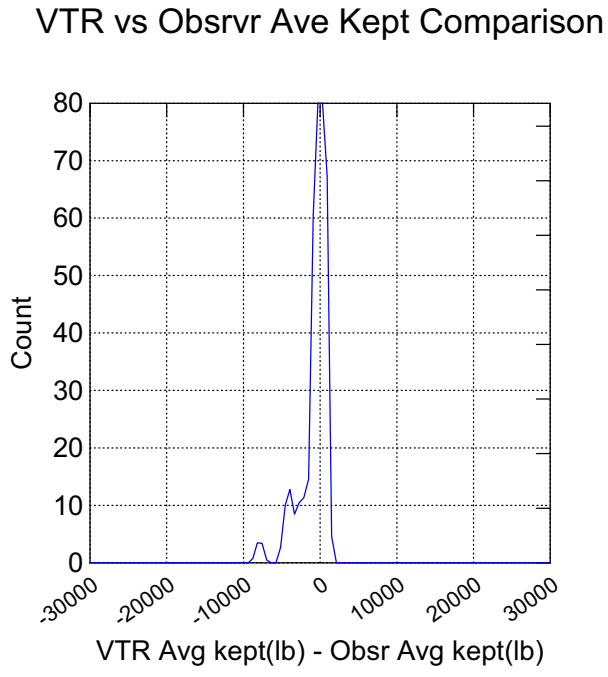
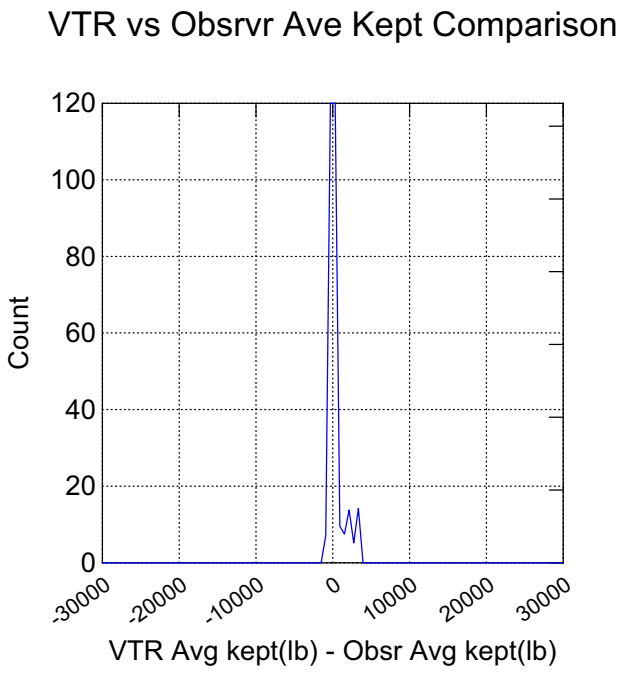
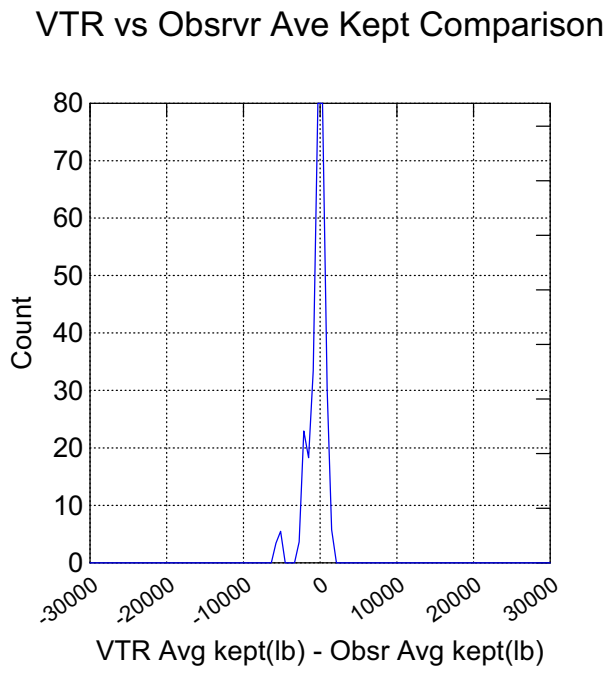


Figure 8. The distribution of differences in the **average kept pounds** of species groups in the NEFOP and VTR data for 2004.

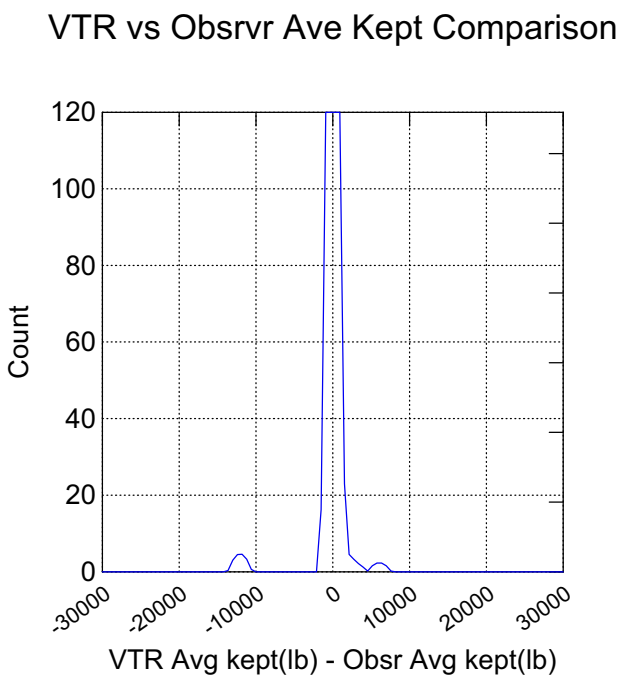
NE Multispecies (Small Mesh)



Monkfish



Herring



Mackerel-Squid-Butterfish

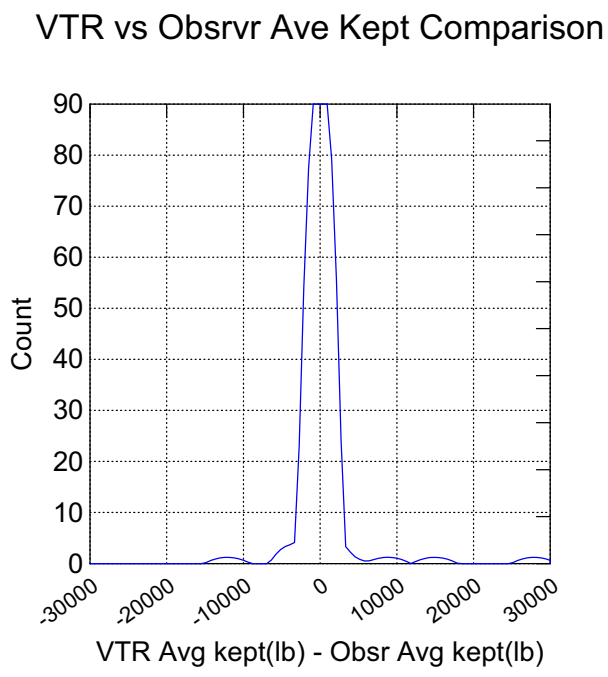
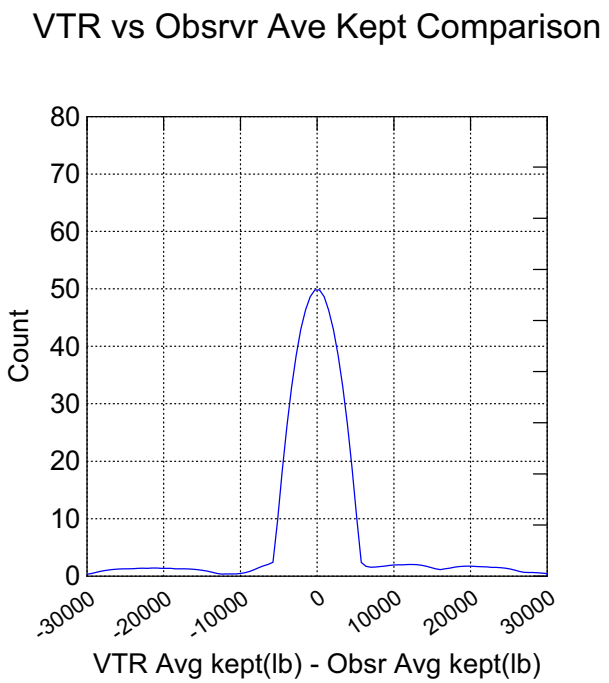
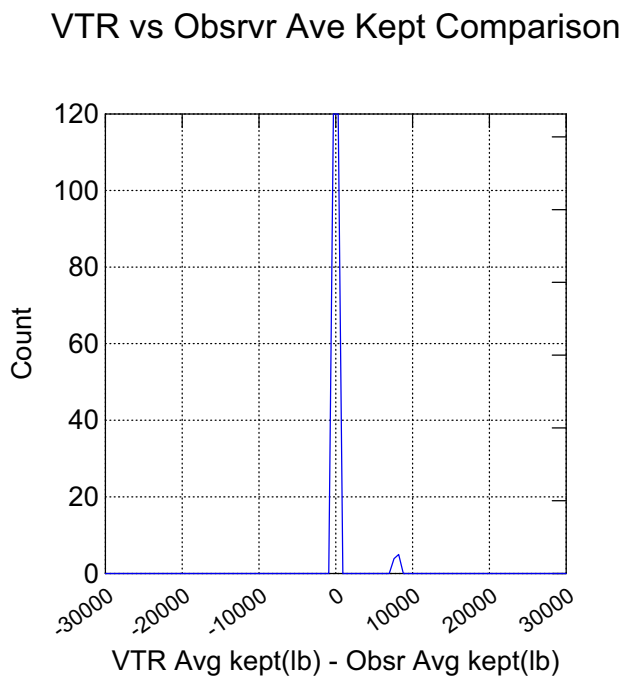


Figure 8 continued.

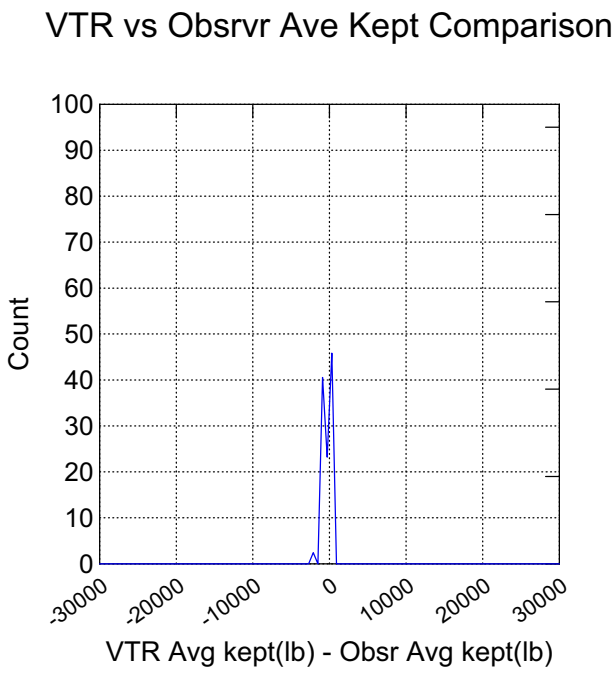
Scallops



Tilefish



Skate Complex



All Species

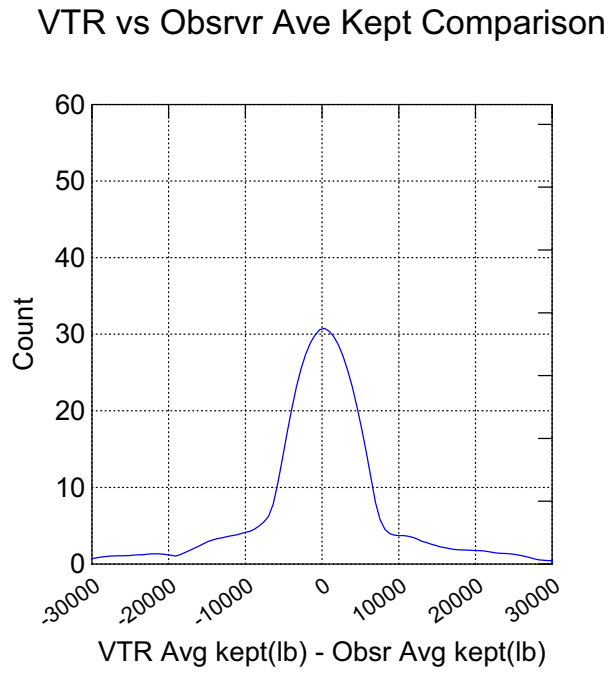
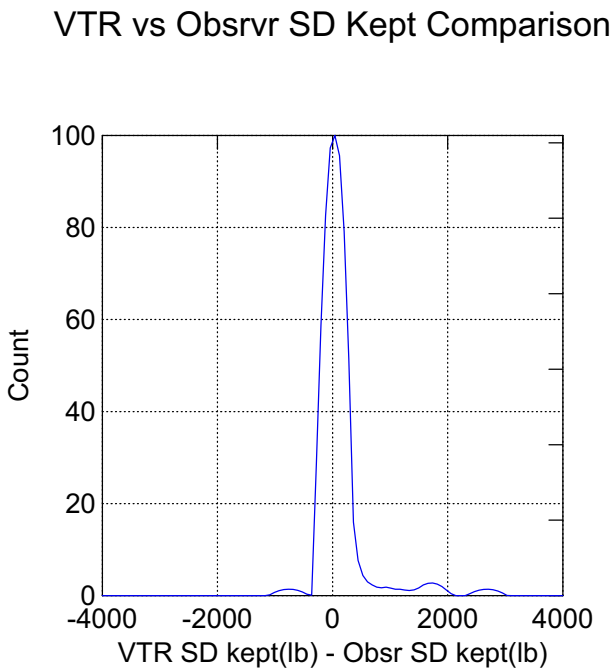
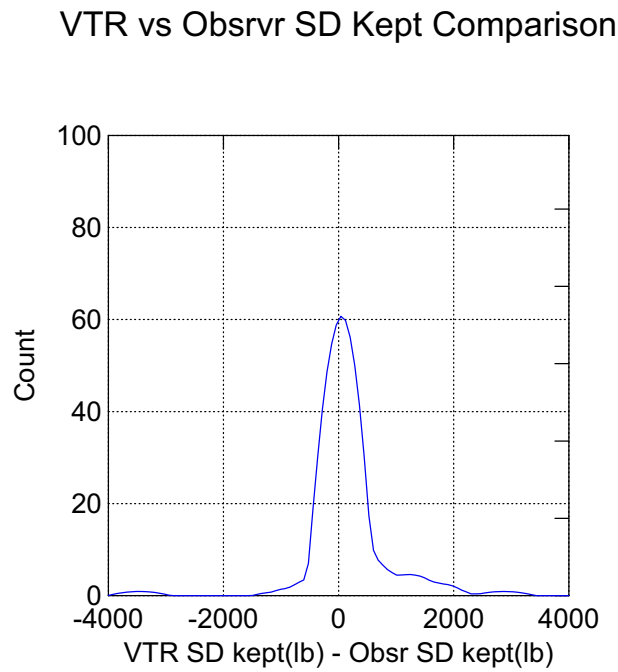


Figure 8 continued.

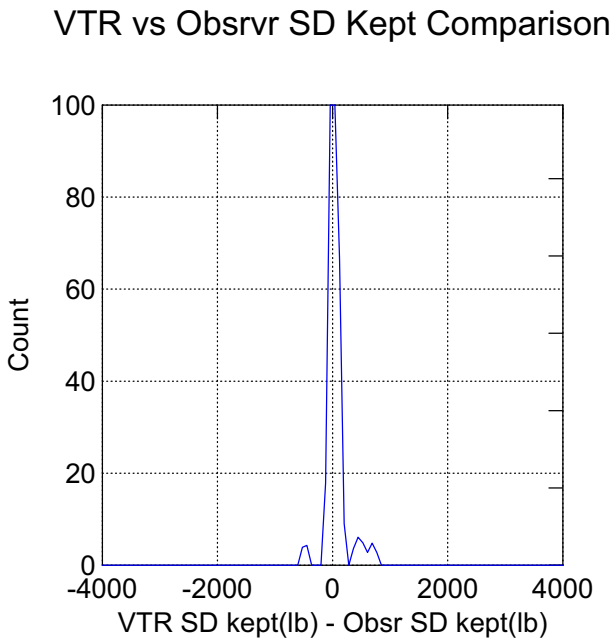
Bluefish



Fluke-Scup-Black Sea Bass



Spiny Dogfish



NE Multispecies (Large Mesh)

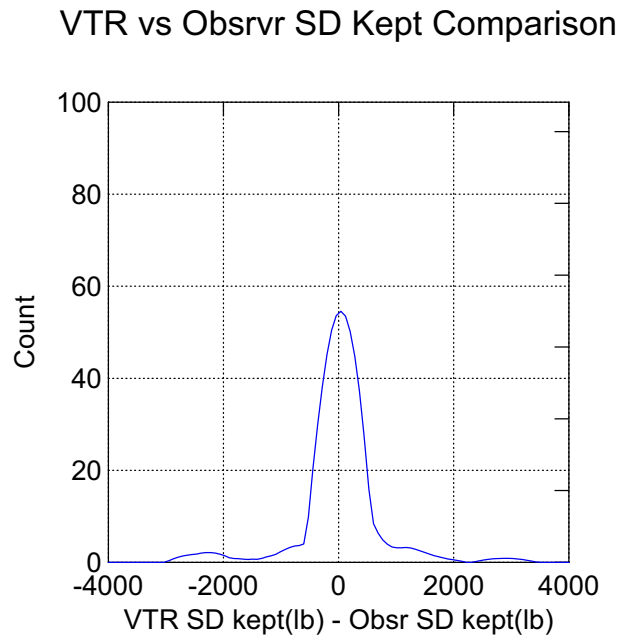
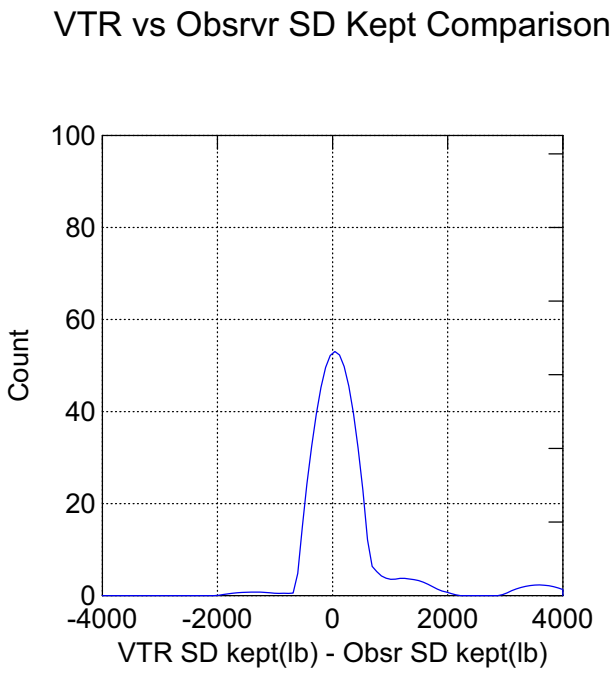
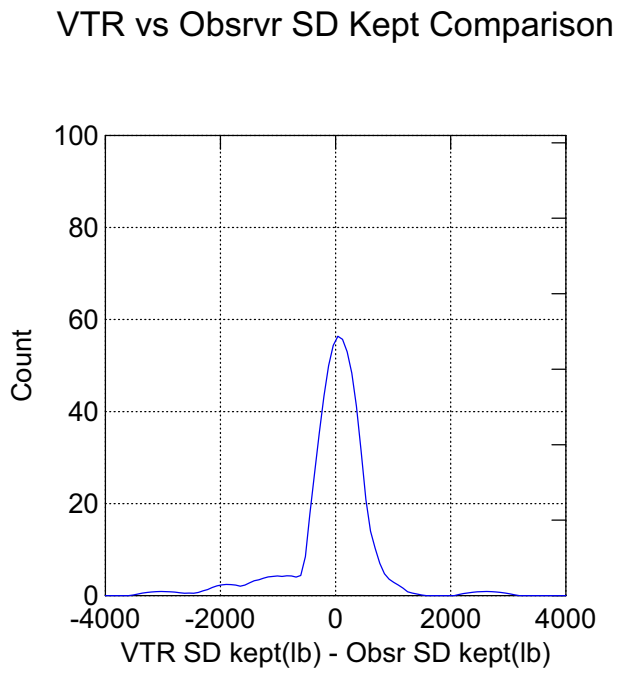


Figure 9. The distribution of difference between the **standard deviation of average kept pounds** of species groups in the NEFOP and VTR data for 2004.

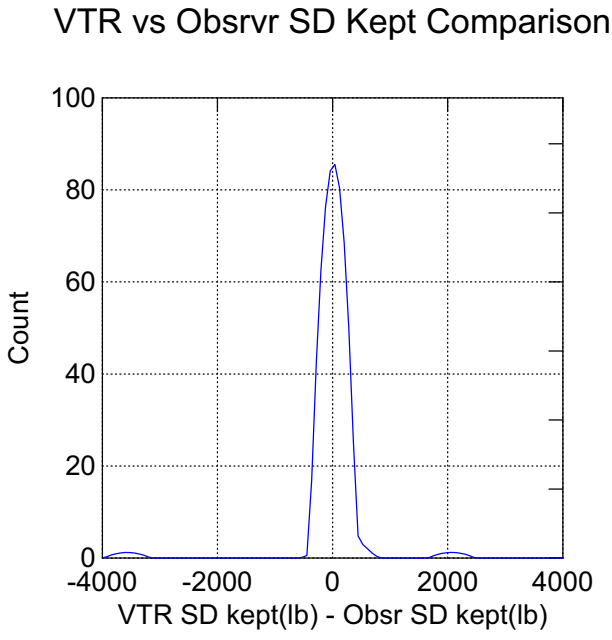
NE Multispecies (Small Mesh)



Monkfish



Herring



Mackerel Squid-butterfish

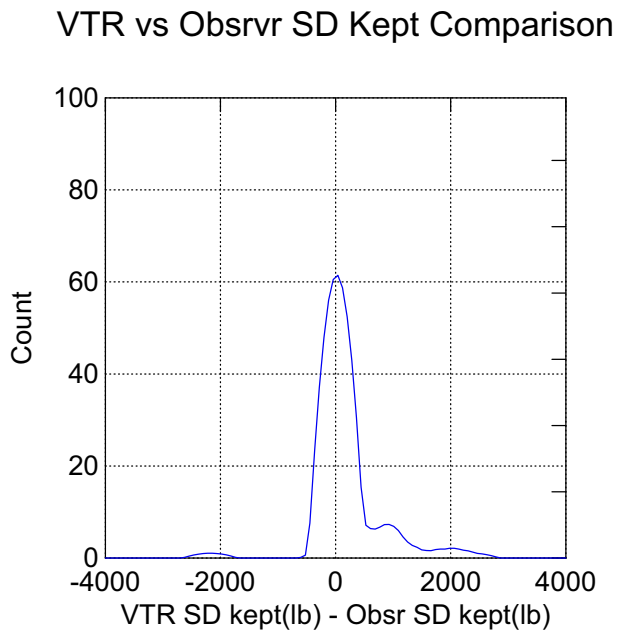
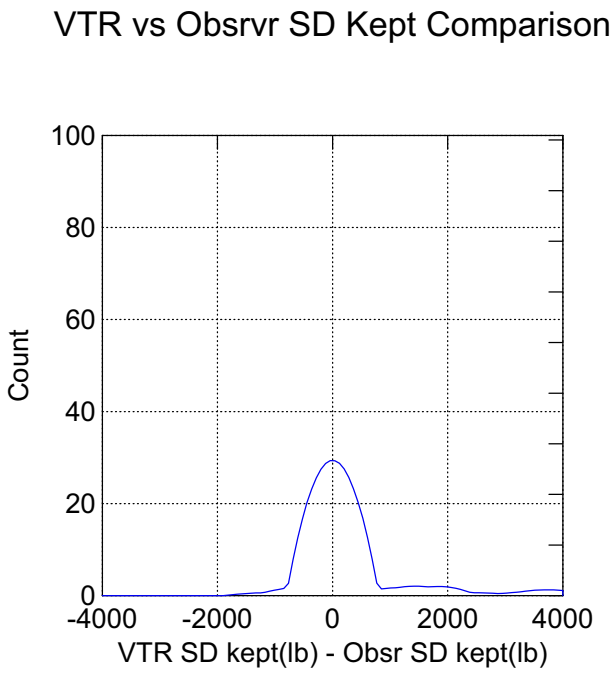
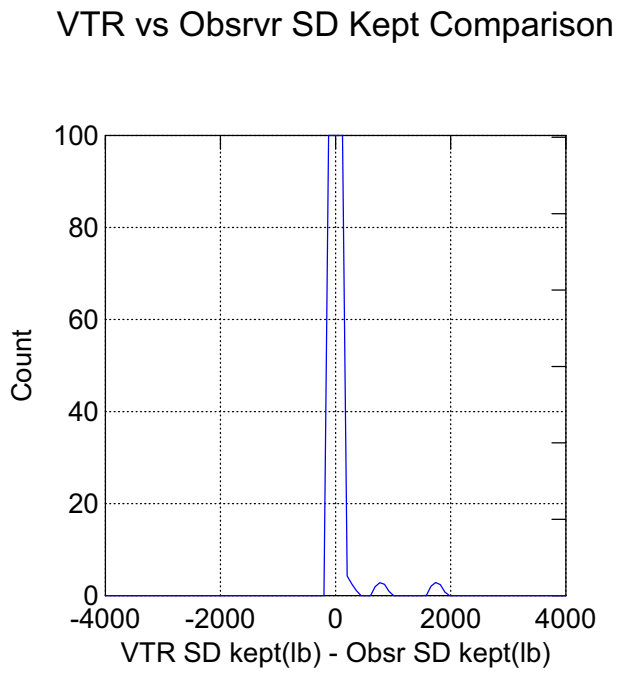


Figure 9 continued.

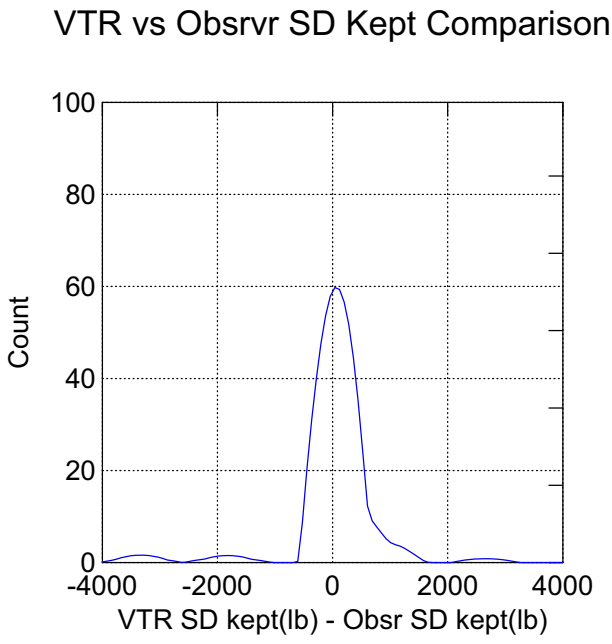
Scallop



Tilefish



Skate Complex



All Species

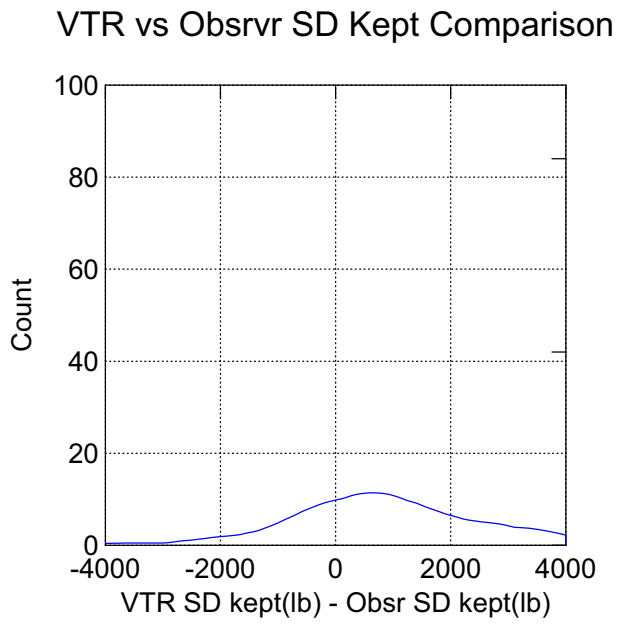


Figure 9 continued.

ALL TRIPS

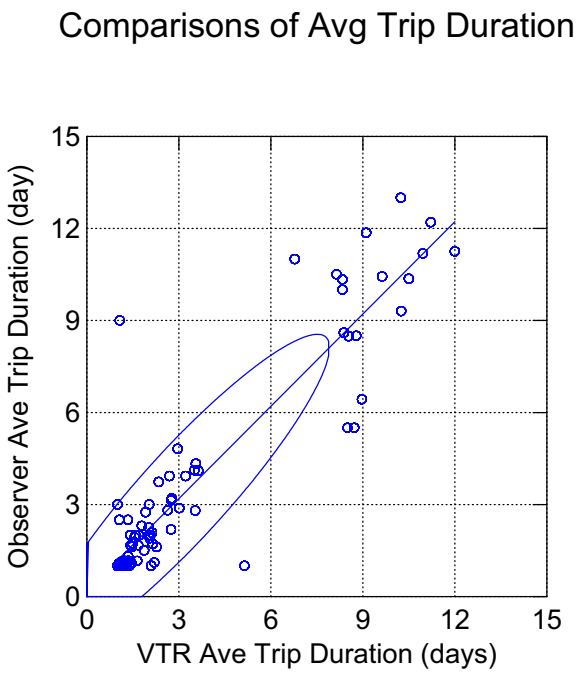


Figure 10. Comparison of **average trip duration** (days) for all trips in the NEFOP and VTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

ALL TRIPS

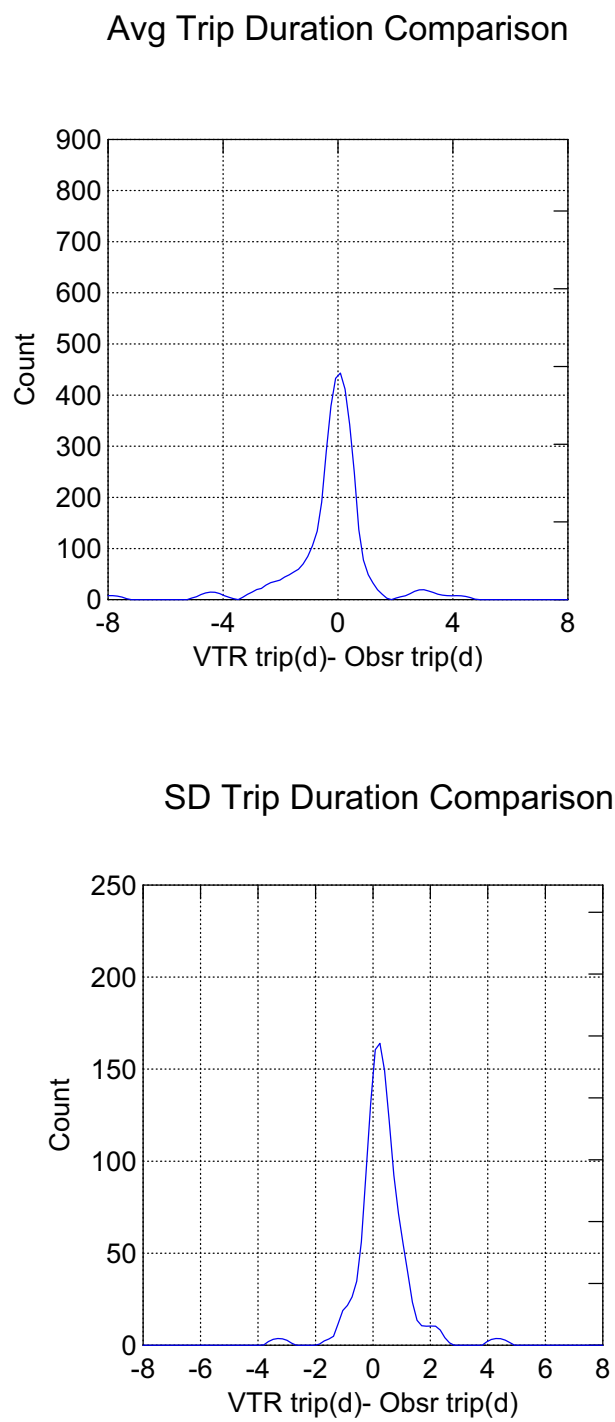


Figure 11. The distribution of differences between the **average trip duration** (top), and **standard deviation of average trip duration** (bottom) for trips in the NEFOP and the VTR data for 2004.

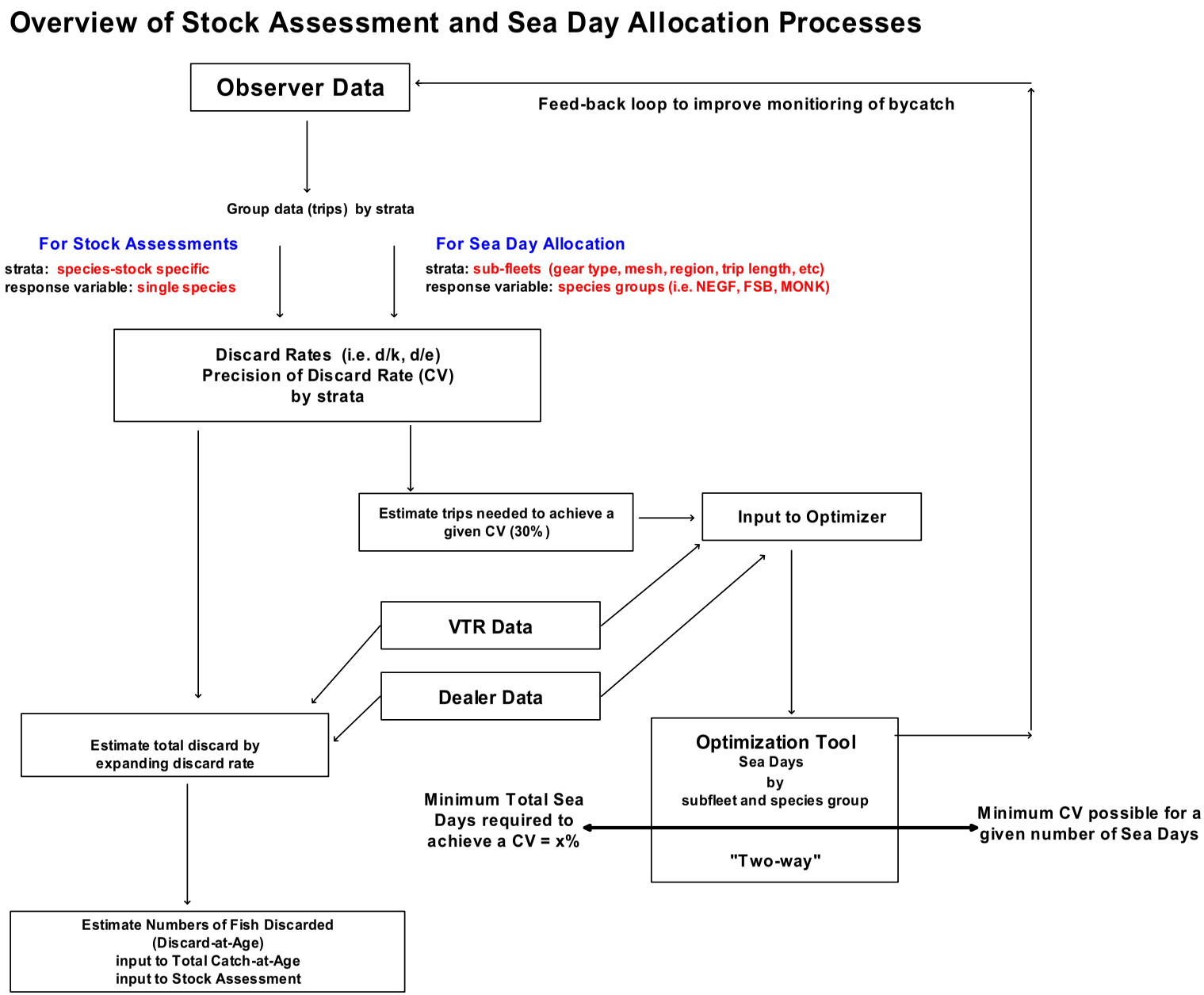


Figure 12. Overview of feed-back loop to improve monitoring of bycatch in the Northeast.

Appendix Table I. Precision (CV) of total composite 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	1.077	**0.168**	*	0.482	**0.135**	0.421	**0.167**	**0.255**	0.468	**0.158**	**0.222**
Scallop Dredge	closed	limited	MA	all	1.208	0.660	*	0.357	**0.198**	0.310	0.648	0.338	0.638	0.303	**0.280**
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	*	*	*	0.545	0.539	0.546	0.539	0.539	1.048
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.

Appendix Table I *continued.*

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	NE MULTI-SPP (LARGE-MESH)	Cod	Haddock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Windowpane	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	**0.159**	0.510	0.423	**0.211**	0.829	**0.188**	**0.200**	*	*	0.478	0.355	**0.179**	0.427
Scallop Dredge	closed	limited	MA	all	0.712	*	*	1.256	0.320	0.350	1.269	*	*	0.602	0.886	*	1.239
Scallop Dredge	closed	general	NE	all													
Scallop Dredge	closed	general	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Mid-water paired & single Trawl	all	all	NE	all	0.669	1.198	0.951	*	1.155	1.203	1.298	0.967	0.996	1.604	*	*	*
Mid-water paired & single Trawl	all	all	MA	all	0.708	*	*	*	*	1.146	*	*	*	0.541	*	*	*
Fish Pots/ Traps	all	all	NE	all													
Fish Pots/ Traps	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*
Purse Seine	all	all	NE	all	0.973	*	*	*	*	*	*	*	0.973	*	*	*	*
Purse Seine	all	all	MA	all													
Hand Line	all	all	NE	all	4.030	4.030	*	*	*	*	*	*	*	*	*	*	*
Hand Line	all	all	MA	all													
Scottish Seine	all	all	NE	all	**0.289**	**0.279**	**0.279**	*	**0.279**	*	0.543	*	*	**0.279**	0.354	*	*
Clam Quahog Dredge	all	all	NE	all													
Clam Quahog Dredge	all	all	MA	all													
Crab Pots	all	all	NE	all													
Crab Pots	all	all	MA	all													
Lobster Pots	all	all	NE	all													
Lobster Pots	all	all	MA	all													

Note: when discard ratio = 0, CV is null (*); Gray-shaded cells indicate unlikely species/gear combinations.

Appendix Table I *continued.*

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	0.396	0.403	0.489	0.448	**0.126**	0.326	**0.291**	**0.293**	**0.218**	**0.161**	**0.198**	*
Scallop Dredge	closed	limited	MA	all	**0.268**	0.323	*	**0.282**	**0.142**	0.425	0.383	0.385	1.011	0.333	0.321	*
Scallop Dredge	closed	general	NE	all												
Scallop Dredge	closed	general	MA	all	*	*	*	*	**0.000**	*	**0.000**	**0.000**	*	*	*	*
Mid-water paired & single Trawl	all	all	NE	all	0.994	1.000	*	0.748	1.177	0.418	0.628	*	0.671	1.626	*	*
Mid-water paired & single Trawl	all	all	MA	all	0.539	0.539	*	0.539	*	**0.246**	1.165	1.142	*	1.176	*	*
Fish Pots/ Traps	all	all	NE	all												
Fish Pots/ Traps	all	all	MA	all	*	*	*	*	*	*	**0.161**	*	**0.163**	**0.161**	*	*
Purse Seine	all	all	NE	all	*	*	*	*	*	0.972	*	*	*	*	*	*
Purse Seine	all	all	MA	all												
Hand Line	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	*	*
Hand Line	all	all	MA	all												
Scottish Seine	all	all	NE	all	**0.279**	**0.279**	*	**0.279**	0.319	*	**0.253**	**0.259**	0.808	0.808	*	*
Clam Quahog Dredge	all	all	NE	all												
Clam Quahog Dredge	all	all	MA	all												
Crab Pots	all	all	NE	all												
Crab Pots	all	all	MA	all												
Lobster Pots	all	all	NE	all												
Lobster Pots	all	all	MA	all												

Note: when discard ratio = 0, CV is null (*); Gray-shaded cells indicate unlikely species/gear combinations.

Appendix Table I continued.

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	**0.165**	*	*	**0.165**	*	*	*	*	*	*	*	*	*
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.

Appendix Table I continued.

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	*	*	*	*	*	*	*	*	*	**0.163**	**0.119**	
Scallop Dredge	closed	limited	MA	all	*	*	*	*	*	*	*	*	*	*	**0.119**	
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	*	*	*	*	*	*	*	*	*	*	0.408	
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.

Appendix Table II. 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.

Appendix Table II *continued*.

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.

Appendix Table II *continued*.

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.

Appendix Table II *continued*.

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.

Appendix Table II *continued*.

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/DOLP HIN, 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.

Appendix Table III. 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.

Appendix Table III *continued*.

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.

Appendix Table III *continued*.

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.

Appendix Table III *continued*.

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.

Appendix Table III *continued*.

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/DOLP HIN, 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.

Appendix Table IV. Number of **sea days** needed to achieve a 30% coefficient of variation based on the **quarterly bycatch ratio.**

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	1864	1808	211	2576	2496	601	1374	1019	1470	1070	746
Otter Trawl	all	all	NE	large	4514	3937	730	2943	2930	1194	3309	3552	2373	3054	340
Otter Trawl	all	all	MA	small	1350	1411	196	668	1606	1494	2195	2000	2100	1524	1100
Otter Trawl	all	all	MA	large	503	781	342	342	729	631	469	692	755	862	366
Scallop Trawl	open	limited	MA	all	95	95	95	95	95	95	95	95	95	95	95
Scallop Trawl	open	general	MA	all	155	51	51	399	119	181	51	277	200	270	115
Shrimp Trawl	all	all	NE	all	42	101	42	42	389	401	42	42	42	401	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	1487	760	141	3213	539	2323	1797	779	141	2285	1275
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	688	1119	144	1276	1511	2477	2480	144	144	1031	452
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	105	29	29	29	29	29	29	29	29	29	29
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	131	68	68	68	301	68	68	68	68	68	104
Scallop Dredge	open	limited	NE	all	269	269	269	992	724	1466	269	1452	1510	857	556
Scallop Dredge	open	limited	MA	all	329	329	329	870	559	1152	870	2133	1863	1877	458
Scallop Dredge	open	general	NE	all	92	92	92	92	204	176	92	176	92	92	117
Scallop Dredge	open	general	MA	all	96	96	96	96	254	250	96	96	250	96	66
Scallop Dredge	closed	limited	NE	all	1469	392	139	1610	313	839	379	1538	957	1790	357
Scallop Dredge	closed	limited	MA	all	369	228	108	182	191	368	221	537	474	260	116
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	371	611	56	56	409	692	631	706	401	820	437
Mid-water paired & single Trawl	all	all	MA	all	35	288	35	35	35	44	47	45	33	45	366
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	103
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					15,364	14,016	4,573	16,986	14,833	16,019	15,915	16,920	14,396	17,926	8,583
Total Sea Days excluding shaded cells					11,484	11,315	0	8,952	10,409	14,384	14,371	14,301	12,346	13,200	7,571

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

Appendix Table IV *continued*.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	NE MULTI-SPP (LARGE-MESH)	Cod	Haddock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Windowpane	Halibut	Ocean pout
Longline	all	all	NE	all	72	95	51	35	35	35	35	90	35	35	35	35	129
Longline	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76	76	76
Otter Trawl	all	all	NE	small	802	1313	2586	1687	1167	1239	1026	2723	1730	2257	1430	1774	1933
Otter Trawl	all	all	NE	large	403	1285	1507	1929	755	733	1146	6606	1204	1573	1475	2137	686
Otter Trawl	all	all	MA	small	807	196	196	1944	1098	1481	1109	196	1514	2839	1278	196	1617
Otter Trawl	all	all	MA	large	359	835	342	1281	342	611	800	835	1050	876	769	342	811
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	85	51	51	505	51	255	423	51	51	399	170	51	51
Shrimp Trawl	all	all	NE	all	23	55	188	134	42	361	32	99	62	24	19	42	385
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	287	497	754	971	796	1533	1211	969	2051	2076	2144	2672	2243
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	550	701	1074	2240	1379	1297	2685	1693	876	1899	2007	2235	1142
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	1129	1434	1041	1945	1041	1535	1328	1041	269	1303	1382	269	2156
Scallop Dredge	open	limited	MA	all	1118	329	329	1896	3188	2223	3048	329	329	3026	1700	329	2613
Scallop Dredge	open	general	NE	all	82	120	92	85	110	146	92	92	92	92	90	92	190
Scallop Dredge	open	general	MA	all	194	96	96	250	243	166	93	96	96	169	198	96	96
Scallop Dredge	closed	limited	NE	all	233	655	507	591	1442	426	575	139	139	944	534	202	989
Scallop Dredge	closed	limited	MA	all	361	108	108	569	215	295	391	108	108	566	497	108	380
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	540	639	429	56	613	695	363	737	468	663	56	56	56
Mid-water paired & single Trawl	all	all	MA	all	364	35	35	35	35	354	35	35	35	45	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	137	137	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	18	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					9,170	10,069	10,943	17,711	14,109	14,945	15,956	17,397	11,812	20,343	15,370	12,228	17,071
Total Sea Days excluding shaded cells					8,908	9,270	7,267	16,468	7,446	10,829	15,028	13,087	6,750	14,936	14,204	9,603	16,223

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

Appendix Table IV *continued*.

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	59	35	35	59	112	249	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	899	926	2255	2203	1068	1031	1292	927	2123	2116	1654	1567
Otter Trawl	all	all	NE	large	801	1287	4129	2182	736	870	2655	2928	4191	5196	5201	2448
Otter Trawl	all	all	MA	small	1068	1509	804	1530	639	1006	804	736	1231	1481	2705	759
Otter Trawl	all	all	MA	large	725	741	342	637	199	643	373	296	1052	919	984	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	292	297	51	155	80	443	408	75	102	396	51	51
Shrimp Trawl	all	all	NE	all	136	141	42	127	273	385	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	1142	1381	141	1537	828	454	2180	2230	141	921	141	141
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	2176	1529	144	1757	287	452	1325	1325	1023	144	144	448
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	99	96	29	29	29	29	29	29
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	68	68	68	68	55	58	120	120	68	68	68	68
Scallop Dredge	open	limited	NE	all	970	1341	1998	1105	269	1179	1038	1124	1157	1499	1452	269
Scallop Dredge	open	limited	MA	all	2936	3292	2746	2604	294	2350	566	966	2309	1176	2410	329
Scallop Dredge	open	general	NE	all	135	204	92	148	120	120	92	92	92	92	190	92
Scallop Dredge	open	general	MA	all	113	109	96	243	76	130	245	245	96	96	220	96
Scallop Dredge	closed	limited	NE	all	727	804	1442	848	165	765	693	714	1757	376	1813	139
Scallop Dredge	closed	limited	MA	all	410	504	108	509	162	296	216	224	446	364	291	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	832	835	56	450	685	256	462	56	176	342	56	56
Mid-water paired & single Trawl	all	all	MA	all	45	45	35	35	35	49	354	354	35	355	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	73	40	40	40
Purse Seine	all	all	NE	all	19	19	19	19	19	172	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					15,026	16,538	16,075	17,687	7,645	12,446	14,411	13,997	17,617	17,126	18,981	8,514
Total Sea Days excluding shaded cells					13,796	15,273	6,472	16,207	5,930	11,002	12,499	12,491	9,074	10,450	133	5,286

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

Appendix Table IV *continued*.

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	1473	196	196	1473	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	1058	353	141	1446	2569	141
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	144	144	144	144	144	144	1314	309	1207	1802	1637	144
Sink, Anchor, Drift Gillnet	all	all	MA	small	993	62	555	62	62	499	62	62	62	62	62	62
Sink, Anchor, Drift Gillnet	all	all	MA	large	104	140	29	140	29	29	29	29	29	29	29	29
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	662	68	411	319	68	68	1018	68	68	589	497	68
Scallop Dredge	open	limited	NE	all	2132	269	269	2132	269	269	269	269	269	269	269	269
Scallop Dredge	open	limited	MA	all	3283	329	329	3283	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	275	139	139	275	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					12,404	4,684	5,410	11,166	4,573	5,011	7,610	4,951	5,636	8,057	8,923	4,573
Total Sea Days excluding shaded cells					12,404	2,309	4,468	11,166	3,632	5,011	6,326	3,668	2,714	6,236	7,102	3,290

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

Appendix Table IV *continued*.

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	214	146	
Longline	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76	76	pilot
Otter Trawl	all	all	NE	small	1457	1457	211	211	1525	1494	1727	211	211	211	2060	436	
Otter Trawl	all	all	NE	large	3609	3609	730	730	2027	2027	730	730	730	730	4349	440	
Otter Trawl	all	all	MA	small	196	196	196	196	1300	196	1300	196	196	196	833	454	
Otter Trawl	all	all	MA	large	342	342	342	342	342	342	342	342	342	342	447	126	
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	38	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	1148	1095	141	141	1241	141	3165	217	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	144	144	144	144	1418	144	144	1209	1462	144	2836	170	
Sink, Anchor, Drift Gillnet	all	all	MA	small	62	62	62	62	62	62	62	62	62	62	372	62	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	29	29	29	29	29	29	29	29	29	29	157	95	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	68	68	68	68	497	68	68	68	497	68	1022	51	pilot for fish
Scallop Dredge	open	limited	NE	all	269	269	269	269	269	269	269	269	269	269	790	258	
Scallop Dredge	open	limited	MA	all	329	329	329	329	329	329	329	329	329	329	329	209	
Scallop Dredge	open	general	NE	all	92	92	92	92	92	92	92	92	92	92	92	88	pilot
Scallop Dredge	open	general	MA	all	96	96	96	96	96	96	96	96	96	96	96	18	
Scallop Dredge	closed	limited	NE	all	139	139	139	139	139	139	139	139	139	139	333	181	
Scallop Dredge	closed	limited	MA	all	108	108	108	108	108	108	108	108	108	108	108	99	
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	494	494	56	56	301	301	56	56	56	56	512	287	
Mid-water paired & single Trawl	all	all	MA	all	35	35	35	35	35	35	35	35	35	35	35	99	
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	37	pilot
Purse Seine	all	all	NE	all	19	19	19	19	19	19	19	19	19	19	19	119	
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	137	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	20	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					9,136	9,136	4,573	4,573	11,244	8,353	7,193	5,639	7,420	4,573	19,241	5,067	
Total Sea Days excluding shaded cells					8,060	8,060	2,593	3,497	11,244	8,353	7,193	5,101	7,330	4,573	19,241	5,067	

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

Appendix Table V. Number of **trips** needed to achieve a 30% coefficient of variation based on the **quarterly bycatch ratio.**

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	653	594	70	872	831	209	480	331	502	372	258
Otter Trawl	all	all	NE	large	1877	1636	304	1351	1238	471	1290	1317	975	1212	147
Otter Trawl	all	all	MA	small	681	640	104	387	849	726	1094	1040	1092	741	577
Otter Trawl	all	all	MA	large	248	302	177	177	381	291	213	277	360	392	201
Scallop Trawl	open	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12
Scallop Trawl	open	general	MA	all	72	25	25	196	56	85	25	132	94	129	54
Shrimp Trawl	all	all	NE	all	42	100	42	42	386	397	42	42	42	397	24
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	1070	571	104	2352	346	1748	1342	599	104	1668	952
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	441	864	94	990	1037	1709	1711	94	94	569	295
Sink, Anchor, Drift Gillnet	all	all	MA	small	58	58	58	58	58	58	58	58	58	58	58
Sink, Anchor, Drift Gillnet	all	all	MA	large	100	27	27	27	27	27	27	27	27	27	27
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	94	51	51	51	211	51	51	51	51	51	76
Scallop Dredge	open	limited	NE	all	25	25	25	95	66	137	25	136	140	78	51
Scallop Dredge	open	limited	MA	all	36	36	36	97	62	129	97	236	209	212	51
Scallop Dredge	open	general	NE	all	71	71	71	71	149	130	71	130	71	71	89
Scallop Dredge	open	general	MA	all	69	69	69	69	182	183	69	69	183	69	45
Scallop Dredge	closed	limited	NE	all	173	38	15	190	33	95	37	176	108	206	40
Scallop Dredge	closed	limited	MA	all	41	24	12	21	21	39	23	58	52	28	13
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	156	232	21	21	155	290	259	311	152	351	189
Mid-water paired & single Trawl	all	all	MA	all	11	83	12	12	12	14	16	15	10	14	106
Fish Pots/ Traps	all	all	NE	all	19	19	19	19	19	19	19	19	19	19	19
Fish Pots/ Traps	all	all	MA	all	37	37	37	37	37	37	37	37	37	37	97
Purse Seine	all	all	NE	all	10	82	10	10	10	76	10	76	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					6,908	6,508	2,306	8,069	7,093	7,846	7,920	6,153	5,313	7,635	4,305
Total Trips excluding shaded cells					5,585	5,344	0	3,114	4,062	6,612	6,823	4,150	3,749	4,326	3,509

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

Appendix Table V *continued*.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	NE MULTI-SPP (LARGE-MESH)	Cod	Haddock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Windowpane	Halibut	Ocean pout
Longline	all	all	NE	all	53	70	40	26	26	26	26	75	26	26	26	26	99
Longline	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	12	12
Otter Trawl	all	all	NE	small	275	443	857	544	375	428	345	911	579	765	449	605	635
Otter Trawl	all	all	NE	large	164	548	647	757	326	324	503	2859	504	692	565	940	286
Otter Trawl	all	all	MA	small	384	104	104	847	384	793	646	104	639	1427	546	104	665
Otter Trawl	all	all	MA	large	181	394	177	584	177	346	332	394	379	412	321	177	398
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	41	25	25	244	25	125	207	25	25	196	81	25	25
Shrimp Trawl	all	all	NE	all	22	55	187	133	41	358	32	98	62	24	19	42	381
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	216	374	564	732	588	1066	895	715	1509	1477	1582	2022	1675
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	329	415	690	1473	828	1007	1754	1092	553	1254	1566	1597	741
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	106	135	100	181	100	143	125	100	25	122	127	25	201
Scallop Dredge	open	limited	MA	all	124	36	36	214	368	249	340	36	36	340	186	36	301
Scallop Dredge	open	general	NE	all	64	91	71	66	84	109	71	71	71	71	70	71	140
Scallop Dredge	open	general	MA	all	139	69	69	183	178	121	66	69	69	123	142	69	69
Scallop Dredge	closed	limited	NE	all	24	76	58	63	164	48	60	15	15	105	62	20	110
Scallop Dredge	closed	limited	MA	all	40	12	12	62	22	32	43	12	12	61	54	12	42
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	241	267	184	21	258	290	138	322	204	278	21	21	21
Mid-water paired & single Trawl	all	all	MA	all	105	12	12	12	12	102	12	12	12	15	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	80	10	10	10	10	10	10	10	80	10	10	10	10
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9	9	9
Hand Line	all	all	NE	all	129	129	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	18	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					3,731	4,288	4,933	7,242	5,056	6,666	6,701	8,009	5,889	8,486	6,921	6,904	6,900
Total Trips excluding shaded cells					3,554	3,859	3,576	6,288	2,822	5,195	5,979	6,205	3,649	6,826	6,028	5,415	6,344

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

Appendix Table V *continued*.

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	83	185	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	307	321	760	731	376	357	434	313	708	728	593	545
Otter Trawl	all	all	NE	large	336	525	1659	946	289	347	1025	1139	1808	2019	2193	884
Otter Trawl	all	all	MA	small	537	754	494	778	314	496	410	361	649	798	1324	279
Otter Trawl	all	all	MA	large	338	361	177	321	109	269	156	163	432	368	484	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	142	144	25	72	39	216	200	36	48	195	25	25
Shrimp Trawl	all	all	NE	all	135	140	42	126	270	381	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	830	987	104	1153	609	338	1610	1640	104	578	104	104
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	1406	894	94	1369	180	287	968	968	565	94	94	253
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	42	44	87	87	51	51	51	51
Scallop Dredge	open	limited	NE	all	90	124	186	103	25	109	94	102	108	139	134	25
Scallop Dredge	open	limited	MA	all	334	372	310	297	33	272	64	110	256	130	277	36
Scallop Dredge	open	general	NE	all	102	149	71	111	91	91	71	71	71	71	140	71
Scallop Dredge	open	general	MA	all	81	78	69	178	54	94	178	178	69	69	161	69
Scallop Dredge	closed	limited	NE	all	82	91	167	96	18	86	79	82	204	40	209	15
Scallop Dredge	closed	limited	MA	all	45	56	12	56	17	32	24	25	48	40	31	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	335	336	21	197	286	106	190	21	55	156	21	21
Mid-water paired & single Trawl	all	all	MA	all	15	15	12	11	12	18	102	102	12	102	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	84	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					6,261	6,473	5,329	7,690	3,964	4,916	6,827	6,533	6,353	6,713	6,970	3,695
Total Trips excluding shaded cells					5,314	5,499	2,495	6,659	2,868	3,734	5,714	5,589	3,865	4,295	139	1,980

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

Appendix Table V *continued*.

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	874	104	104	874	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	757	269	104	1125	1952	104
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	94	94	94	94	94	94	894	175	663	1171	1048	94
Sink, Anchor, Drift Gillnet	all	all	MA	small	933	58	528	58	58	463	58	58	58	58	58	58
Sink, Anchor, Drift Gillnet	all	all	MA	large	101	137	27	136	27	27	27	27	27	27	27	27
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	494	51	287	259	51	51	764	51	51	410	406	51
Scallop Dredge	open	limited	NE	all	200	25	25	200	25	25	25	25	25	25	25	25
Scallop Dredge	open	limited	MA	all	368	36	36	368	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	31	15	15	31	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					4,990	2,416	3,012	3,915	2,306	2,711	4,471	2,552	2,875	4,762	5,462	2,306
Total Trips excluding shaded cells					4,990	1,388	2,638	3,915	1,933	2,711	4,134	2,214	1,746	4,144	4,843	1,969

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

Appendix Table V *continued*.

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	187	106	
Longline	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	12	pilot
Otter Trawl	all	all	NE	small	483	483	70	70	526	495	593	70	70	70	652	150	
Otter Trawl	all	all	NE	large	1534	1534	304	304	762	762	304	304	304	304	1916	173	
Otter Trawl	all	all	MA	small	104	104	104	104	774	104	774	104	104	104	513	213	
Otter Trawl	all	all	MA	large	177	177	177	177	177	177	177	177	177	177	251	64	
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	18	pilot
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	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	867	810	104	104	935	104	2327	159	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	94	94	94	94	899	94	94	664	922	94	2058	108	
Sink, Anchor, Drift Gillnet	all	all	MA	small	58	58	58	58	58	58	58	58	58	58	359	58	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	27	27	27	27	27	27	27	27	27	27	139	91	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	51	51	51	51	406	51	51	51	406	51	766	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	24	
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	34	19	
Scallop Dredge	closed	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12	11	
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	187	187	21	21	90	90	21	21	21	21	208	117	
Mid-water paired & single Trawl	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	30	
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	58	
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	129	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	20	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					4,115	4,115	2,306	2,306	5,881	3,964	3,499	2,876	4,320	2,306	10,711	2,602	
Total Trips excluding shaded cells					3,860	3,860	1,550	2,051	5,881	3,964	3,499	2,595	4,287	2,306	10,711	2,602	

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

Appendix Table VI. Number of **sea days** needed to achieve a 30% coefficient of variation based on the **total composite discard**.

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	1103	882	211	848	1998	249	1748	487	454	633	757
Otter Trawl	all	all	NE	large	26644	12864	730	798	1233	3159	2582	9820	3561	5259	81
Otter Trawl	all	all	MA	small	2231	1869	196	5417	1162	1125	2841	1362	1697	1160	497
Otter Trawl	all	all	MA	large	3625	883	342	342	311	242	374	753	327	394	140
Scallop Trawl	open	limited	MA	all	95	95	95	95	95	95	95	95	95	95	95
Scallop Trawl	open	general	MA	all	155	51	51	399	119	181	51	277	200	270	115
Shrimp Trawl	all	all	NE	all	42	92	42	42	353	364	42	42	42	364	22
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	443	486	141	2592	4357	3758	3929	5405	141	6119	408
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	267	1004	144	3266	1255	1701	1708	144	144	4216	238
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	105	29	29	29	29	29	29	29	29	29	29
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	131	68	68	68	301	68	68	68	68	68	104
Scallop Dredge	open	limited	NE	all	269	269	269	1596	80	1380	269	709	3260	6097	320
Scallop Dredge	open	limited	MA	all	329	329	329	8713	280	641	8713	1662	986	2528	213
Scallop Dredge	open	general	NE	all	92	92	92	92	204	176	92	176	92	92	117
Scallop Dredge	open	general	MA	all	96	96	96	96	54	293	96	96	293	96	17
Scallop Dredge	closed	limited	NE	all	3861	344	139	1473	167	1301	327	564	1531	273	429
Scallop Dredge	closed	limited	MA	all	1777	772	108	341	157	337	764	370	989	324	283
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	699	747	56	56	1793	346	347	829	1786	1712	718
Mid-water paired & single Trawl	all	all	MA	all	182	453	35	35	35	167	181	165	182	182	492
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	103
Purse Seine	all	all	NE	all	19	219	19	19	19	206	19	206	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					43,547	23,025	4,573	27,698	15,384	17,200	25,658	24,643	17,279	31,311	6,541
Total Sea Days excluding shaded cells					35,867	19,828	0	5,547	6,049	15,522	24,114	17,398	15,185	19,567	5,528

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

Appendix Table VI *continued*.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	NE MULTI-SPP (LARGE-MESH)	Cod	Haddock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Windowpane	Halibut	Ocean pout
Longline	all	all	NE	all	27	39	36	35	35	35	35	310	35	35	35	35	76
Longline	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76	76	76
Otter Trawl	all	all	NE	small	266	1861	1892	774	442	523	852	1351	1507	969	405	2129	490
Otter Trawl	all	all	NE	large	107	321	719	505	663	219	1837	3732	630	568	440	1793	268
Otter Trawl	all	all	MA	small	429	196	196	2763	3849	904	1172	196	2272	2580	633	196	3911
Otter Trawl	all	all	MA	large	101	5866	342	677	342	137	272	5866	1315	5882	156	342	358
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	85	51	51	505	51	255	423	51	51	399	170	51	51
Shrimp Trawl	all	all	NE	all	20	50	171	121	38	328	29	89	56	22	17	42	349
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	83	142	320	360	693	1325	724	315	607	488	1500	1532	1504
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	206	249	473	963	833	3315	1829	750	948	979	2892	1281	1245
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	708	1855	1611	1077	1611	728	2851	1611	269	848	633	269	1298
Scallop Dredge	open	limited	MA	all	411	329	329	2708	3159	1660	2108	329	329	1687	715	329	6549
Scallop Dredge	open	general	NE	all	82	120	92	85	110	146	92	92	92	92	90	92	190
Scallop Dredge	open	general	MA	all	40	96	96	293	288	171	73	96	96	173	46	96	96
Scallop Dredge	closed	limited	NE	all	227	1735	1311	390	3105	315	355	139	139	1576	988	439	1332
Scallop Dredge	closed	limited	MA	all	1136	108	108	1819	333	404	1829	108	108	800	1409	108	1803
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	688	1451	855	56	1437	1037	1616	1217	1219	1128	56	56	56
Mid-water paired & single Trawl	all	all	MA	all	281	35	35	35	35	547	35	35	35	176	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	217	19	19	19	19	19	19	19	217	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	137	137	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	18	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					6,712	16,129	10,194	14,724	18,580	13,608	17,695	17,846	11,464	19,958	11,769	10,382	21,169
Total Sea Days excluding shaded cells					6,450	15,330	5,143	13,481	9,033	9,941	16,768	7,934	5,380	15,652	10,603	7,758	20,321

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

Appendix Table VI *continued*.

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	185	35	35	185	89	99	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	269	233	5131	762	2024	492	455	365	1344	2115	3822	441
Otter Trawl	all	all	NE	large	341	530	1053	1255	316	614	1034	1091	7275	6224	15593	2692
Otter Trawl	all	all	MA	small	944	1324	1690	1198	202	532	584	314	1120	952	836	3057
Otter Trawl	all	all	MA	large	998	321	342	3401	70	481	98	114	201	643	584	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	292	297	51	155	80	443	408	75	102	396	51	51
Shrimp Trawl	all	all	NE	all	123	128	42	115	247	349	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	313	514	141	439	482	109	3767	4020	141	6294	141	141
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	2059	345	144	2902	109	214	417	418	4204	144	144	502
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	99	96	29	29	29	29	29	29
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	68	68	68	68	55	58	120	120	68	68	68	68
Scallop Dredge	open	limited	NE	all	534	1706	3605	390	177	807	649	693	325	1172	478	269
Scallop Dredge	open	limited	MA	all	3080	3657	3443	1081	114	371	465	512	2642	2077	2958	329
Scallop Dredge	open	general	NE	all	135	204	92	148	120	120	92	92	92	92	190	92
Scallop Dredge	open	general	MA	all	96	90	96	288	17	124	88	88	96	96	271	96
Scallop Dredge	closed	limited	NE	all	1180	1214	1618	1434	145	857	703	712	452	252	375	139
Scallop Dredge	closed	limited	MA	all	287	339	108	298	88	567	481	485	1568	378	334	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	1218	1226	56	826	1034	316	697	56	797	1134	56	56
Mid-water paired & single Trawl	all	all	MA	all	182	182	35	182	35	43	557	544	35	563	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	73	40	40	40
Purse Seine	all	all	NE	all	19	19	19	19	19	217	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					13,792	13,902	19,241	16,616	6,965	8,351	12,200	11,286	22,079	24,187	27,502	9,984
Total Sea Days excluding shaded cells					12,562	12,637	6,272	15,136	4,901	6,943	9,850	9,591	10,416	10,673	133	6,703

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

Appendix Table VI *continued*.

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	1229	196	196	1229	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	531	1007	141	889	2518	141
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	144	144	144	144	144	144	470	1694	3812	973	731	144
Sink, Anchor, Drift Gillnet	all	all	MA	small	1259	62	1841	62	62	1757	62	62	62	62	62	62
Sink, Anchor, Drift Gillnet	all	all	MA	large	653	913	29	913	29	29	29	29	29	29	29	29
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	468	68	799	764	68	68	804	68	68	1175	1272	68
Scallop Dredge	open	limited	NE	all	1261	269	269	1261	269	269	269	269	269	269	269	269
Scallop Dredge	open	limited	MA	all	3956	329	329	3956	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	414	139	139	414	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					12,721	5,457	7,083	12,079	4,573	6,269	6,025	6,990	8,241	7,257	8,741	4,573
Total Sea Days excluding shaded cells					12,721	3,082	6,142	12,079	3,632	6,269	4,742	5,706	5,319	5,436	6,920	3,290

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

Appendix Table VI *continued*.

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
Longline	all	all	NE	all	35	35	35	35	35	35	35	35	35	35	267	57
Longline	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76	76
Otter Trawl	all	all	NE	small	3082	3082	211	211	2265	3099	2594	211	211	211	1870	183
Otter Trawl	all	all	NE	large	10526	10526	730	730	2111	2111	730	730	730	730	3237	159
Otter Trawl	all	all	MA	small	196	196	196	196	1164	196	1164	196	196	196	1880	250
Otter Trawl	all	all	MA	large	342	342	342	342	342	342	342	342	342	342	727	55
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	38
Shrimp Trawl	all	all	NE	all	42	42	42	42	42	42	42	42	42	42	42	39
Shrimp Trawl	all	all	MA	all	76	76	76	76	76	76	76	76	76	76	76	55
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	1398	3642	141	141	1557	141	1306	82
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	144	144	144	144	806	144	144	3816	871	144	2661	59
Sink, Anchor, Drift Gillnet	all	all	MA	small	62	62	62	62	62	62	62	62	62	62	880	62
Sink, Anchor, Drift Gillnet	all	all	MA	large	29	29	29	29	29	29	29	29	29	29	311	95
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	68	68	68	68	1272	68	68	68	1272	68	806	51
Scallop Dredge	open	limited	NE	all	269	269	269	269	269	269	269	269	269	269	3194	123
Scallop Dredge	open	limited	MA	all	329	329	329	329	329	329	329	329	329	329	329	89
Scallop Dredge	open	general	NE	all	92	92	92	92	92	92	92	92	92	92	92	88
Scallop Dredge	open	general	MA	all	96	96	96	96	96	96	96	96	96	96	96	14
Scallop Dredge	closed	limited	NE	all	139	139	139	139	139	139	139	139	139	139	407	130
Scallop Dredge	closed	limited	MA	all	108	108	108	108	108	108	108	108	108	108	108	61
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	1606	1606	56	56	1464	1464	56	56	56	56	808	193
Mid-water paired & single Trawl	all	all	MA	all	35	35	35	35	35	35	35	35	35	35	35	111
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	37
Purse Seine	all	all	NE	all	19	19	19	19	19	19	19	19	19	19	19	143
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	137
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	20
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					18,791	18,791	4,573	4,573	13,507	13,752	7,923	8,245	7,920	4,573	20,503	3,513
Total Sea Days excluding shaded cells					17,714	17,714	2,593	3,497	13,507	13,752	7,923	7,708	7,829	4,573	20,503	3,513

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

Appendix Table VII. Number of **trips** needed to achieve a 30% coefficient of variation based on the **total composite discard**.

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	364	291	70	280	659	82	576	161	150	209	250
Otter Trawl	all	all	NE	large	11227	5420	304	336	520	1331	1088	4138	1501	2216	34
Otter Trawl	all	all	MA	small	1189	995	104	2885	619	599	1513	725	904	618	265
Otter Trawl	all	all	MA	large	1879	458	177	177	161	125	194	390	170	204	72
Scallop Trawl	open	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12
Scallop Trawl	open	general	MA	all	72	25	25	196	56	85	25	132	94	129	54
Shrimp Trawl	all	all	NE	all	42	91	42	42	350	361	42	42	42	361	22
Shrimp Trawl	all	all	MA	all	13	13	13	13	13	13	13	13	13	13	13
Sink, Anchor, Drift Gillnet	all	all	NE	small	12	12	12	12	12	12	12	12	12	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	327	359	104	1913	3216	2774	2900	3990	104	4517	301
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	175	657	94	2139	822	1114	1119	94	94	2760	156
Sink, Anchor, Drift Gillnet	all	all	MA	small	58	58	58	58	58	58	58	58	58	58	58
Sink, Anchor, Drift Gillnet	all	all	MA	large	100	27	27	27	27	27	27	27	27	27	27
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	94	51	51	51	211	51	51	51	51	51	76
Scallop Dredge	open	limited	NE	all	25	25	25	146	7	126	25	65	298	558	29
Scallop Dredge	open	limited	MA	all	36	36	36	966	31	71	966	184	109	280	24
Scallop Dredge	open	general	NE	all	71	71	71	71	149	130	71	130	71	71	89
Scallop Dredge	open	general	MA	all	69	69	69	69	39	210	69	69	210	69	12
Scallop Dredge	closed	limited	NE	all	449	40	15	171	19	151	38	66	178	32	50
Scallop Dredge	closed	limited	MA	all	194	84	12	37	17	37	83	40	108	35	31
Scallop Dredge	closed	general	NE	all	12	12	12	12	12	12	12	12	12	12	12
Scallop Dredge	closed	general	MA	all	15	15	15	15	15	15	15	15	15	15	15
Mid-water paired & single Trawl	all	all	NE	all	266	285	21	21	683	132	132	316	681	652	274
Mid-water paired & single Trawl	all	all	MA	all	52	130	12	12	12	48	52	47	52	52	141
Fish Pots/ Traps	all	all	NE	all	19	19	19	19	19	19	19	19	19	19	19
Fish Pots/ Traps	all	all	MA	all	37	37	37	37	37	37	37	37	37	37	97
Purse Seine	all	all	NE	all	10	108	10	10	10	102	10	102	10	10	10
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9
Hand Line	all	all	NE	all	68	68	68	68	68	68	68	68	68	68	68
Hand Line	all	all	MA	all	126	126	126	126	126	126	126	126	126	126	126
Scottish Seine	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12
Clam Quahog Dredge	all	all	NE	all	69	69	69	69	69	69	69	69	69	69	69
Clam Quahog Dredge	all	all	MA	all	69	69	69	69	69	69	69	69	69	69	69
Crab Pots	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12
Crab Pots	all	all	MA	all	27	27	27	27	27	27	27	27	27	27	27
Lobster Pots	all	all	NE	all	353	353	353	353	353	353	353	353	353	353	353
Lobster Pots	all	all	MA	all	75	75	75	75	75	75	75	75	75	75	75
Total Trips					17,678	10,260	2,306	10,588	8,647	8,594	10,019	11,808	5,891	13,889	3,015
Total Trips excluding shaded cells					15,925	9,034	0	1,539	2,468	7,333	8,922	6,413	4,300	5,539	2,219

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

Appendix Table VII *continued*.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	NE MULTI-SPP (LARGE-MESH)	Cod	Haddock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Windowpane	Halibut	Ocean pout
Longline	all	all	NE	all	21	30	28	26	26	26	26	242	26	26	26	26	59
Longline	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	12	12
Otter Trawl	all	all	NE	small	88	614	624	255	146	173	281	446	497	319	133	702	161
Otter Trawl	all	all	NE	large	45	135	303	213	279	92	774	1572	266	239	185	755	113
Otter Trawl	all	all	MA	small	229	104	104	1472	2050	481	624	104	1210	1374	337	104	2083
Otter Trawl	all	all	MA	large	52	3040	177	351	177	71	141	3040	681	3048	81	177	185
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	41	25	25	244	25	125	207	25	25	196	81	25	25
Shrimp Trawl	all	all	NE	all	20	49	169	120	37	325	29	89	56	22	17	42	346
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	61	105	236	266	512	978	534	232	448	360	1107	1131	1110
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	135	163	310	631	545	2171	1197	491	621	641	1893	839	815
Sink, Anchor, Drift Gillnet	all	all	MA	small	58	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	65	170	147	99	147	67	261	147	25	78	58	25	119
Scallop Dredge	open	limited	MA	all	46	36	36	300	350	184	234	36	36	187	79	36	726
Scallop Dredge	open	general	NE	all	64	91	71	66	84	109	71	71	71	71	70	71	140
Scallop Dredge	open	general	MA	all	29	69	69	210	206	123	53	69	69	124	33	69	69
Scallop Dredge	closed	limited	NE	all	26	202	152	45	361	37	41	15	15	183	115	51	155
Scallop Dredge	closed	limited	MA	all	124	12	12	199	36	44	200	12	12	87	154	12	197
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	262	553	326	21	548	395	616	464	465	430	21	21	21
Mid-water paired & single Trawl	all	all	MA	all	81	12	12	12	12	157	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	107	10	10	10	10	10	10	10	107	10	10	10	10
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9	9	9
Hand Line	all	all	NE	all	129	129	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	18	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					2,641	6,572	3,902	5,630	6,641	6,657	6,407	8,167	5,730	8,536	5,495	5,198	7,437
Total Trips excluding shaded cells					2,464	6,143	2,403	4,676	2,717	5,239	5,685	3,669	2,618	7,001	4,602	3,710	6,881

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

Appendix Table VII *continued*.

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	144	26	26	144	69	78	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	89	77	1692	251	668	162	150	120	443	698	1260	146
Otter Trawl	all	all	NE	large	143	223	444	529	133	259	436	460	3065	2623	6570	1134
Otter Trawl	all	all	MA	small	503	705	900	638	108	283	311	167	596	507	445	1628
Otter Trawl	all	all	MA	large	517	166	177	1762	36	249	51	59	104	333	303	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	142	144	25	72	39	216	200	36	48	195	25	25
Shrimp Trawl	all	all	NE	all	122	127	42	114	245	346	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	231	380	104	324	356	81	2780	2967	104	4646	104	104
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	1348	226	94	1900	71	140	273	273	2753	94	94	329
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	42	44	87	87	51	51	51	51
Scallop Dredge	open	limited	NE	all	49	156	330	36	16	74	59	63	30	107	44	25
Scallop Dredge	open	limited	MA	all	342	406	382	120	13	41	52	57	293	230	328	36
Scallop Dredge	open	general	NE	all	102	149	71	111	91	91	71	71	71	71	140	71
Scallop Dredge	open	general	MA	all	69	65	69	206	12	89	63	63	69	69	194	69
Scallop Dredge	closed	limited	NE	all	137	141	188	167	17	100	82	83	52	29	44	15
Scallop Dredge	closed	limited	MA	all	31	37	12	33	10	62	53	53	171	41	37	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	464	467	21	315	394	121	266	21	304	432	21	21
Mid-water paired & single Trawl	all	all	MA	all	52	52	12	52	12	12	160	156	12	161	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	107	10	10	10	10	10	10
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9	9
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					5,584	4,647	5,688	7,873	3,447	3,658	6,227	5,872	9,332	11,423	10,788	4,971
Total Trips excluding shaded cells					4,637	3,673	2,211	6,842	2,243	2,511	4,981	4,874	4,476	4,543	139	3,180

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

Appendix Table VII *continued*.

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	654	104	104	654	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	392	743	104	656	1859	104
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	94	94	94	94	94	94	308	1109	2496	637	479	94
Sink, Anchor, Drift Gillnet	all	all	MA	small	1195	58	1747	58	58	1668	58	58	58	58	58	58
Sink, Anchor, Drift Gillnet	all	all	MA	large	604	845	27	845	27	27	27	27	27	27	27	27
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	351	51	600	573	51	51	604	51	51	882	955	51
Scallop Dredge	open	limited	NE	all	115	25	25	115	25	25	25	25	25	25	25	25
Scallop Dredge	open	limited	MA	all	439	36	36	439	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	48	15	15	48	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					5,397	3,124	4,543	4,722	2,306	3,916	3,360	3,961	4,708	4,232	5,349	2,306
Total Trips excluding shaded cells					5,397	2,096	4,169	4,722	1,933	3,916	3,023	3,623	3,579	3,613	4,730	1,969

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

Appendix Table VII *continued*.

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
Longline	all	all	NE	all	26	26	26	26	26	26	26	26	26	26	208	44
Longline	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	12
Otter Trawl	all	all	NE	small	1016	1016	70	70	747	1022	855	70	70	70	617	60
Otter Trawl	all	all	NE	large	4435	4435	304	304	890	890	304	304	304	304	1364	67
Otter Trawl	all	all	MA	small	104	104	104	104	620	104	620	104	104	104	1001	133
Otter Trawl	all	all	MA	large	177	177	177	177	177	177	177	177	177	177	377	29
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	18
Shrimp Trawl	all	all	NE	all	42	42	42	42	42	42	42	42	42	42	42	38
Shrimp Trawl	all	all	MA	all	13	13	13	13	13	13	13	13	13	13	13	9
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	1032	2688	104	104	1149	104	964	61
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	94	94	94	94	528	94	94	2499	570	94	1742	38
Sink, Anchor, Drift Gillnet	all	all	MA	small	58	58	58	58	58	58	58	58	58	58	835	58
Sink, Anchor, Drift Gillnet	all	all	MA	large	27	27	27	27	27	27	27	27	27	27	288	91
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	51	51	51	51	955	51	51	51	955	51	605	39
Scallop Dredge	open	limited	NE	all	25	25	25	25	25	25	25	25	25	25	292	11
Scallop Dredge	open	limited	MA	all	36	36	36	36	36	36	36	36	36	36	36	10
Scallop Dredge	open	general	NE	all	71	71	71	71	71	71	71	71	71	71	71	69
Scallop Dredge	open	general	MA	all	69	69	69	69	69	69	69	69	69	69	69	10
Scallop Dredge	closed	limited	NE	all	15	15	15	15	15	15	15	15	15	15	47	15
Scallop Dredge	closed	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12	7
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	612	612	21	21	558	558	21	21	21	21	308	73
Mid-water paired & single Trawl	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	32
Fish Pots/ Traps	all	all	NE	all	19	19	19	19	19	19	19	19	19	19	19	19
Fish Pots/ Traps	all	all	MA	all	37	37	37	37	37	37	37	37	37	37	37	34
Purse Seine	all	all	NE	all	10	10	10	10	10	10	10	10	10	10	10	71
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9	9
Hand Line	all	all	NE	all	68	68	68	68	68	68	68	68	68	68	68	129
Hand Line	all	all	MA	all	126	126	126	126	126	126	126	126	126	126	126	126
Scottish Seine	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12	20
Clam Quahog Dredge	all	all	NE	all	69	69	69	69	69	69	69	69	69	69	69	69
Clam Quahog Dredge	all	all	MA	all	69	69	69	69	69	69	69	69	69	69	69	69
Crab Pots	all	all	NE	all	12	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					7,975	7,975	2,306	2,306	6,887	6,965	3,607	4,711	4,731	2,306	9,877	1,992
Total Trips excluding shaded cells					7,720	7,720	1,550	2,051	6,887	6,965	3,607	4,429	4,698	2,306	9,877	1,992

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

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