Northeast Fisheries Science Center Reference Document 06-22

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

by S.E. Wigley, P.J. Rago, K.A. Sosebee, and D.L. Palka

September 2006

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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
ESA	=	Endangered Species Act
FMP	=	Fishery Management Plan
fpc	=	finite population correction factor
MA	=	Mid-Atlantic
MAFMC	=	Mid-Atlantic Fishery Management Council
MMPA	=	Marine Mammal Protection Act
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

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 by 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 33,000 days**.** Application of additional criteria for evaluating the efficacy of the monitoring program may lead to reductions in the total number of days necessary. In particular, criteria related to the magnitude of total discards relative to landings may reduce the number of days necessary to estimate infrequent discard events of fish.

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INTRODUCTION

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), three fleets and twelve 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 Northeast Fisheries Observer Program (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 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. (*Note: Discard rates are not included in this report.*) 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 are 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 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 in 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 Reports (VTRs), 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), marine mammals and sea birds are included in these analyses to illustrate the comprehensive nature of the NEFOP and the SBRM.

The aggregate species approach will illustrate the overall effectiveness of the SBRM. The individual species approach will show the tradeoffs for varying levels of precision. With respect to the precision targets, the NWGB determined that a 20-30% 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 comprised 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 US 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 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 and ports located in states from New York southward comprised the MA region. While data from both VTRs 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 NEFOP 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, fourteen 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 (less than 5.5 inches) and large (5.5 inches and greater). For gillnet, three mesh groups were formed: small (less than 5.5 inches), large (from 5.5 to 7.99 inches), and extra large (8 inches and greater).

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)[1]. Trips using other gear types were not further classified.

[1] See http://www.nefmc.org/scallops/index.html for further information on the sea scallop FMP.

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 sixty individual species or species groups are examined in these analyses. These species/species groups comprise the fourteen FMPs of the NEFMC and MAFMC, an all species combined group, and five protected species groups (Table 1). The fisheries encompassing these sixty species/species groups required forty-five 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. These databases are used to define the size of the sample and the size of the strata, respectively. Data from each source are retrieved and prepared separately before they are combined.

Fishing Vessel Trip Report (VTR) 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 permits[2] who catch and buy/sell species regulated by the NEFMC and/or the MAFMC. The mandatory reporting system consists of two components: 1) dealer reporting and 2) vessel trip reporting. Each component contains information needed for fishery management and stock assessment analyses. The dealer reports contain total landings by market category, while the 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)[3].

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 *(Note: total discards are not presented in this report)*; 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) data and the Days-At-Sea data systems cover only portions of the fisheries and therefore are limited in use for this type of analysis.

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 NMFS-NERO http://www.nero.noaa.gov/ro/fso/vtr_inst.pdf). These self-reported data constitute the basis of

[2] with the exception of those vessels that hold only federal lobster permits.

[3] 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.

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, Chief, Fisheries Information Section, Northeast Regional Office, NMFS).

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) then 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-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 d/k 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 (NEFOP) Data

The NEFOP is a multi-purpose program that collects a broad range of data on all species that are encountered during a fishing trip, as well as gear characteristics data, economic information and biological samples. The NEFOP employs trained, sea-going observers to collect these data, which also include 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[4]. For most gear types, observers use a 'complete' sampling protocol that includes obtaining species weights for both kept and discarded portions of all species in the catch on every haul.

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

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 and another for turtles, marine mammals, and birds that utilized both the 'complete' and 'limited' sampling protocols.

For the fish dataset, only observed hauls in which all discarded species were recorded are used. In the majority of trips, all hauls are observed. However, for some gear types – particularly scallop dredge, where fishing activity occurs continuously and a single observer cannot observe all hauls – it was necessary to expand discard species weights by the ratio of the number of total hauls to the number of observed hauls to account for all hauls in the trip. The expanded discard weight was used in the subsequent discard-to-days-absent analysis (but not in the discard-to-kept analysis) because days absent is a 'trip' level variable representing the entire trip, not just the observed portion of the trip. 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 if 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 Table 2a-b. There is a broad range of observer coverage by gear type in 2004; eleven of the fourteen gear types had

[4] 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, respectively.

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 Mid-Atlantic 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 (for example: 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 exceptions are notable: in the scallop dredge fleets, trips are discarding squid-butterfish-mackerel and surfclam-ocean quahog.

MISSING CELLS

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, we use a simple imputation approach using data from adjoining strata. In this simple imputation, only the temporal stratification (calendar quarter) was relaxed to half year, recognizing that seasonal variation can occur for some species (Table 2a-b). In the case of shrimp trawl, given 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 are described 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 used 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 trips, then there were insufficient data to apply simple imputation, so 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. 197-173). Details of the separate and combined estimators follow a brief introduction to ratio estimators. Overall, we examined two different ratio estimators (discard/kept [d/k] vs discard/days absent [d/da]) for two different pooling strategies (separate vs combined). In addition, the discard per trip estimator (3) was applied individually to the datasets for d/k and d/da. The only differences between the two 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), Eq. 1a and 1b, respectively.

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

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

and

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

where d_{ijh} is the total discard weight of species group j in trip i within stratum h; k_{ih} is the total kept weight of all species in trip i within stratum h; n_h is the sample size (number of observed trips) in stratum h, and $\bar{k}_h$ is the mean kept landings of all species within the stratum.

Note that in this formulation of the variance, the finite population correction factor (fpc) – i.e., one minus the sampling fraction within the stratum – has been omitted. This has been done to improve readability. The fpc is included, however, in Eqs. 12, 16, and 19 for the total variance of the bycatch ratios.

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

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

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

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

where n_h is the number of observed trips in stratum h, N_h is the number of VTR trips in stratum h, s_D is the standard error of the total discard of species group j in stratum h, $\hat{R}$ is the discard ratio of species group j in stratum h.

The number of sea days ($\hat{S}_{30\,jh}$) necessary to achieve a 30% CV for species group j in stratum h is defined as

(5) $$\hat{S}_{30\,jh}=\hat{T}_{jh}*\overline{da_h}$$

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

Ratio Assumptions

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

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

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

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

The correlation of the ratio estimate is defined as

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

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

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

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

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 New England large mesh trawl fishery for monkfish, and in the large and small mesh multispecies groundfish species. Associations for small mesh trawls in New England were also strong for squid, mackerel, and butterfish and small mesh multispecies. Correlations for skate discard rates were above 0.32 in the NE and MA large mesh trawl fisheries, above 0.48 in the NE and MA extra large mesh gill net fisheries, and above 0.2 in four of the six 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[5]. These two illustrative plots (Figure 1a-b) reveal that the fourth root transformation facilitates the depiction of information and does not obscure the underlying pattern of increasing variance and a zero intercept. Thus, using a fourth root transformation, examples of the comparison between discard and kept (or days absent) are illustrated by thirteen fish species groups in otter trawl and gillnet gears by mesh sizes (presented in Figure 1c-zz and by five protected species groups for longline, otter trawl, gillnet and scallop dredge (Figure 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. Examples of these are given for large-mesh groundfish discarded in the otter trawl and gillnet fleets **(**Figure 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 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.

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

Method 1. Separate Ratio Method

Total discarded pounds of species *j* using Method 1:

(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 $\hat{D}_{1,j}$

(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} = 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*.

Coefficient of variation 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*:

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

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* 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*; and n_h is the number of observed trips in stratum *h*.

Variance of $\hat{D}_{2,j}$ for species *j*

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

and

(16b) $V(\hat{D}_{2,j}) = \sum_{h=1}^{L} DA_h^2 \left(\dfrac{N_h - n_h}{n_h N_h} \right) \dfrac{1}{\left(\dfrac{\sum_{i=1}^{n_h} da_{ih}}{n_h} \right)^2} \left[\dfrac{\sum_{i=1}^{n_h} \left(d_{jih}^2 + (r'_{c,j})^2 da_{ih}^2 - 2 r'_{c,j}\, d_{jih} da_{ih} \right)}{n_h - 1} \right]$

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*; $r_{c,jh}$ is the **combined ratio** of species *j* in stratum *h*; d_{jih} is discards of species *j* from trip *i* in stratum *h*; k_{ih} is kept pounds of all species on trip *i* in stratum *h*; da_{ih} is days absent from trip *i* in stratum *h*; N_h is the number of VTR trips in stratum *h*; and n_h is the number of observed trips in stratum *h*.

Coefficient of variation of $\hat{D}_{2,j}$

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

Method 3. Simple Expansion Method: Mean Discard per Trip

Total discarded pounds for species *j* using Method 3:

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

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

Note: $\hat{D}_3$ will differ between discard/da and d/kall 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*

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

where $\hat{D}_{3,j}$ 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*.

Coefficient of variation of $\hat{D}_{3,j}$

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

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

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

if a quarterly sea day estimate was not available (due to no observer coverage or the CV could not be estimated due to a bycatch rate of zero) then the quarterly sea days were estimated by pilot coverage

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

where $\hat{T}$ is 2% of the VTR trips in stratum *h* and quarter *q*, and 3 <= $\hat{T}_{hq}$ <= 100 trips; $\overline{DA}$ is the average trip length of VTR trips in stratum *h* and quarter *q*.

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

META-ANALYSIS

A meta-analysis of the sixty species groups and thirty-nine fleets (excluding five 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-g. 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-n. 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 to 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 consequentially leading to higher coverage.

The meta-analyses indicate that generally there was little difference between the two bycatch ratios (d/da and d/k) for most species in most fleets, with the exception of gillnets where the d/da provided lower estimates of variation of total discards compared with d/k ratios. Generally there was little difference between the three methods, but the ratio estimators tended to give higher CVs of the total than the simple expansion method. A relatively large fraction of the overall estimates for species, gear, and mesh size had CVs less than 30%, 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, 9, 10) are based upon the combined ratio method (Method 2) and the discard to kept ratio.

The precision of the total discards by fleet and species is presented in Table 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. Nineteen 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, 30% 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 be considered when evaluating the precision. There are cases – for example, large-mesh NE multi-species 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 is presented in Table 7a, and ranking of total number of incidental takes of turtles, marine mammals, and sea birds within a fleet is 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 occur 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 New England 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 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 6,058 observer days to estimate surf clam discards in the large mesh New England 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 10 the estimated 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-b present 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[6] (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-b, 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 33,602 to 38,882 days; for comparative purposes, approximately 8,000 observer sea days were utilized by the NEFOP in 2004.

Given this 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. This could be accomplished by applying a series of 'filters' in Table 8. These potential filters are explained in detail in Chapter 6 of the Omnibus SBRM Amendment. Briefly, these filters are based on considerations such as: 1) importance of discard with respect to the stock assessment or resource status for a given species; 2) elimination of cells in which the CV is below 30% at current levels of observer coverage; 3) elimination of cells in which discards are a minor component of the total discards for that species group; and 4) elimination of cells in which discards are a minor component of the total landings for that species group.

[6] Magnuson-Stevens Act covers these 15 species groups.

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 compared 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[7].

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 11). Additionally, a paired t-test of the stratum-specific standard deviations of pounds kept showed significant differences from six of the 14 comparisons. A strong correlation was detected in trip duration between observed and unobserved trips (Figure 10), with observed trips averaging about a quarter-day longer (Figure 11, Table 11). However, the difference in stratum-specific standard deviations of trip length was significantly different from zero ($p = 0.002$). Some skewing of the differences in mean trip duration is evident, with observed trips being slightly longer.

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 distribution of trips for the stratum as a whole (Table 12). 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 and quota-monitoring trips, which have a disproportionately higher rate of observer coverage than other observed trips; this 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 Vessel Monitoring Systems (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

[7] 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.

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 New England 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 then, 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 (QA/QC) 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) has 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 assessments 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 2002, 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 to 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
14. Development of appropriate criteria to filter the importance of fisheries and species combinations for the estimation of adequate sampling coverage.

The statistical theory applicable to the estimation of fisheries bycatch is evolving 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, these 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. The total estimated number of sea days necessary to achieve a 30% CV exceeded 33,000 days.

Analyses were performed to evaluate potential sources of bias in the 2004 NEFOP data. In general, there was no evidence of a systematic bias in amount of kept pounds, trip duration or area fished between the NEFOP and VTR data.

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Table 1. List of sixty species and species group (in bold) corresponding to the fourteen Fishery Management Plans and five 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 Northeast Fisheries Observer Program and Vessel Trip Reports, 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 Northeast Fisheries Observer Program and Vessel Trip Reports, 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 coefficient of variation (CV) of 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.*

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

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

Table 6 *continued.* The coefficient of variation (CV) of 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.*

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

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

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

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

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

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

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

Table 9 *continued.* Number of **trips** needed to achieve a 30% coefficient of variation for estimates of total discard 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	215	107	
Longline	all	all	MA	all	2	12	12	12	12	12	12	pilot
Otter Trawl	all	all	NE	small	200	70	70	505	557	677	157	
Otter Trawl	all	all	NE	large	539	304	304	1577	777	1973	177	
Otter Trawl	all	all	MA	small	205	901	104	104	799	522	222	
Otter Trawl	all	all	MA	large	76	177	177	177	177	251	65	
Scallop Trawl	open	limited	MA	all	3	12	12	12	12	12	12	pilot
Scallop Trawl	open	general	MA	all	39	25	25	25	25	25	19	pilot
Shrimp Trawl	all	all	NE	all	12	42	42	42	42	42	43	
Shrimp Trawl	all	all	MA	all	2	13	13	13	13	13	9	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	small	1	12	12	12	12	12	12	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	large	772	104	844	104	966	2510	182	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	569	94	995	94	973	2176	118	
Sink, Anchor, Drift Gillnet	all	all	MA	small	358	977	58	58	58	395	58	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	81	105	27	27	27	144	91	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	142	519	793	51	418	796	39	pilot for fish
Scallop Dredge	open	limited	NE	all	36	206	25	25	25	72	24	
Scallop Dredge	open	limited	MA	all	78	378	36	36	36	36	25	
Scallop Dredge	open	general	NE	all	20	71	71	71	71	71	69	pilot
Scallop Dredge	open	general	MA	all	39	69	69	69	69	69	13	
Scallop Dredge	closed	limited	NE	all	86	243	15	15	15	263	25	
Scallop Dredge	closed	limited	MA	all	35	12	12	12	12	12	21	
Scallop Dredge	closed	general	NE	all	0	12	12	12	12	12	12	pilot
Scallop Dredge	closed	general	MA	all	1	15	15	15	15	15	15	pilot
Mid-water paired & single Trawl	all	all	NE	all	99	21	21	196	92	218	124	
Mid-water paired & single Trawl	all	all	MA	all	14	12	12	12	12	12	33	
Fish Pots/ Traps	all	all	NE	all	0	19	19	19	19	19	19	pilot
Fish Pots/ Traps	all	all	MA	all	8	37	37	37	37	37	34	pilot
Purse Seine	all	all	NE	all	26	10	10	10	10	10	61	
Purse Seine	all	all	MA	all	2	9	9	9	9	9	9	pilot
Hand Line	all	all	NE	all	9	68	68	68	68	68	130	pilot
Hand Line	all	all	MA	all	3	126	126	126	126	126	126	pilot
Scottish Seine	all	all	NE	all	8	12	12	12	12	12	21	pilot
Clam Quahog Dredge	all	all	NE	all	0	69	69	69	69	69	69	pilot
Clam Quahog Dredge	all	all	MA	all	0	69	69	69	69	69	69	pilot
Crab Pots	all	all	NE	all	0	12	12	12	12	12	12	pilot
Crab Pots	all	all	MA	all	0	27	27	27	27	27	27	pilot
Lobster Pots	all	all	NE	all	3	353	353	353	353	353	353	pilot
Lobster Pots	all	all	MA	all	0	75	75	75	75	75	75	pilot
Total Trips						5,318	4,689	4,189	6,139	11,444	2,689	
Total Trips excluding shaded cells						5,318	4,352	3,934	6,139	11,444	2,689	

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

Table 10a. The maximum number of **sea days** (baseline and filtered) needed to achieve a 30% coefficient of variation on estimates of total discard for any of species groups (20 species groups) and for any of the fish and turtle species groups (15 species groups), by fleet. Filtered values exclude gray-shaded cells within a fleet. The 2004 observed sea days for fish species and protected species (PSPP) are presented for comparisons purposed.

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

Table 10b. The maximum number of **trips** (baseline and filtered) needed to achieve a 30% coefficient of variation on estimates of total discard for any of species groups (20 species groups) and for any of the fish and turtle species groups (15 species groups). Filtered values exclude gray-shaded cells within a fleet. The 2004 observed sea days for fish species and protected species (PSPP) are presented for comparisons purposed.

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

Table 11. 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 12. 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
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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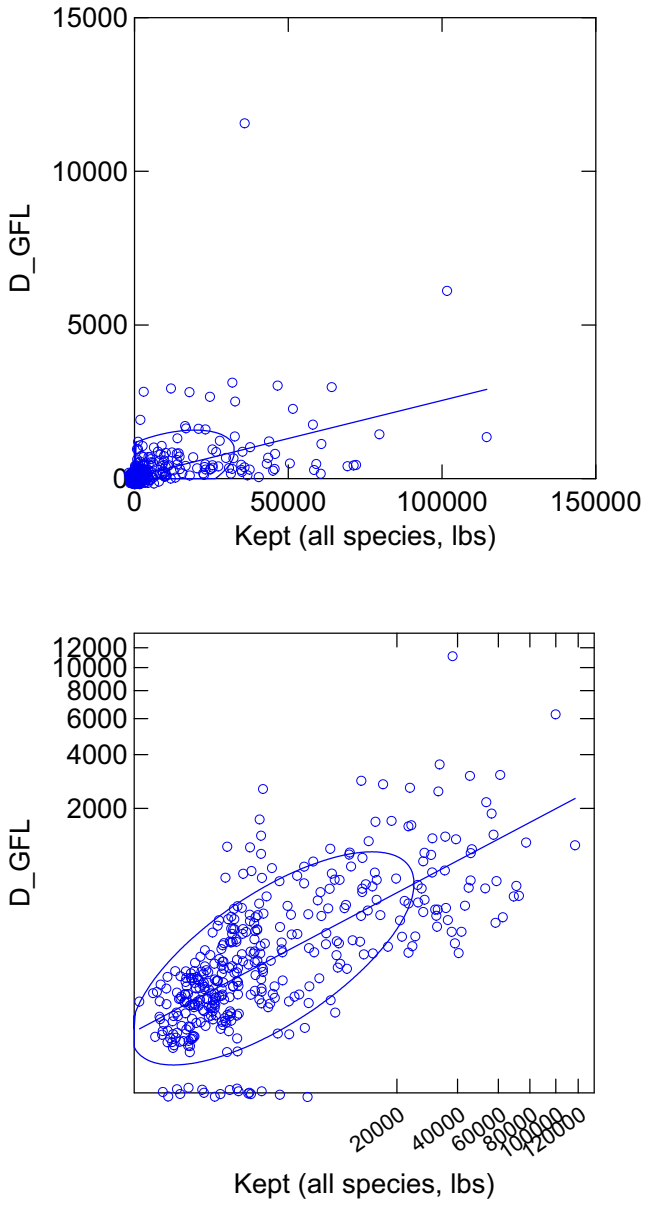


Figure 1a. Comparison of nominal scale (top) and fourth root transformation (bottom) of **NE multispecies (large-mesh) discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed large mesh (=> 5.5 inches) otter trawl trips in New England; each dot represents a trip.

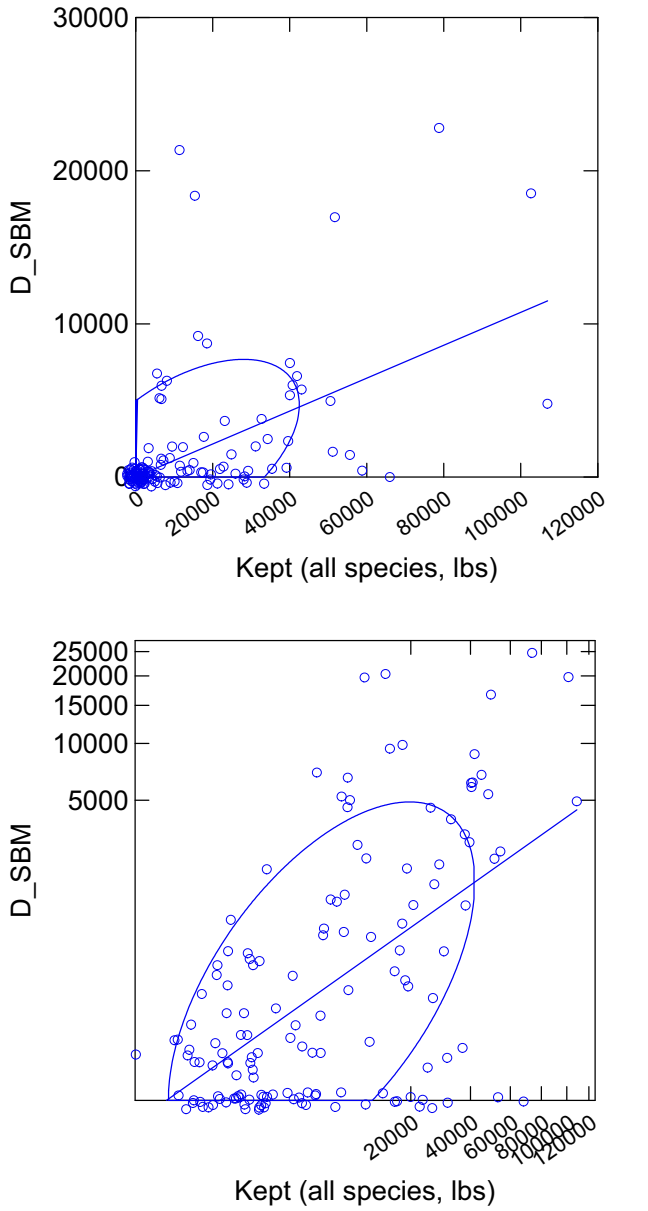


Figure 1b. Comparison of nominal scale (top) and fourth root transformation (bottom) of **squid-butterfish-mackerel discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed small mesh (< 5.5 inches) otter trawl trips in New England; each dot represents a trip.

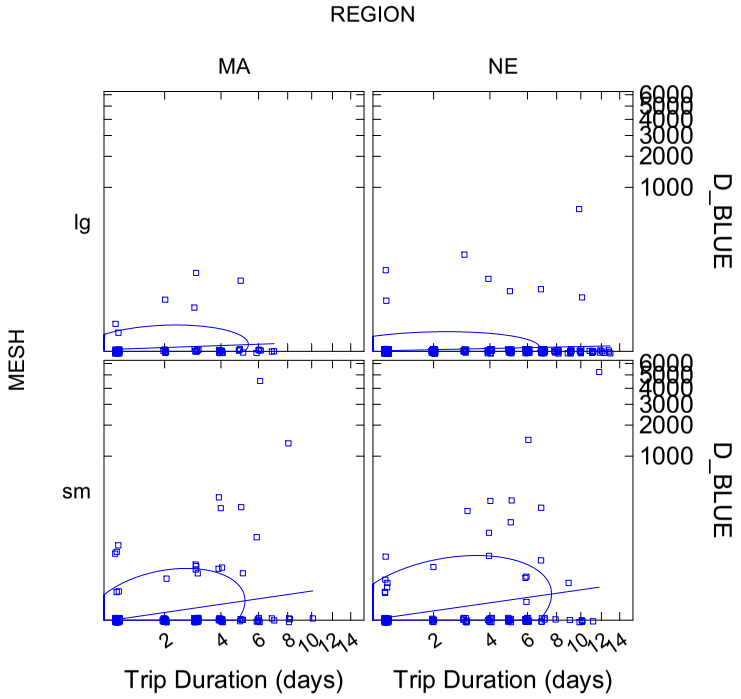


Figure 1c. Comparison of **bluefish discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

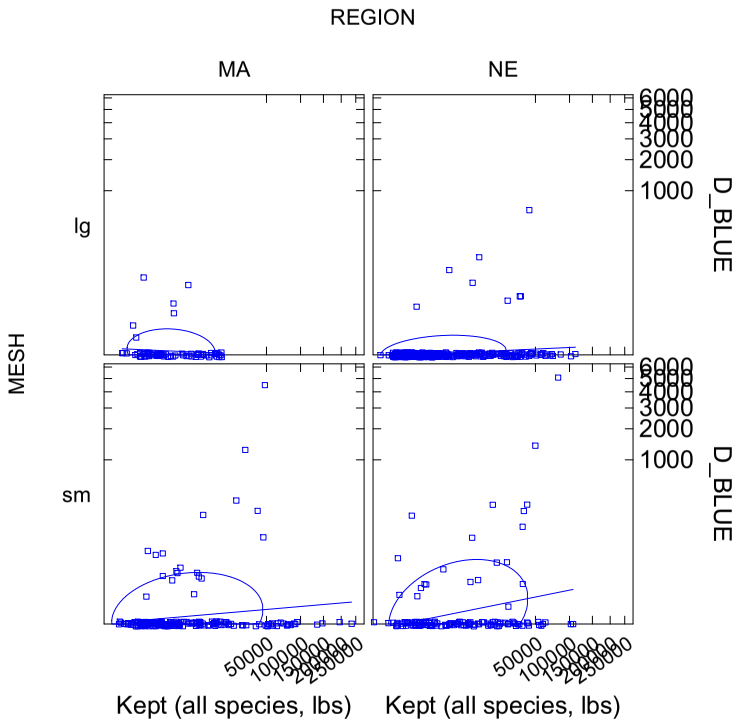


Figure 1d. Comparison of **bluefish discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

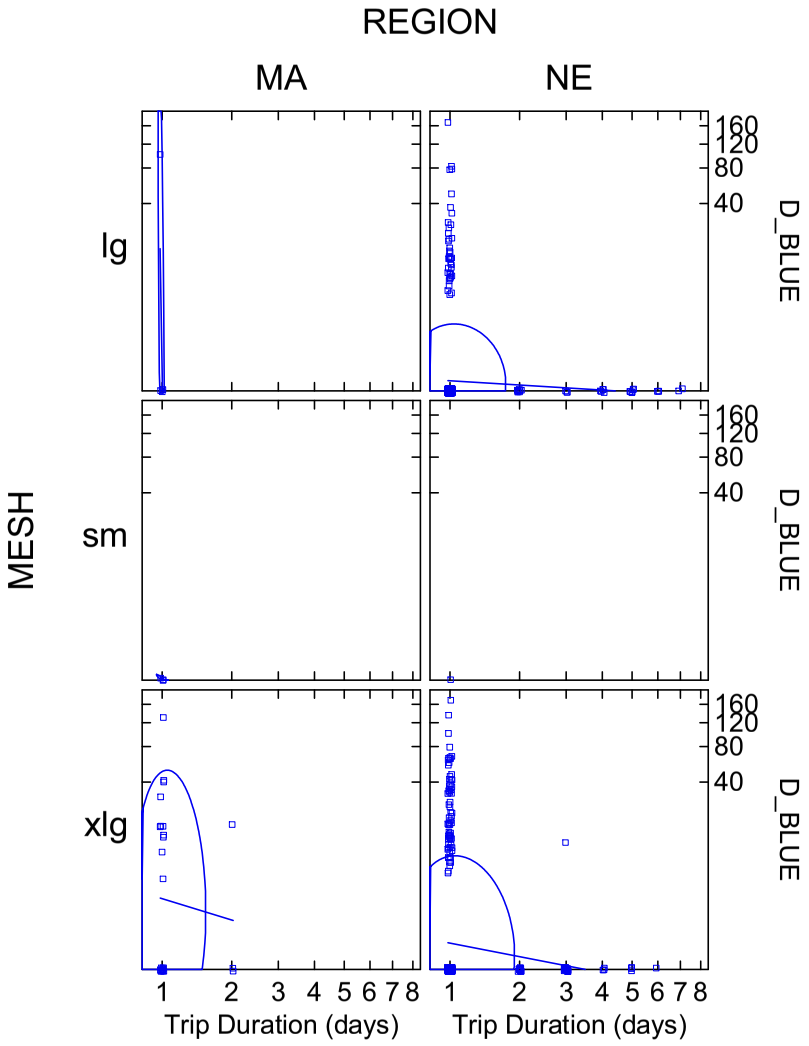


Figure 1e. Comparison of **bluefish** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

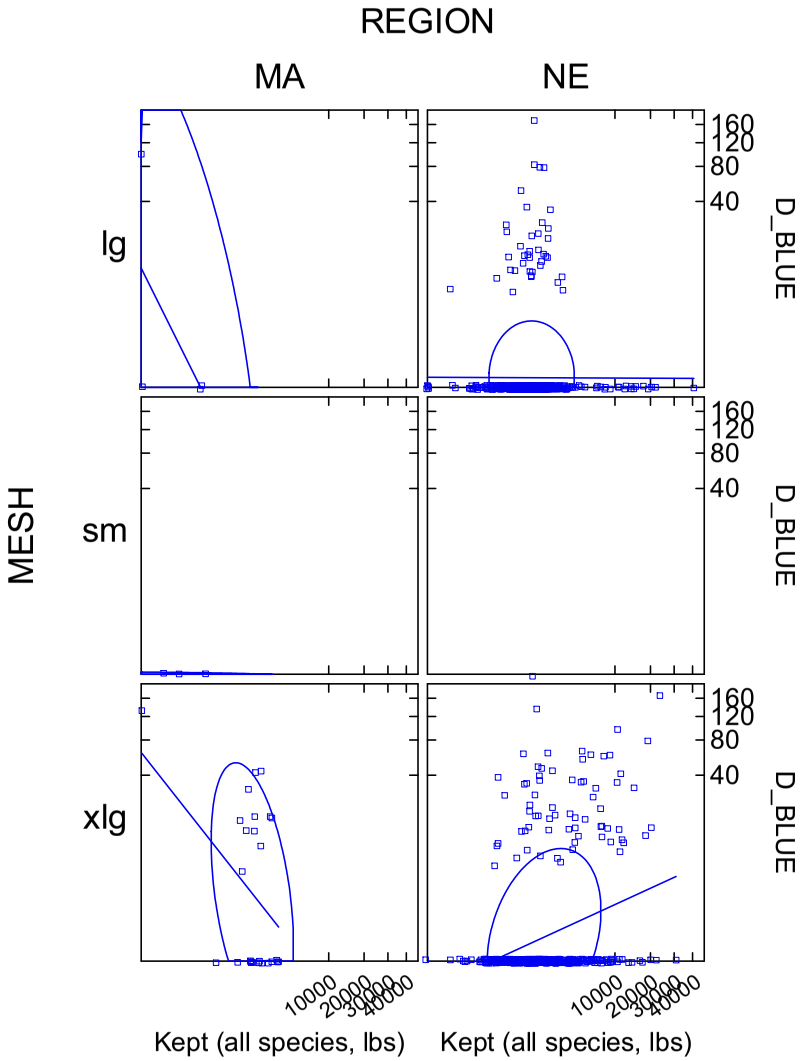


Figure 1f. Comparison of **bluefish** discards (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

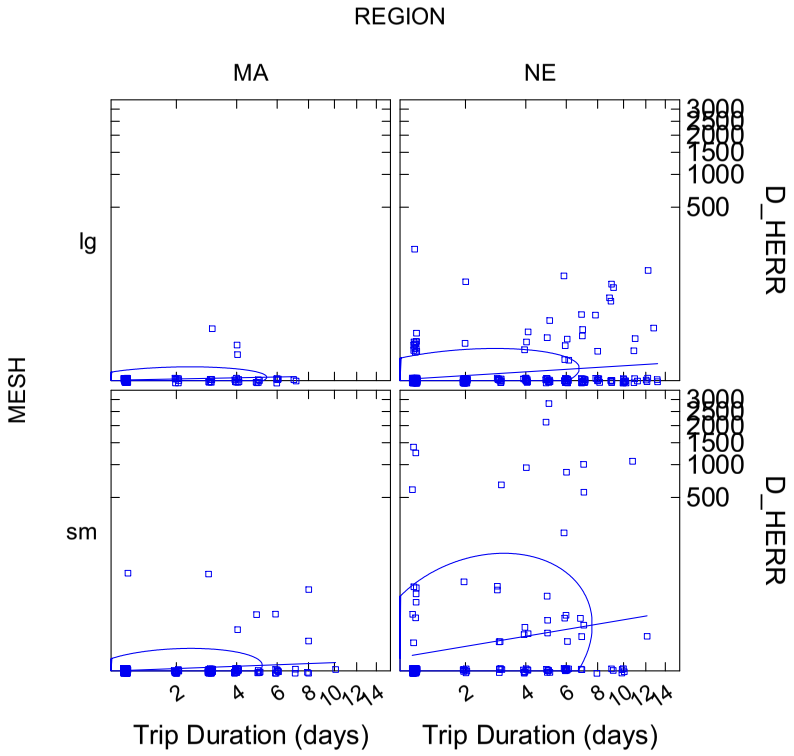


Figure 1g. Comparison of **herring discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

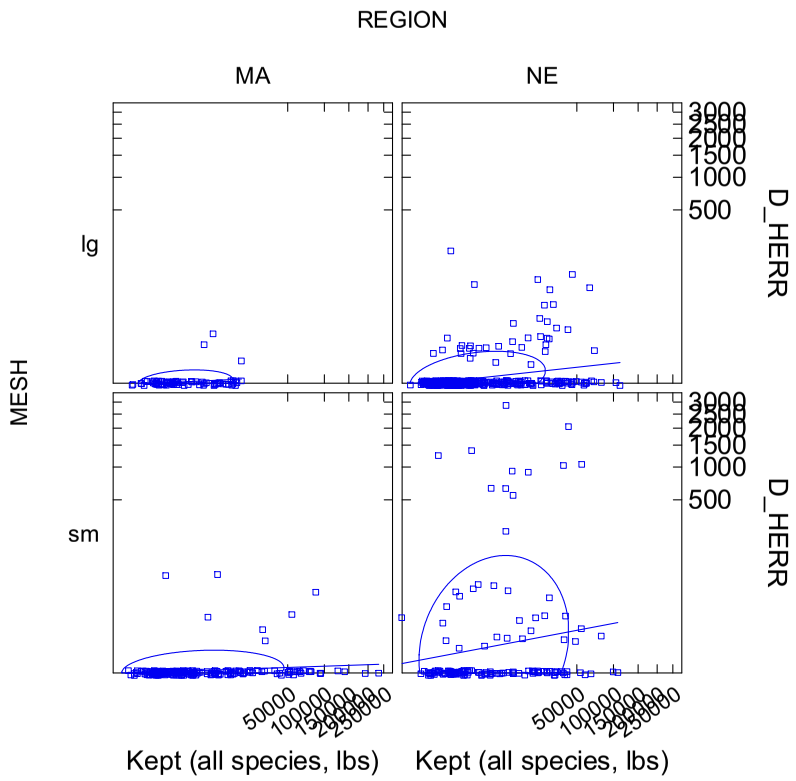


Figure 1h. Comparison of **herring discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

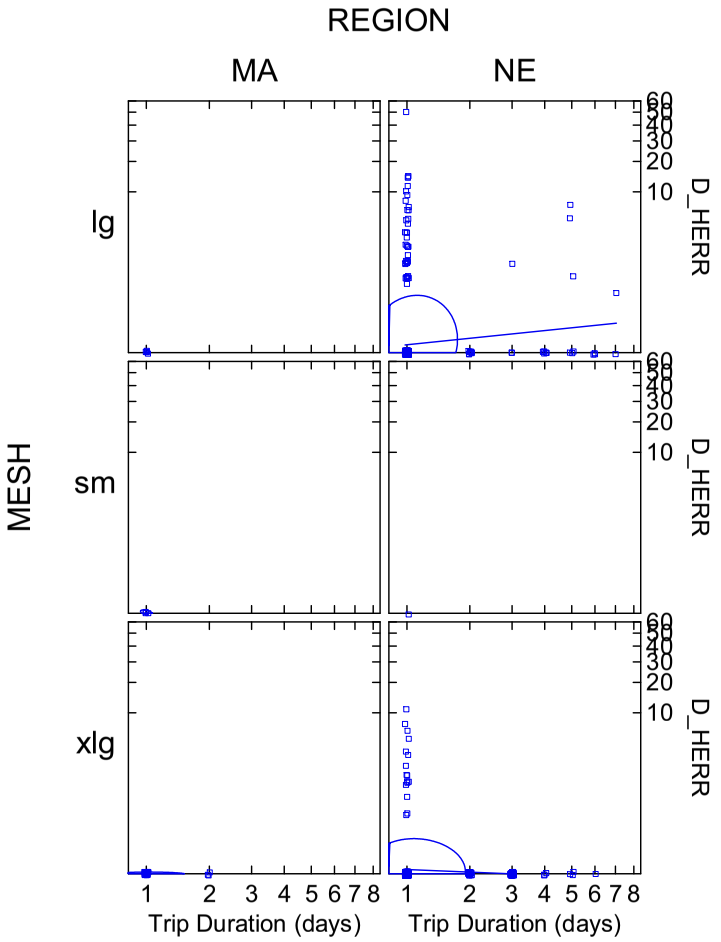


Figure 1i. Comparison of **herring** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

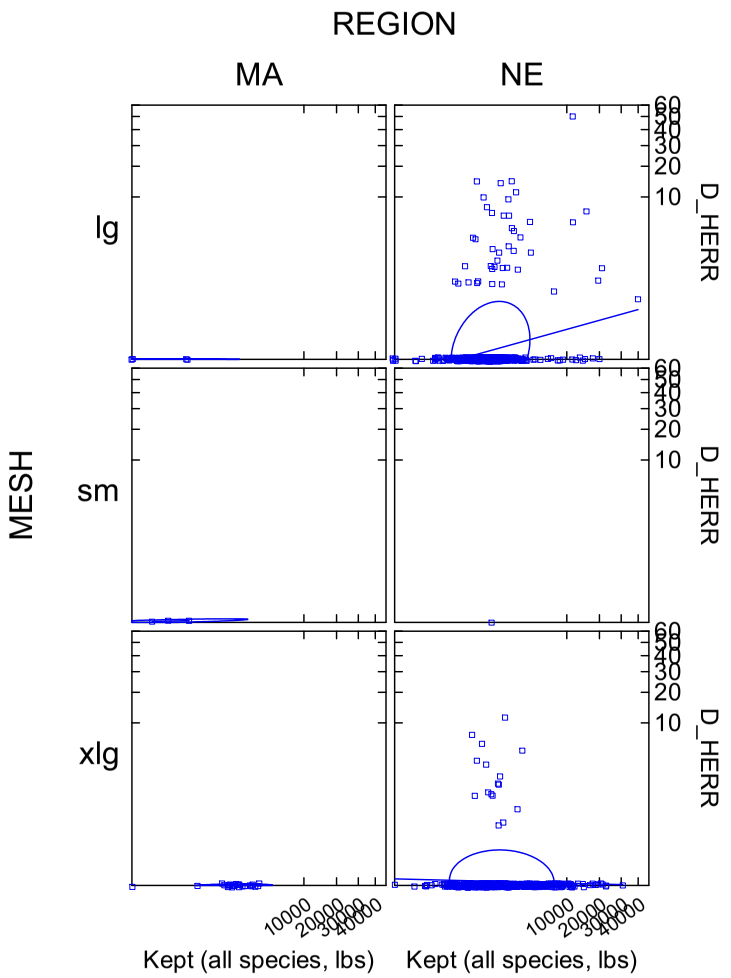


Figure 1j. Comparison of **herring discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

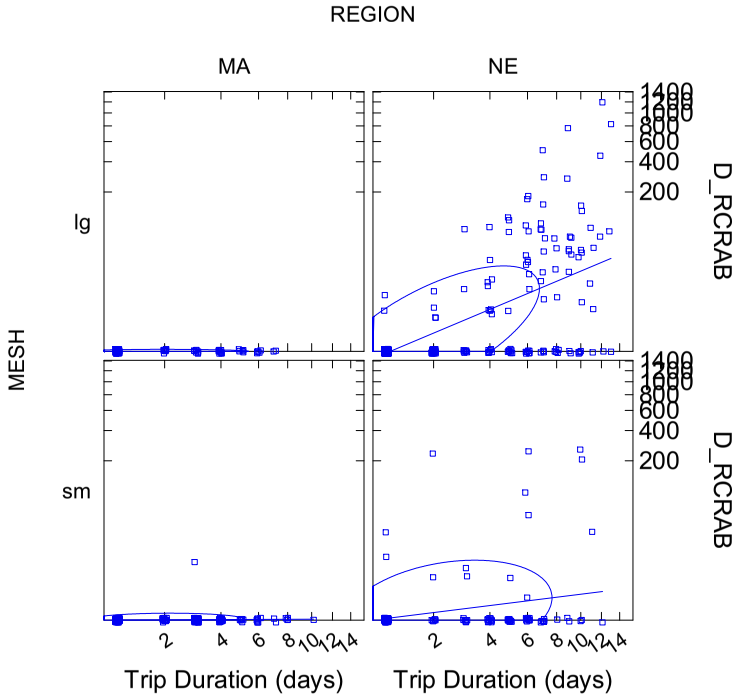


Figure 1k. Comparison of **red crab discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

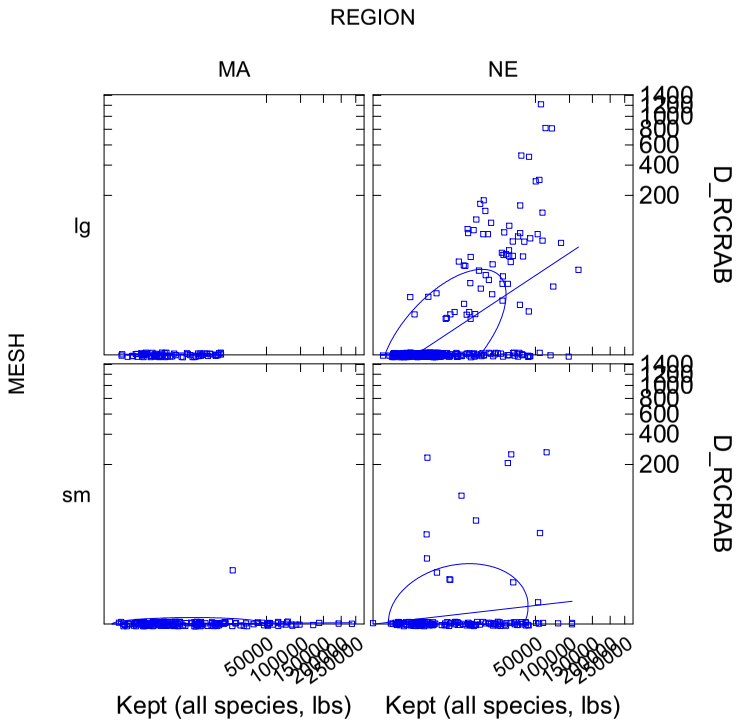


Figure 1l. Comparison of **red crab discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

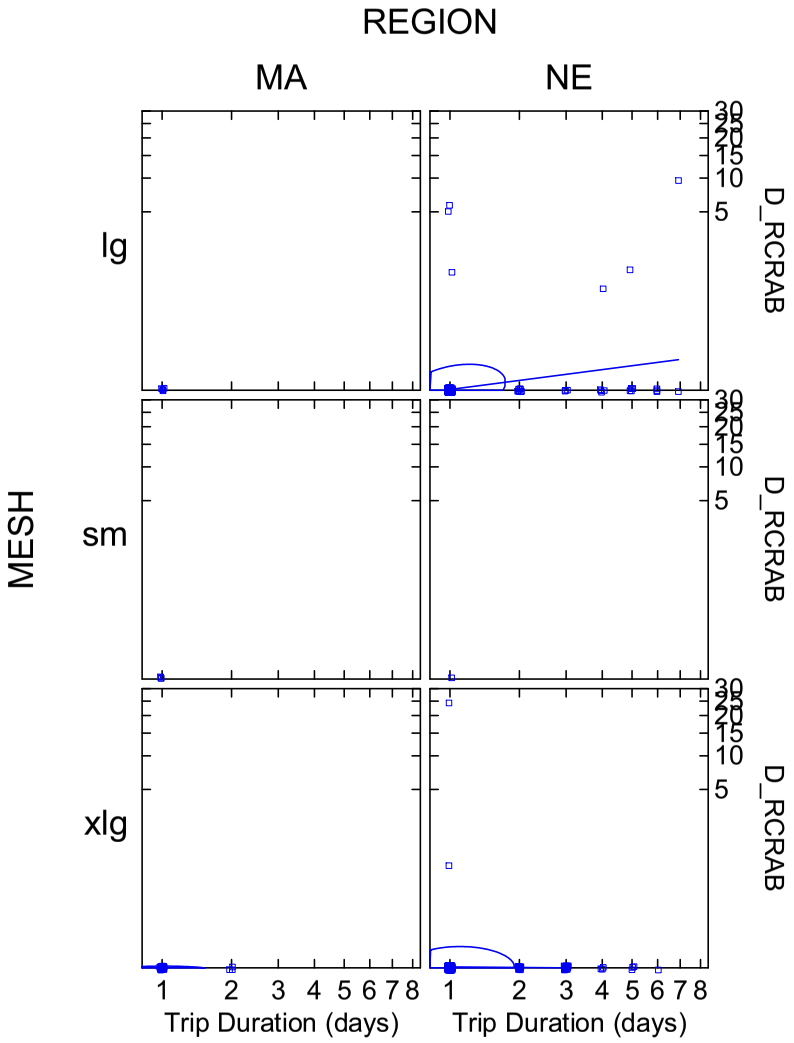


Figure 1m. Comparison of **red crab** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

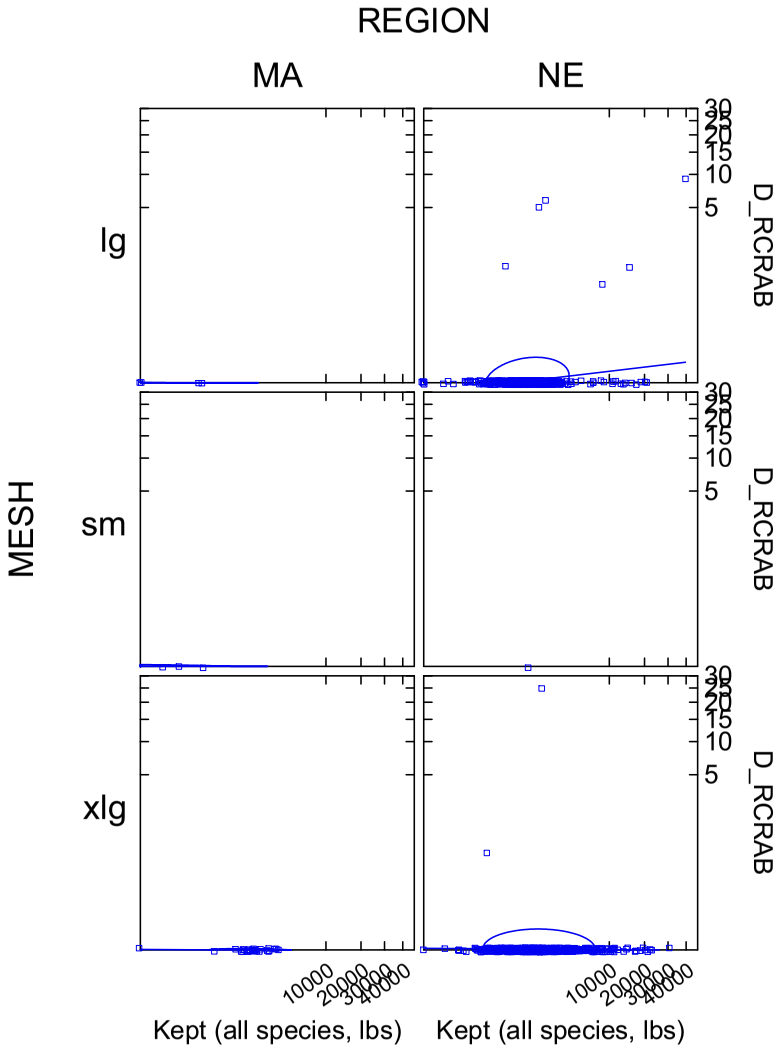


Figure 1n. Comparison of **red crab** discards (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

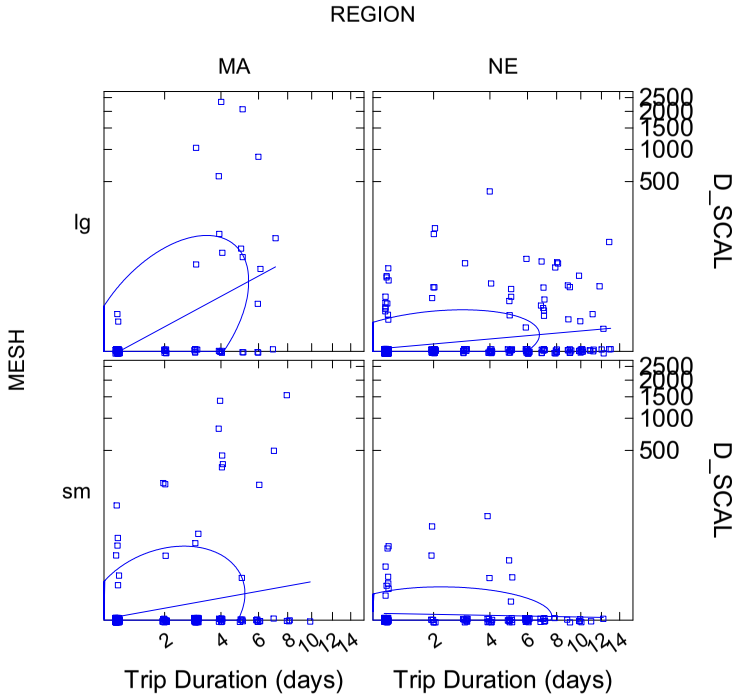


Figure 1o. Comparison of **scallop discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

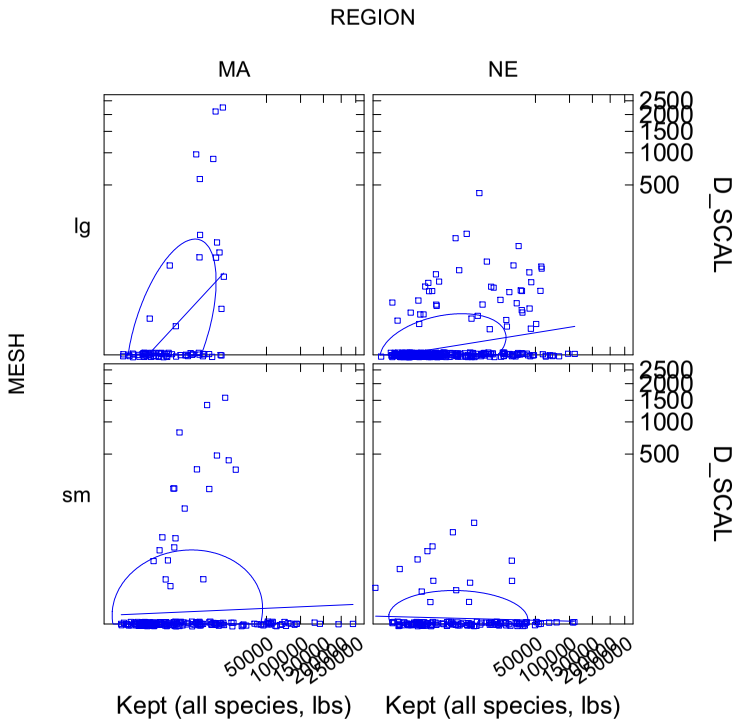


Figure 1p. Comparison of **scallop discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

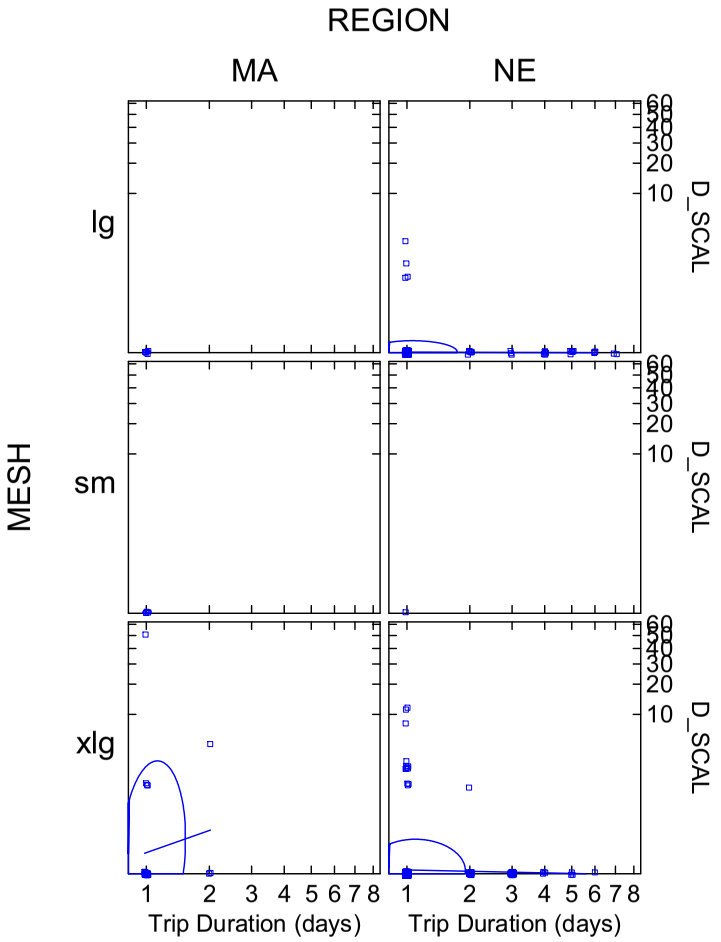


Figure 1q. Comparison of **scallop** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

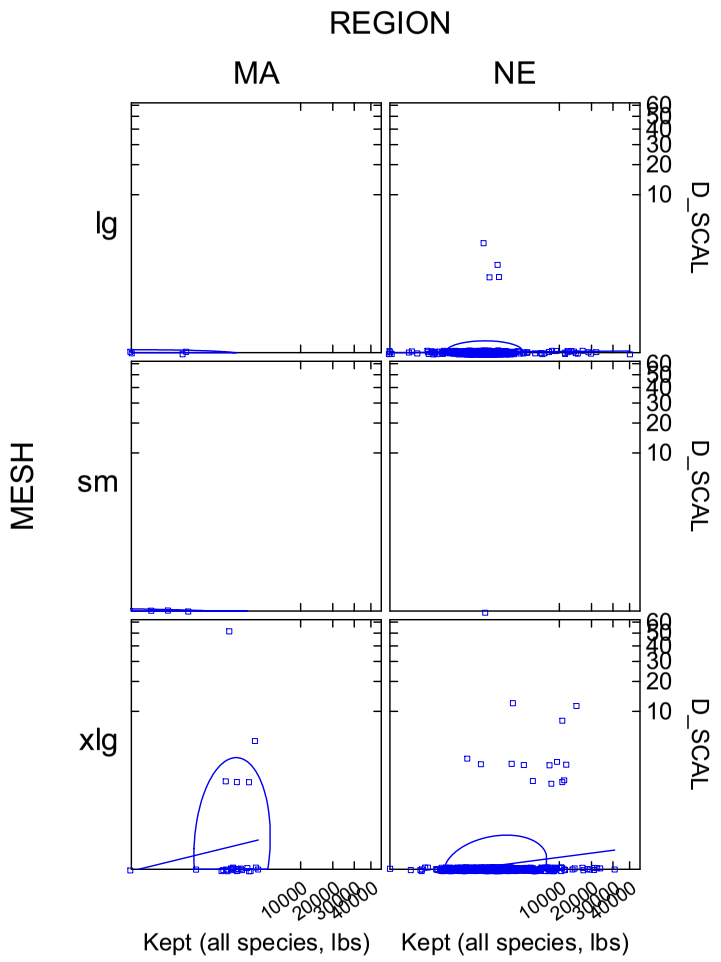


Figure 1r. Comparison of **scallop** discards (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

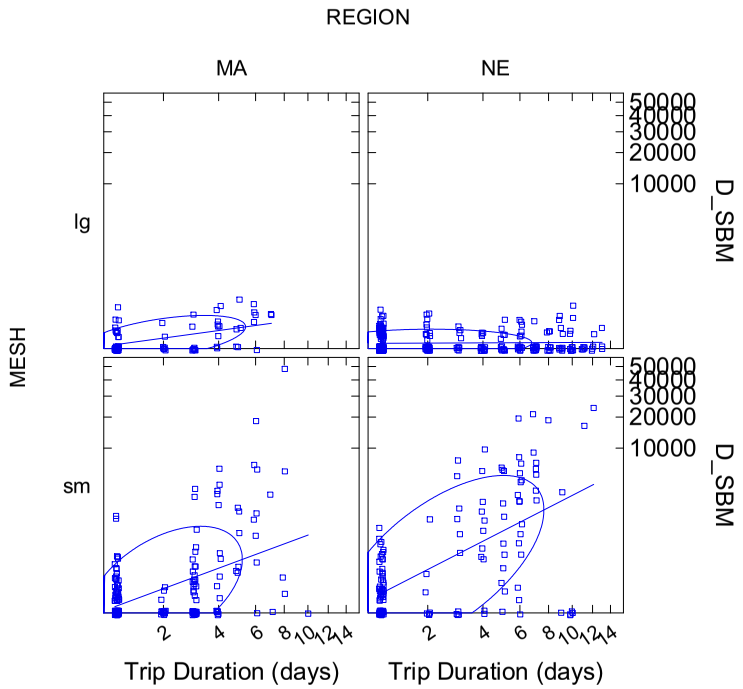


Figure 1s. Comparison of **squid-butterfish-mackerel discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

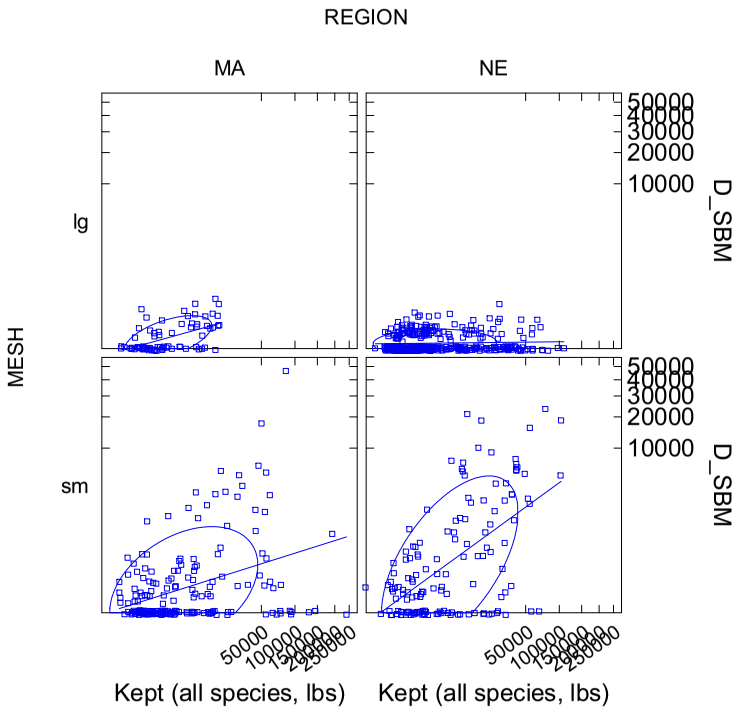


Figure 1t. Comparison of **squid-butterfish-mackerel discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

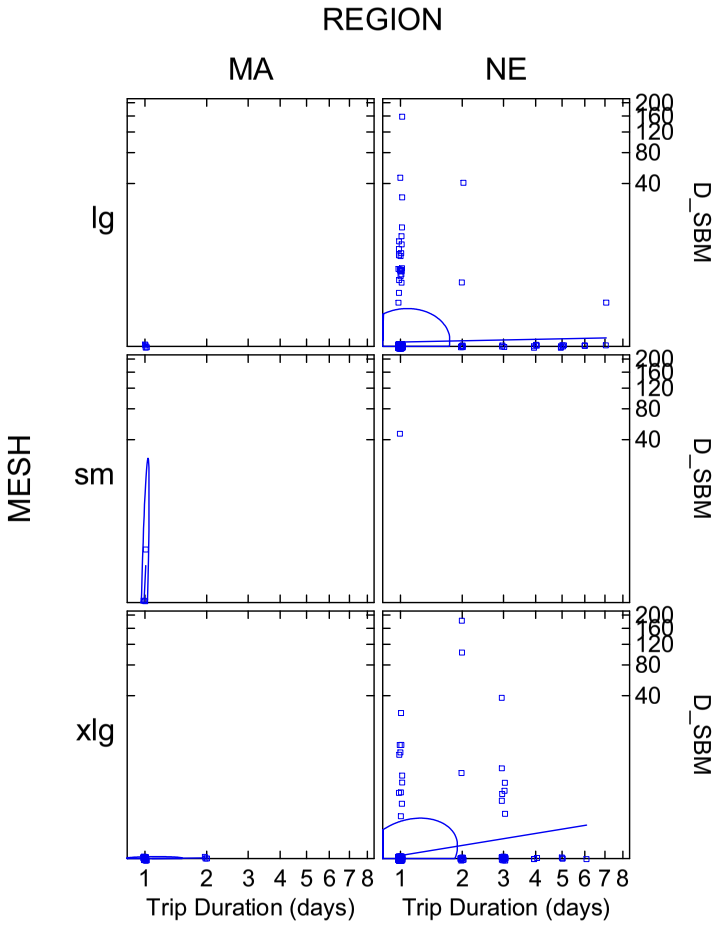


Figure 1u. Comparison of **squid-butterfish-mackerel** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

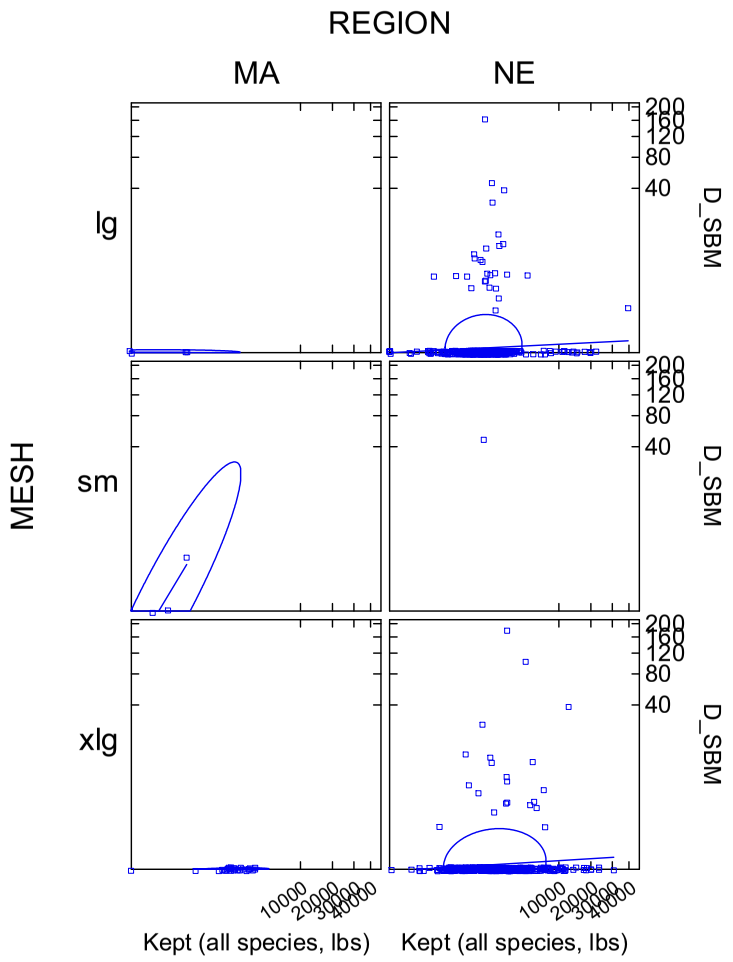


Figure 1v. Comparison of **squid-butterfish-mackerel** discards (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

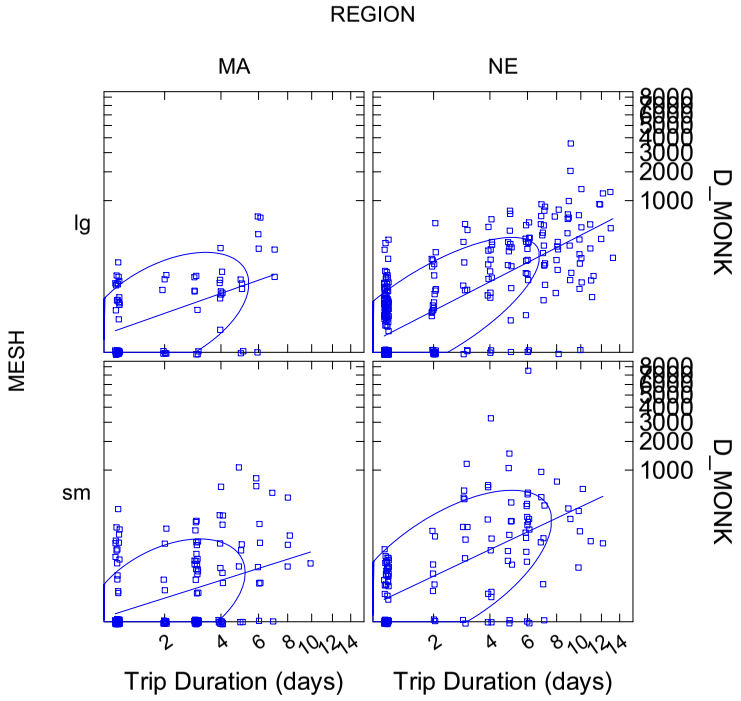


Figure 1w. Comparison of **monkfish discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

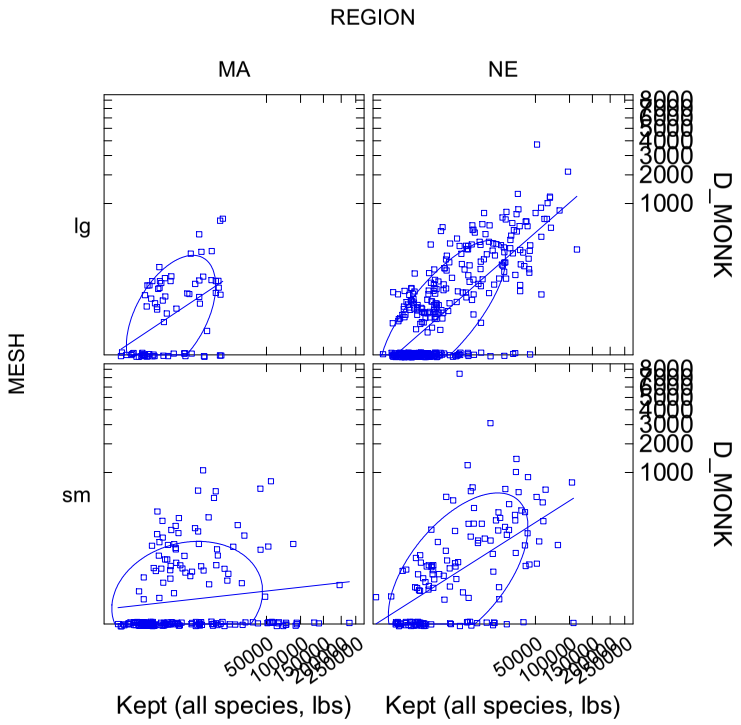


Figure 1x. Comparison of **monkfish discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches)); fourth root transformation used, each dot represents a trip.

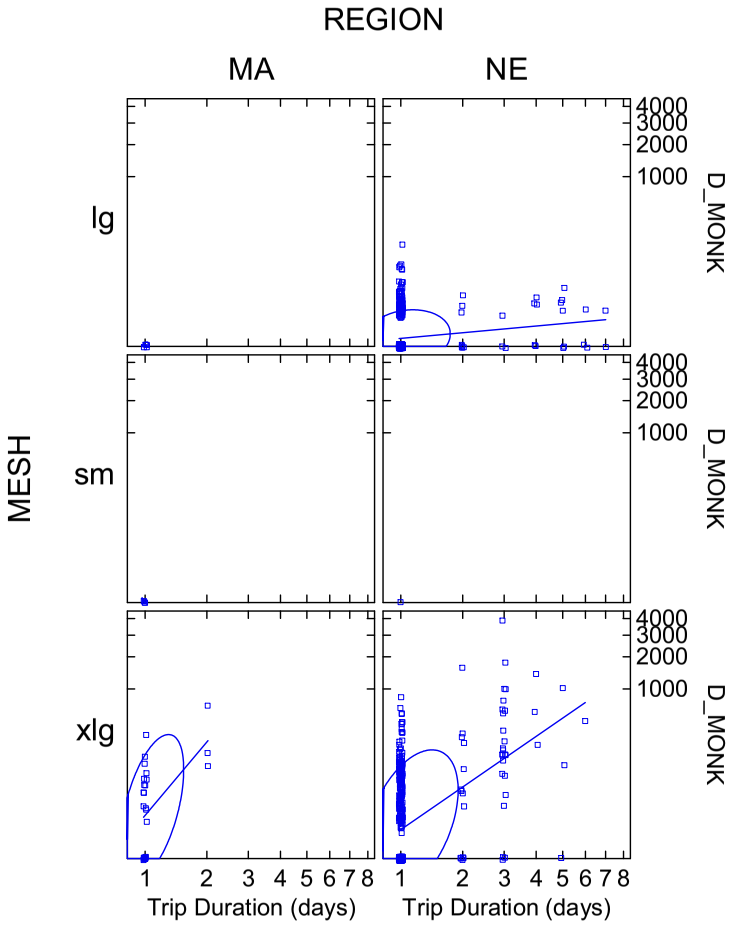


Figure 1y. Comparison of **monkfish** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

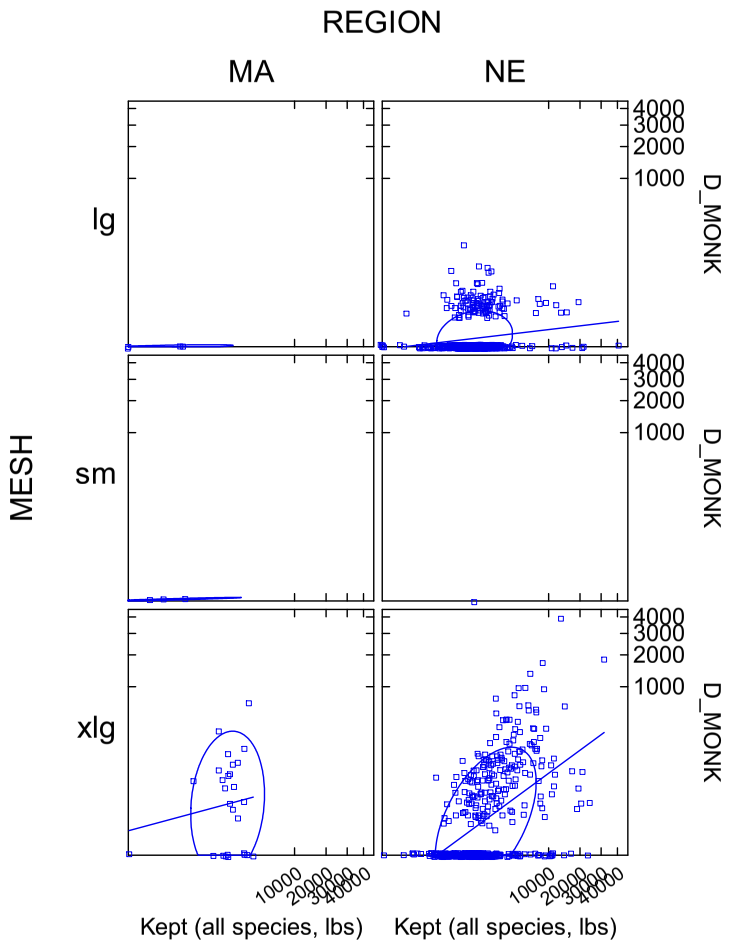


Figure 1z. Comparison of **monkfish** discards (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

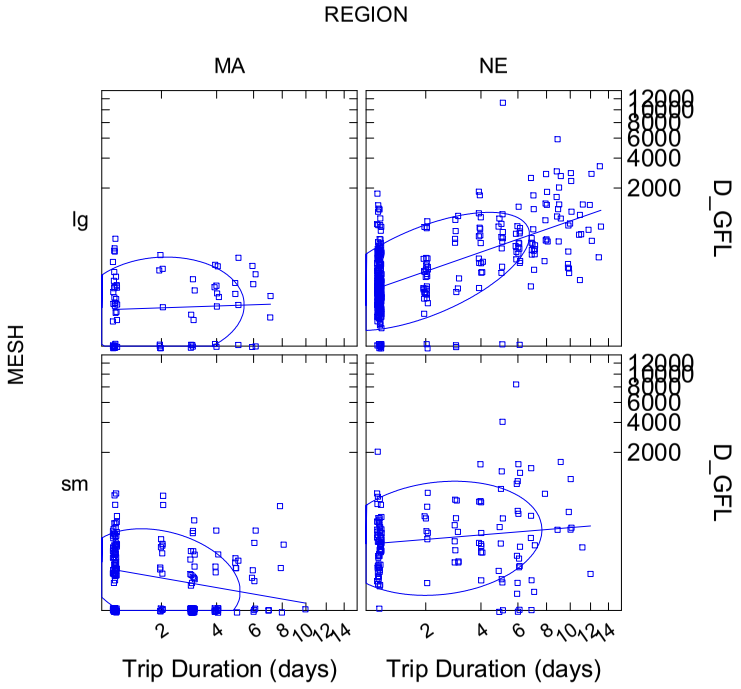


Figure 1aa. Comparison of **NE multispecies (large mesh) discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

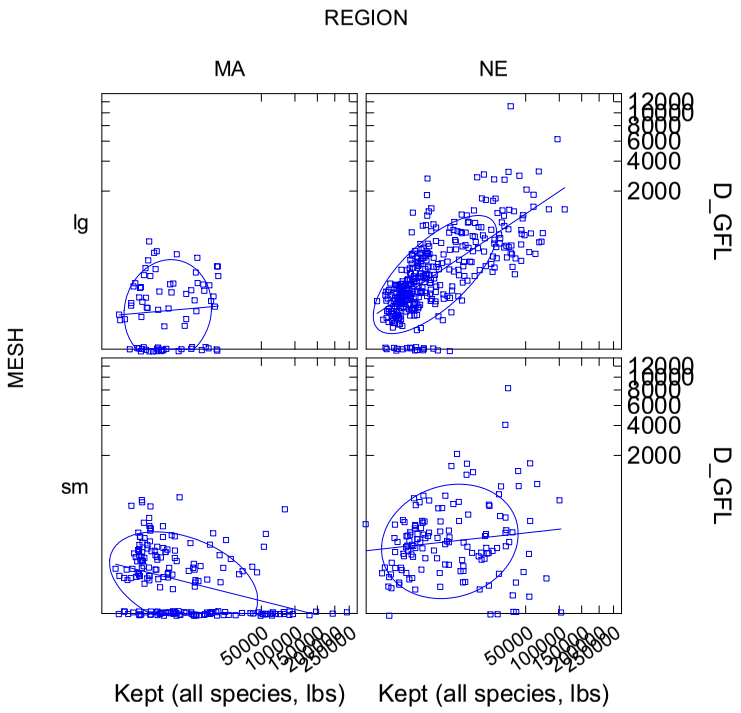


Figure 1bb. Comparison of **NE multispecies (large mesh) discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

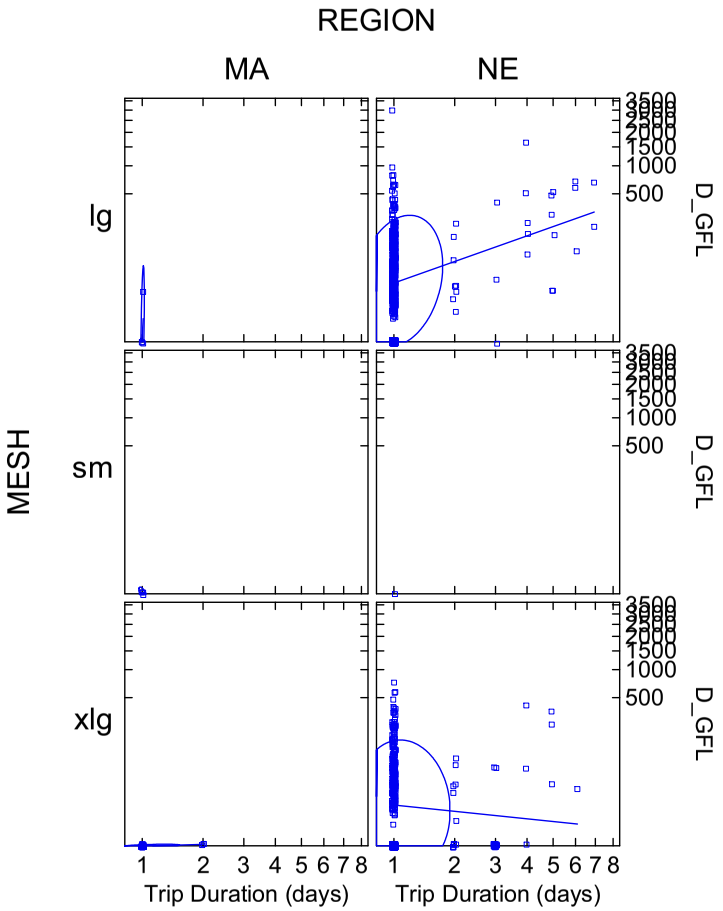


Figure 1cc. Comparison of **NE multispecies (large mesh)** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

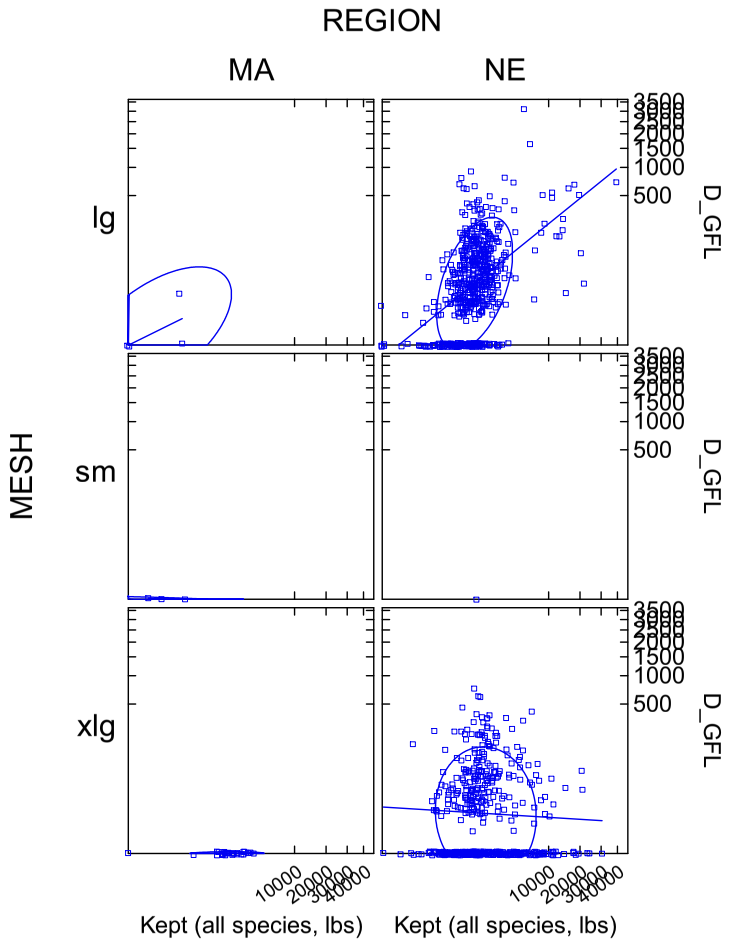


Figure 1dd. Comparison of **NE multispecies (large mesh)** discards (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents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

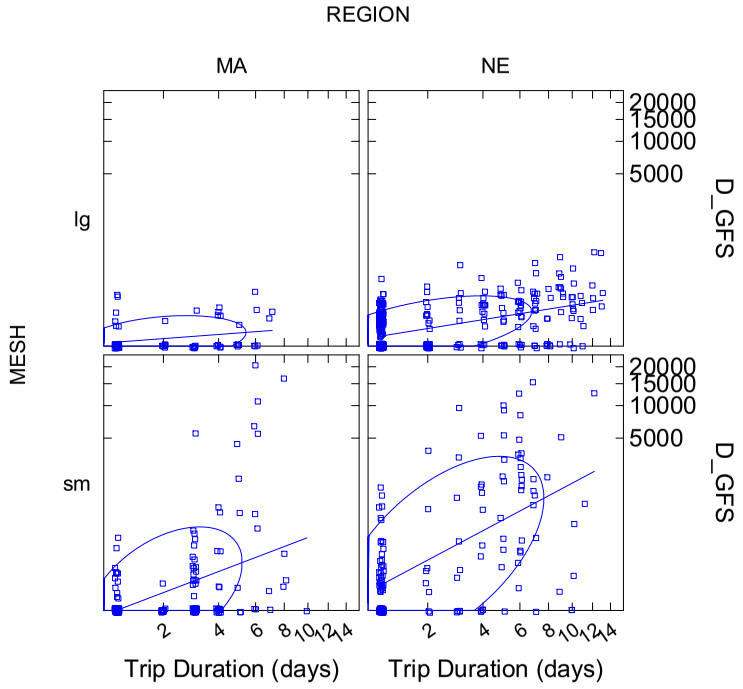


Figure 1ee. Comparison of **NE multispecies (small mesh) discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

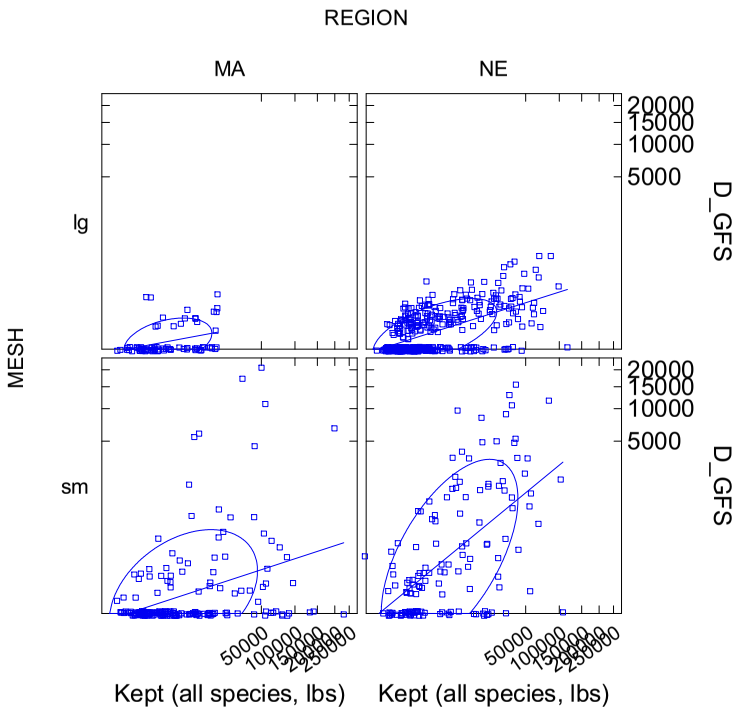


Figure 1ff. Comparison of **NE multispecies (small mesh) discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

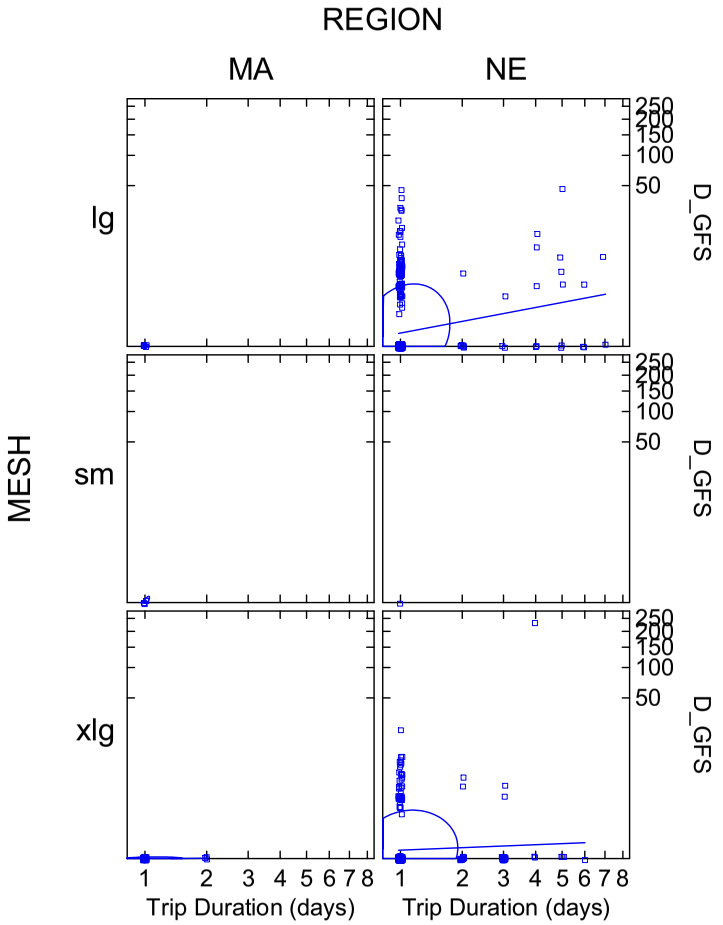


Figure 1gg. Comparison of **NE multispecies** (**small mesh)** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

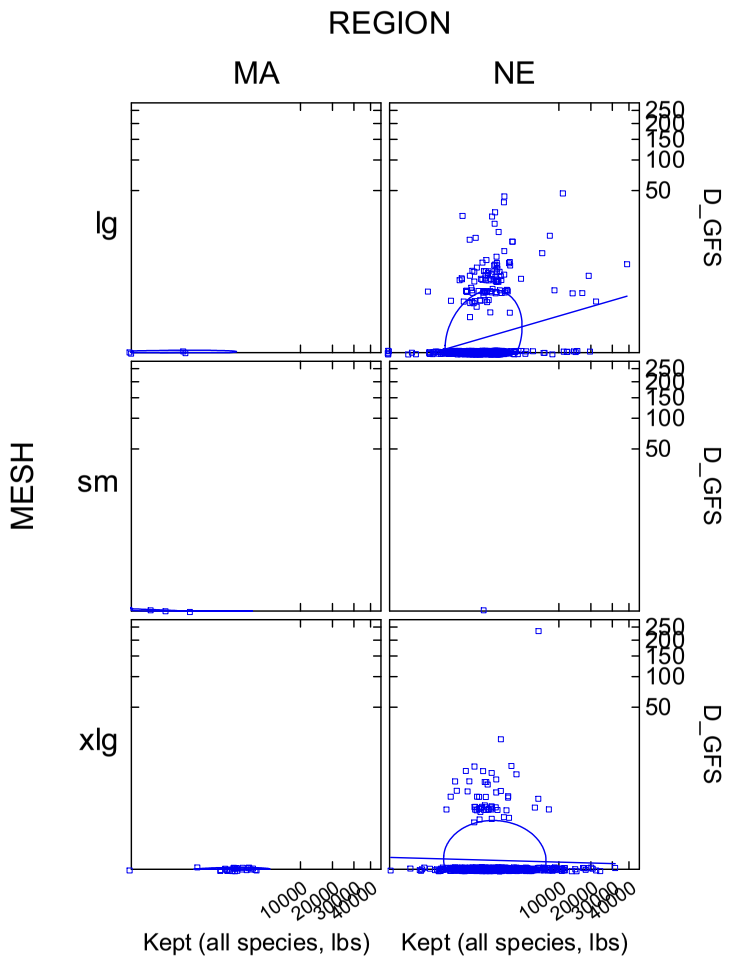


Figure 1hh. Comparison of **NE multispecies** (**small mesh)** discards (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents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

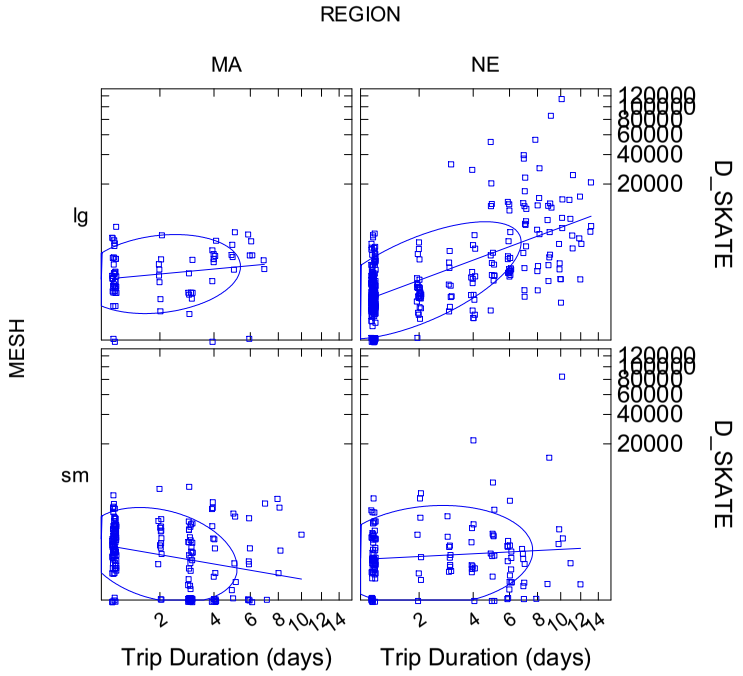


Figure 1ii. Comparison of **skates discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

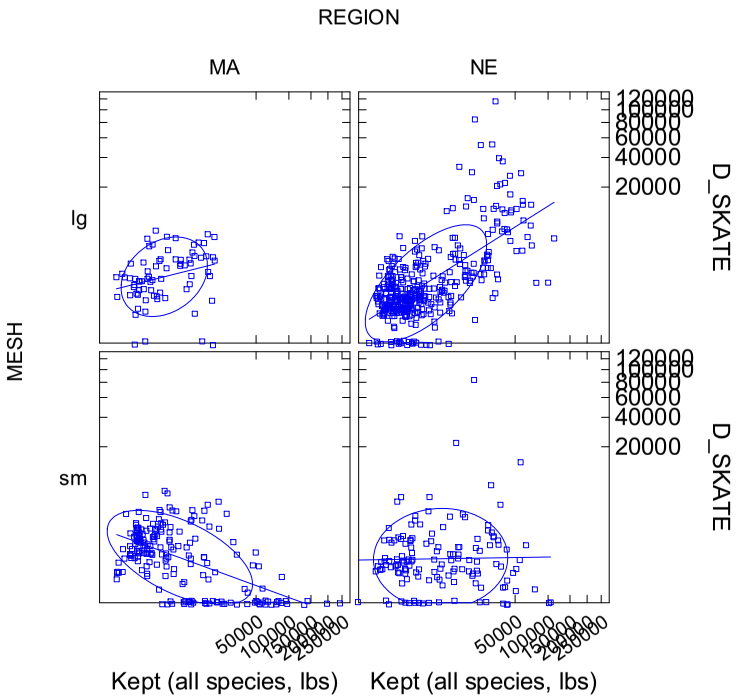


Figure 1jj. Comparison of **skates discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

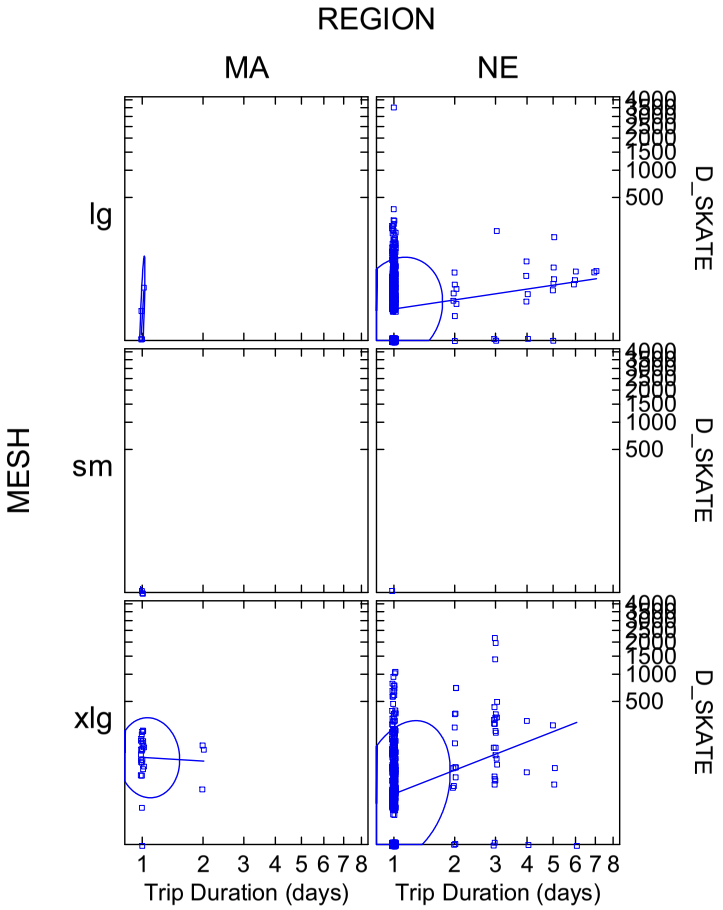


Figure 1kk. Comparison of **skates** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

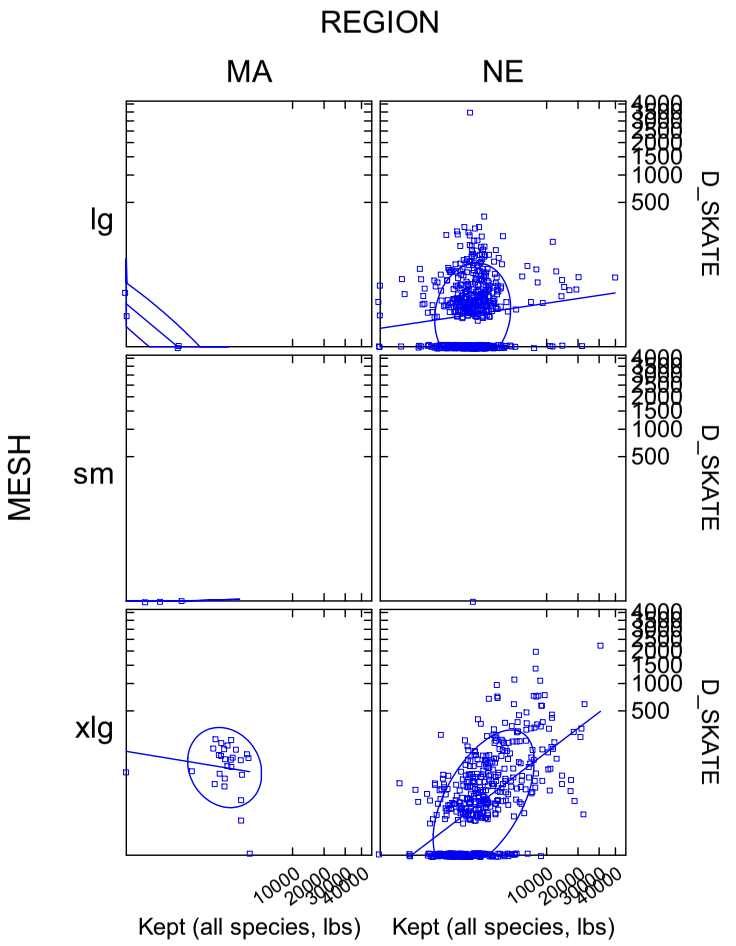


Figure 1ll. Comparison of **skates** discards (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

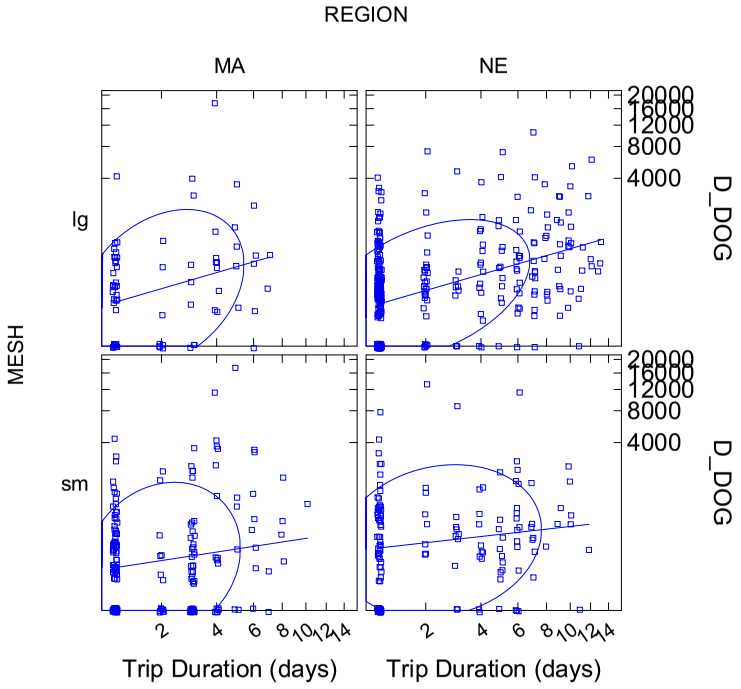


Figure 1mm. Comparison of **spiny dogfish discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

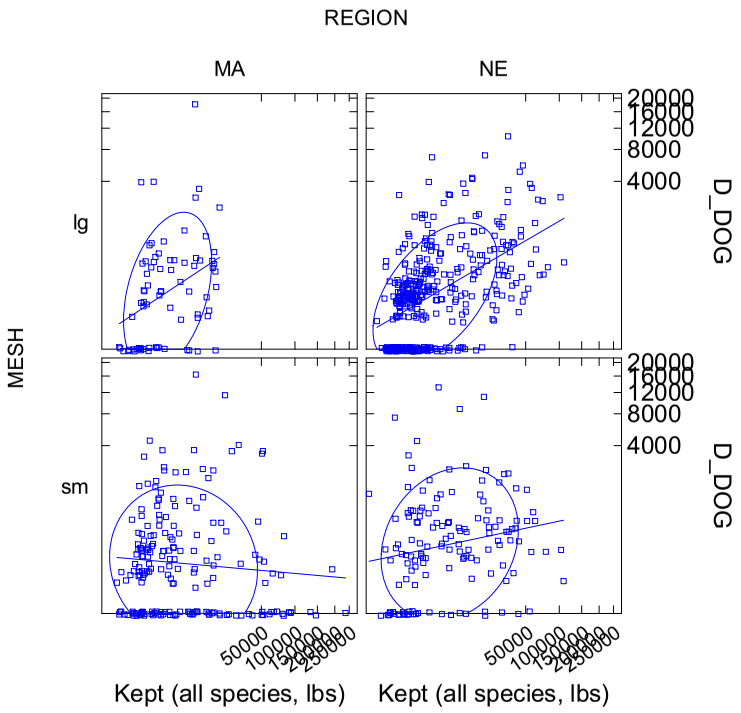


Figure 1nn. Comparison of **spiny dogfish discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

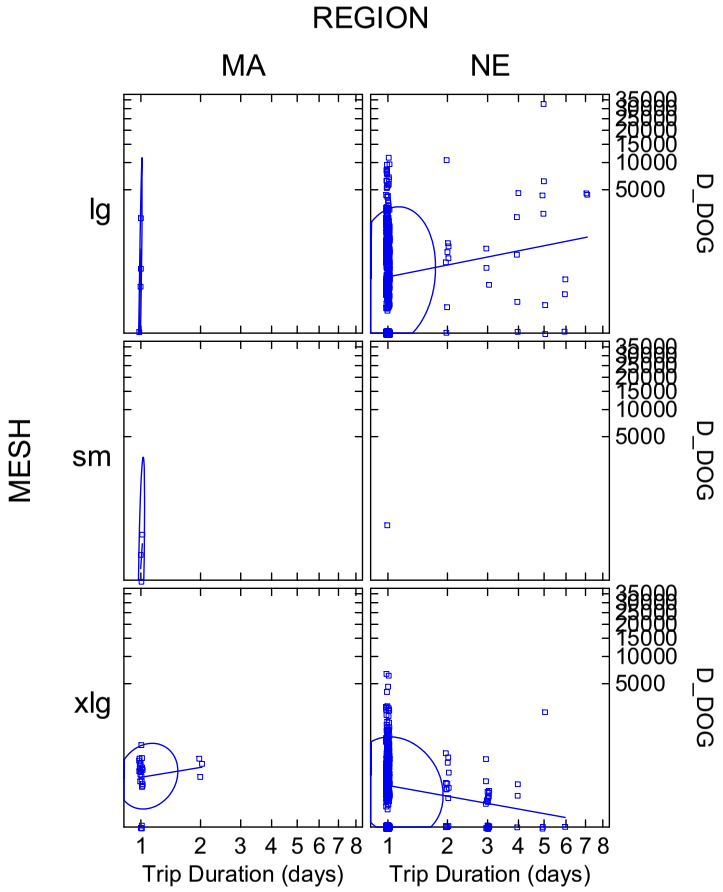


Figure 1oo. Comparison of **spiny dogfish** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

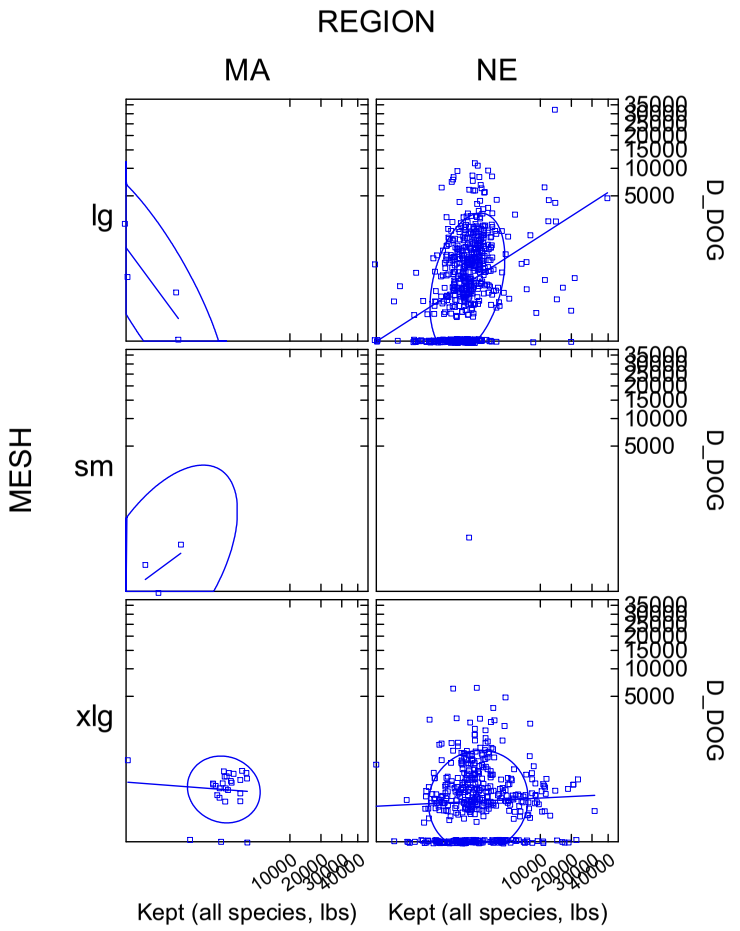


Figure 1pp. Comparison of **spiny dogfish** discards (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

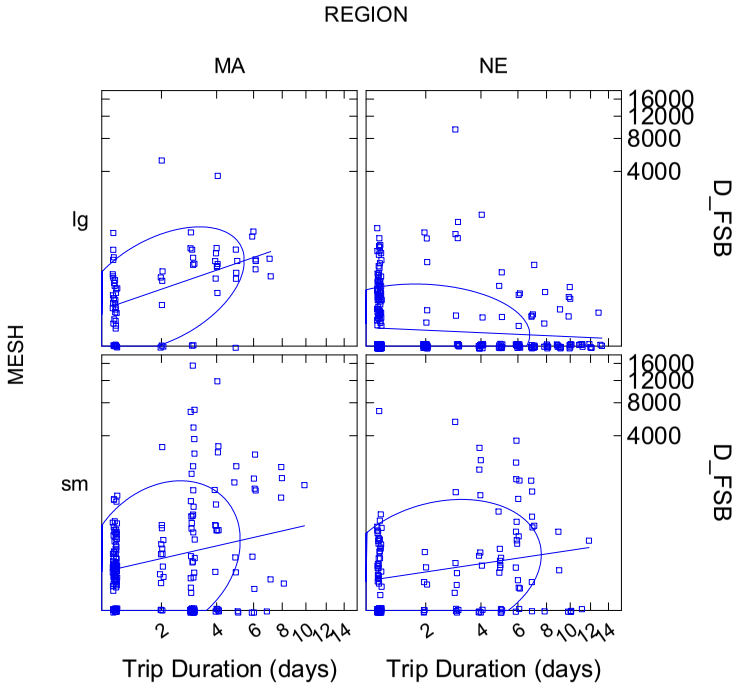


Figure 1qq. Comparison of **fluke-scup-black sea bass discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (; sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

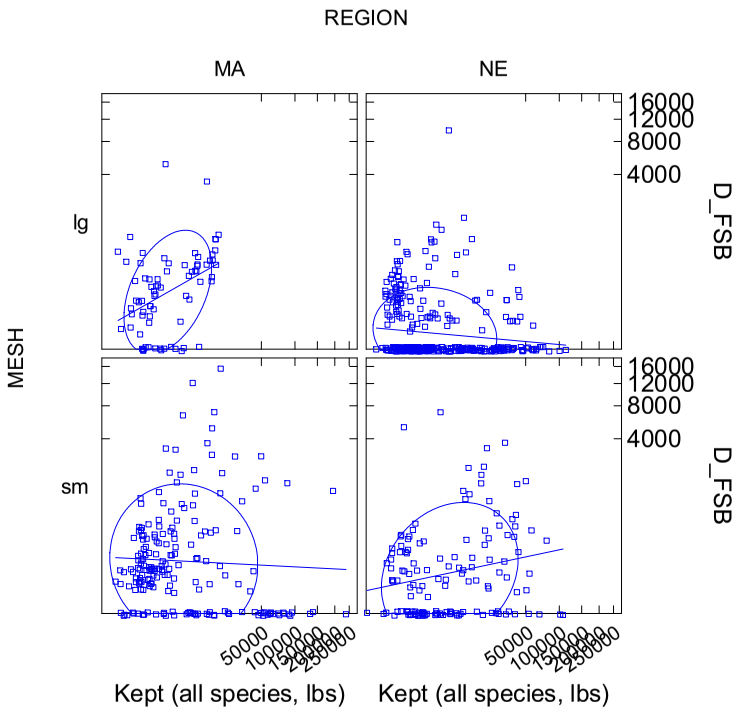


Figure 1rr. Comparison of **fluke-scup-black sea bass discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

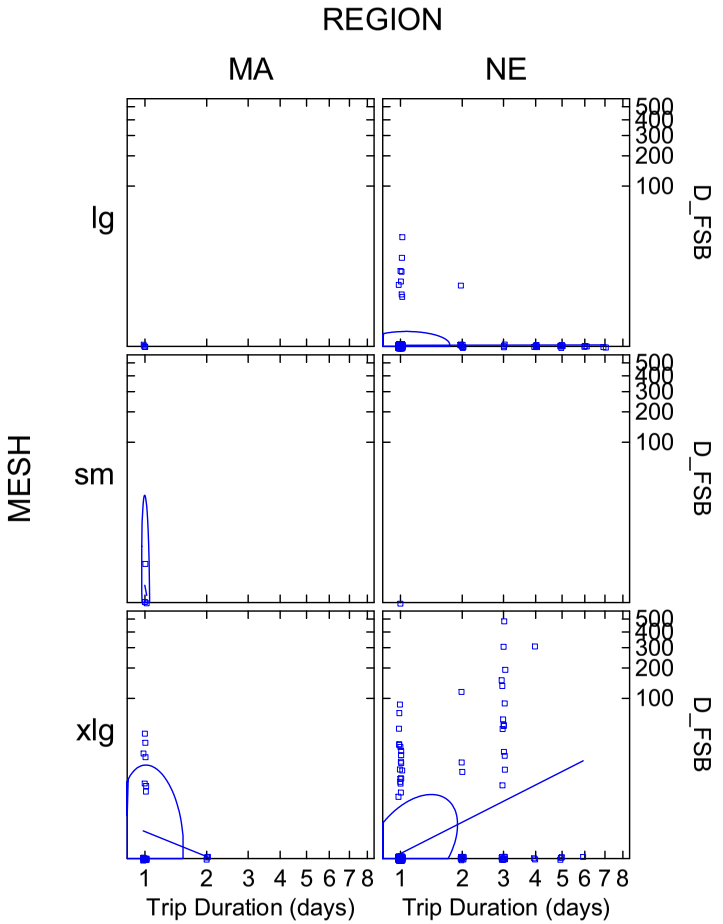


Figure 1ss. Comparison of **fluke-scup-black sea bass** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

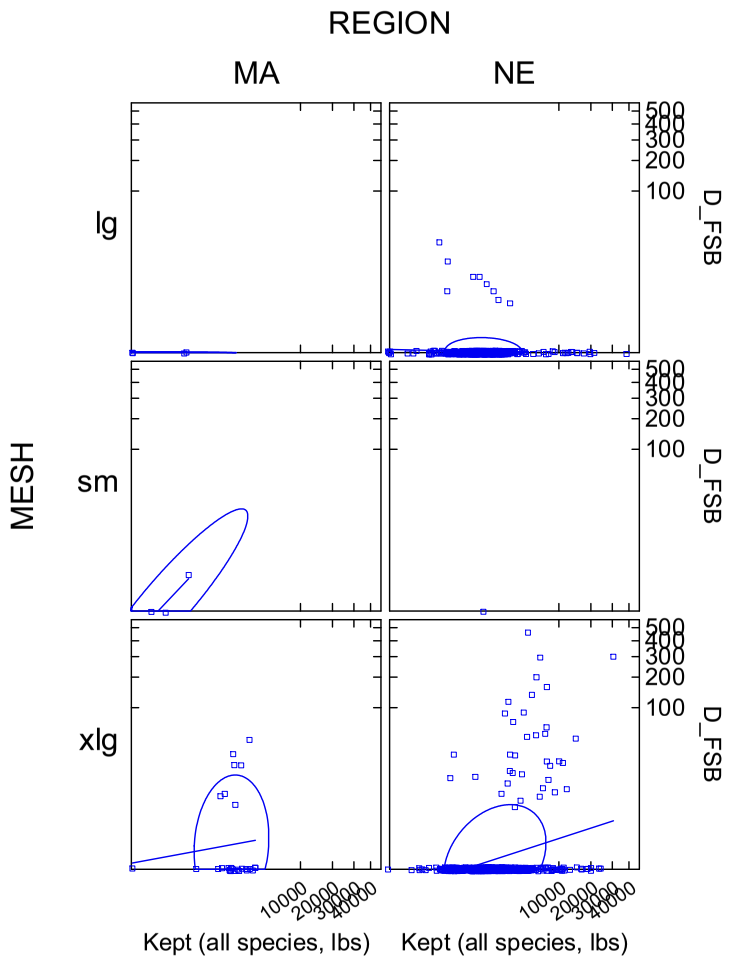


Figure 1tt. Comparison of **fluke-scup-black sea bass** discards (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

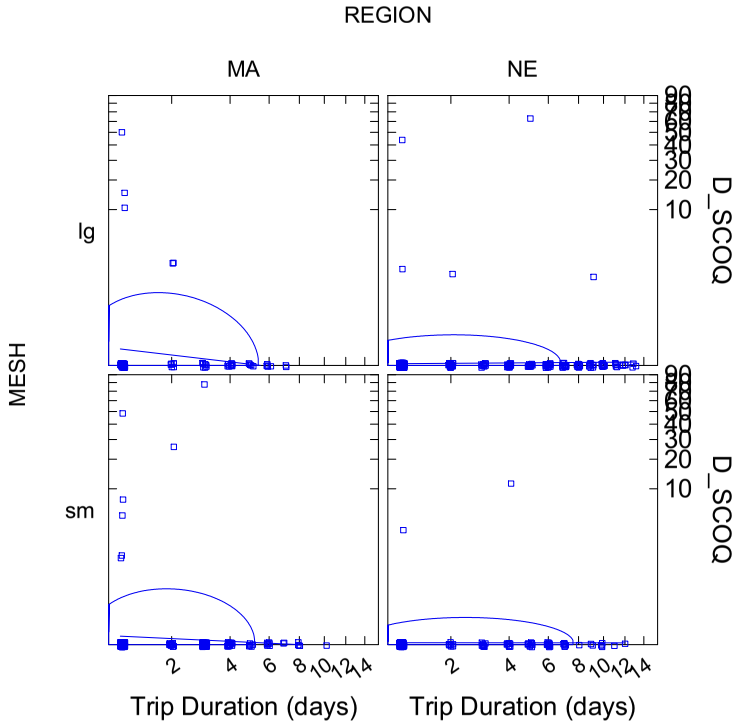


Figure 1uu. Comparison of **surf clams/quahogs discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

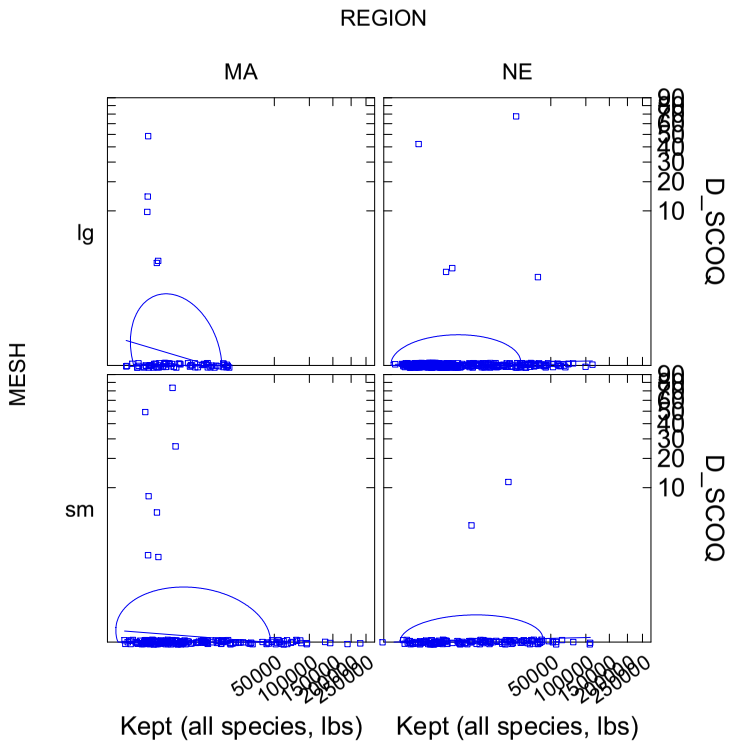


Figure 1vv. Comparison of **surf clams/quahogs discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

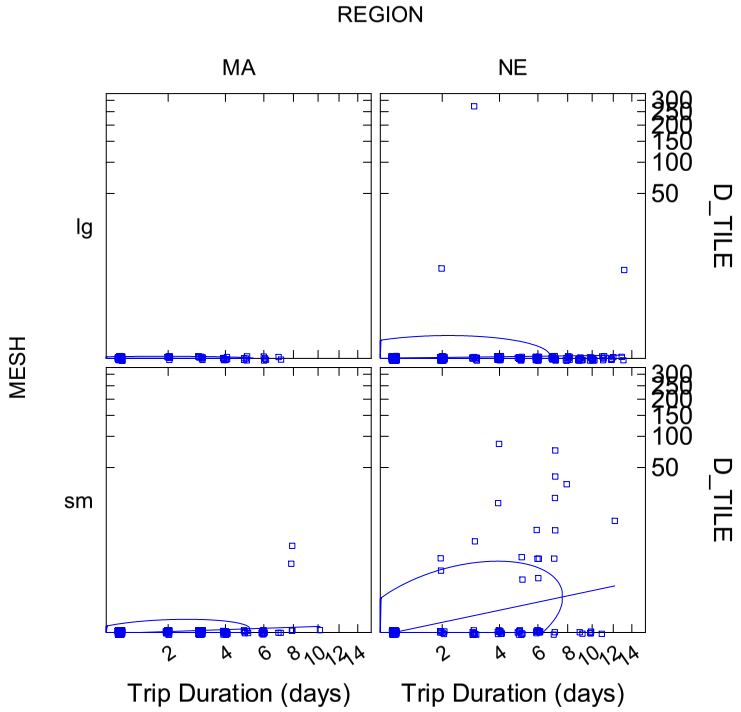


Figure 1ww. Comparison of **tilefish discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

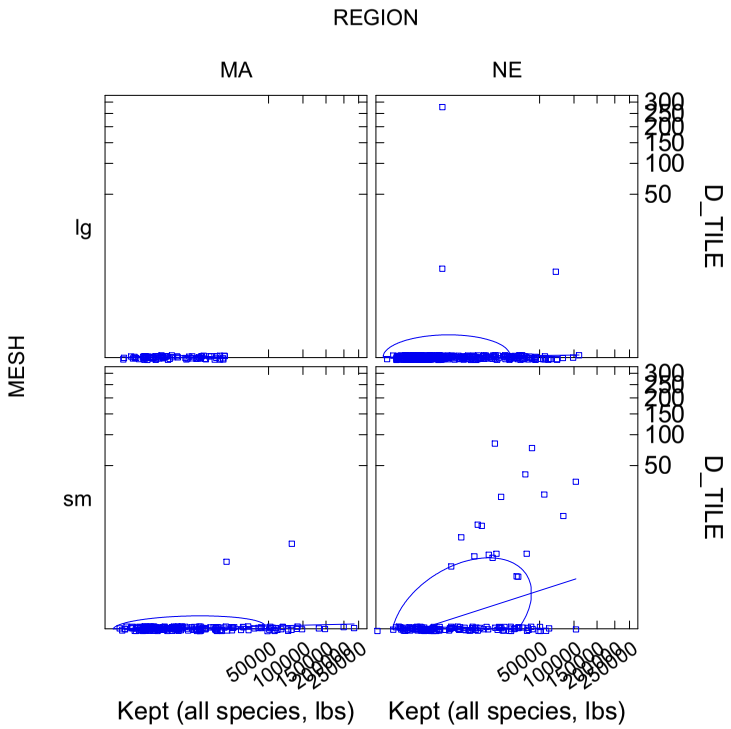


Figure 1xx. Comparison of **tilefish discards** (pounds) and **kept weight** of all species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip.

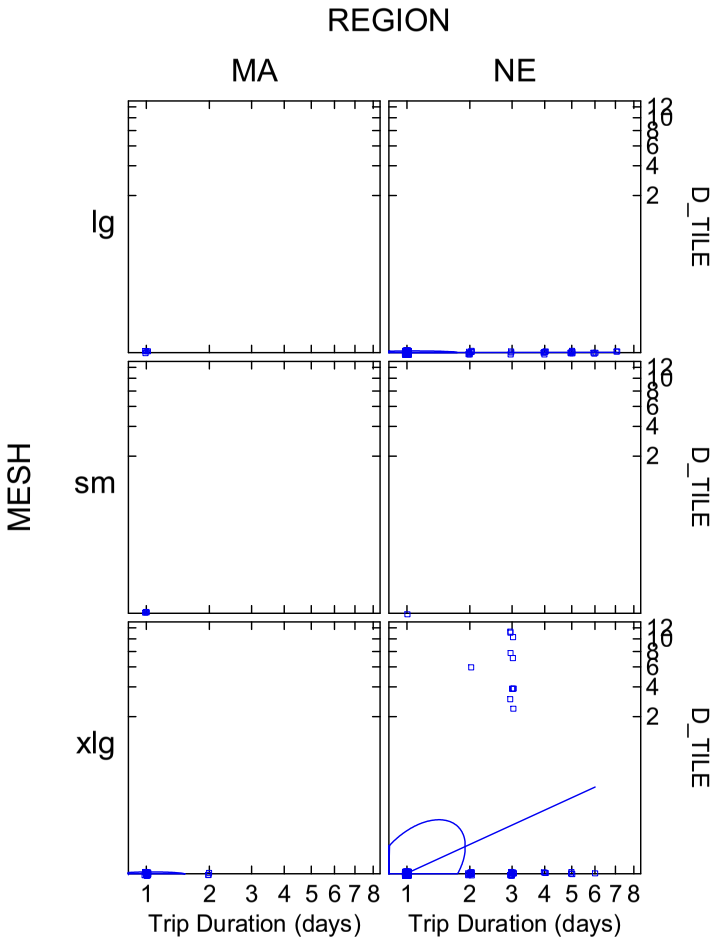


Figure 1yy. Comparison of **tilefish** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

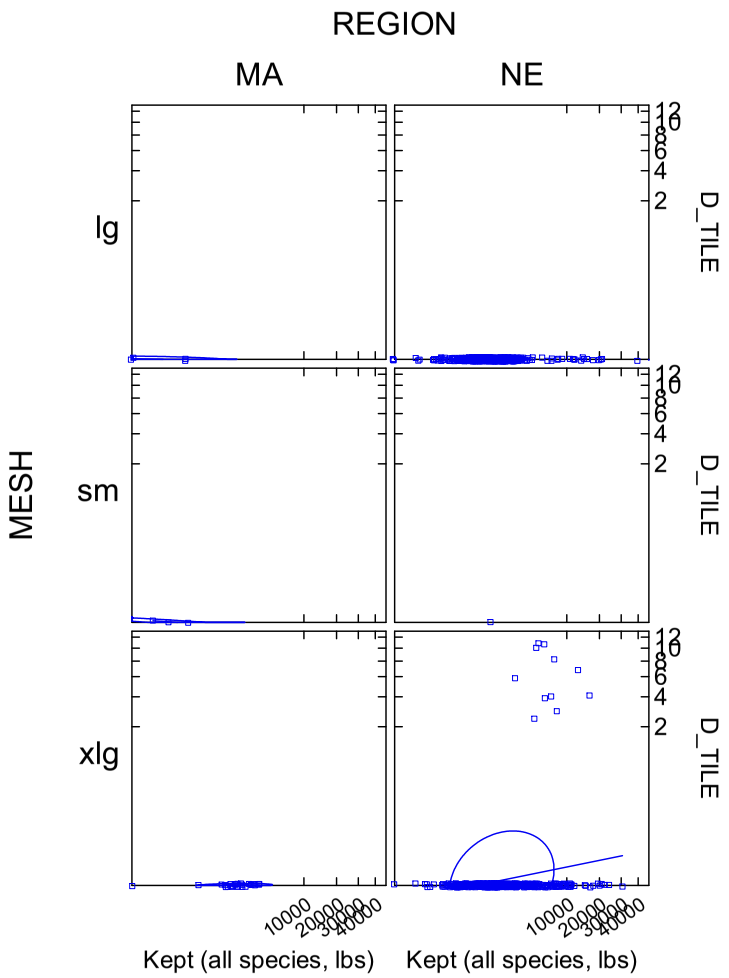


Figure 1zz. Comparison of **tilefish** discards (pounds) and **kept weight** of all species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip.

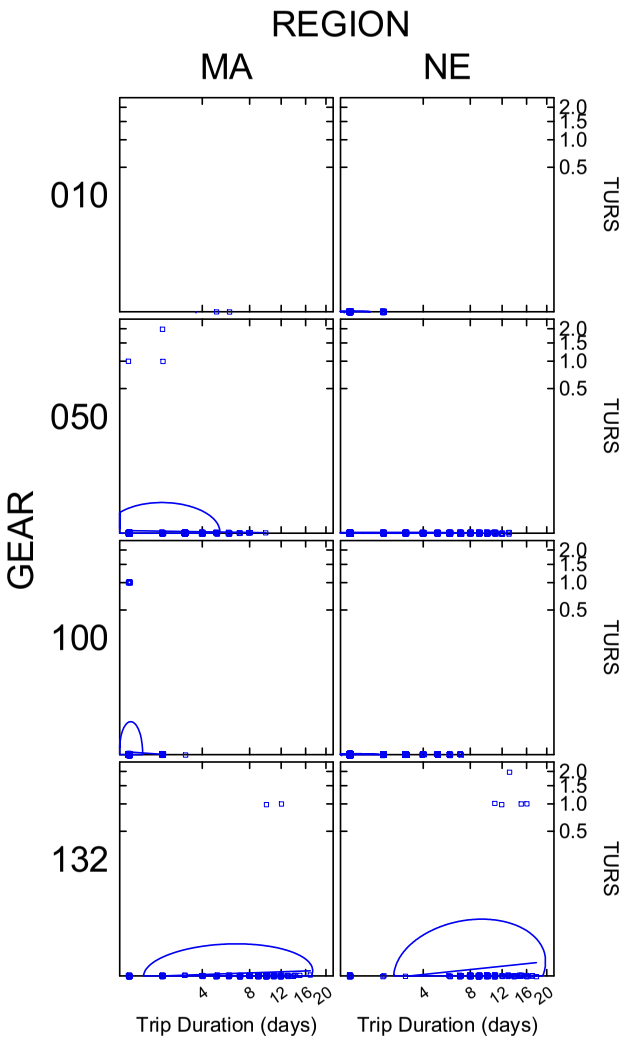


Figure 2a. Comparison of **turtles** and **trip duration** (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

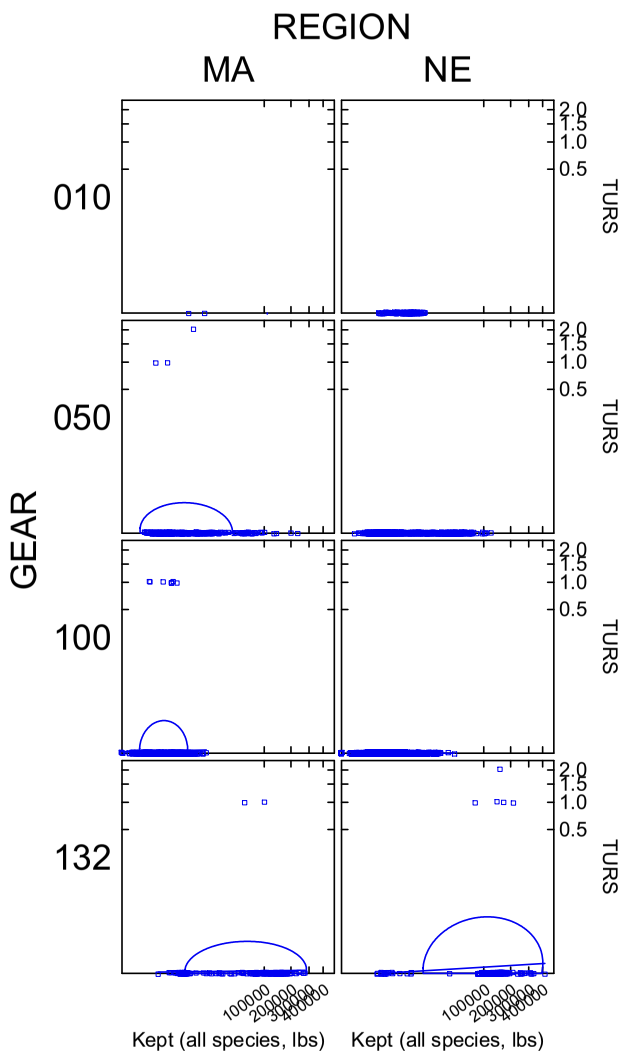


Figure 2b. Comparison of **turtles** and **kept weight** of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

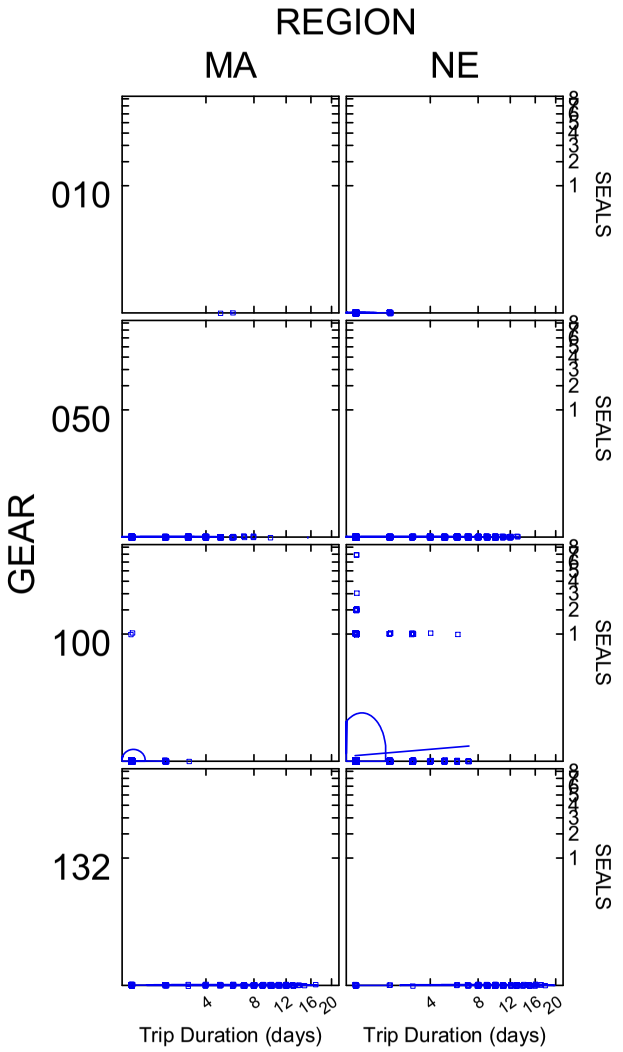


Figure 2c. Comparison of **seals** and **trip duration** (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

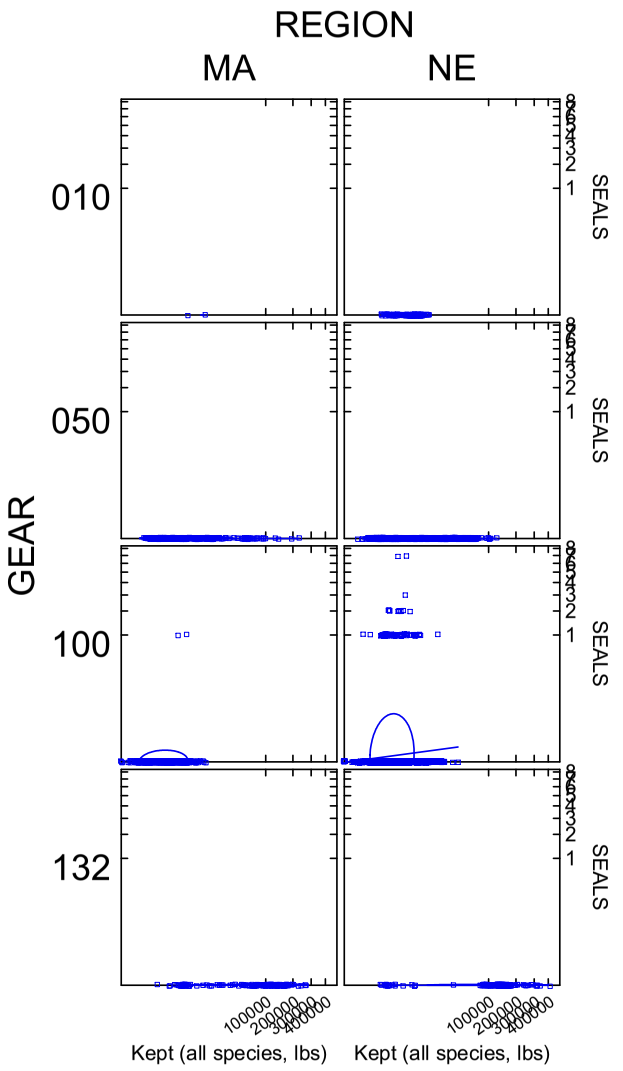


Figure 2d. Comparison of **seals** and **kept weight** of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

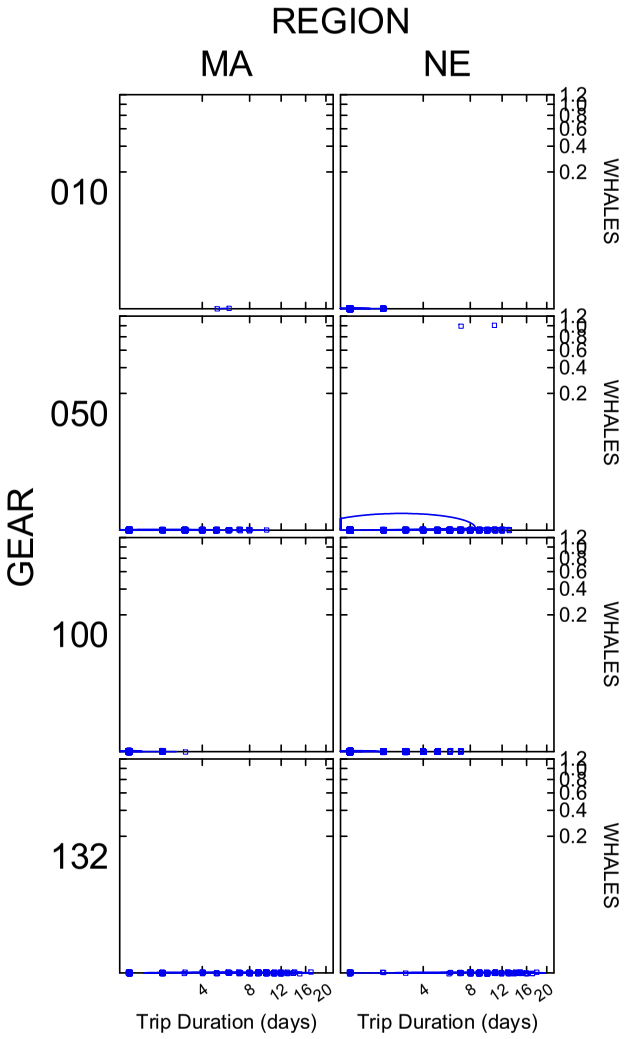


Figure 2e. Comparison of **whales** and **trip duration** (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

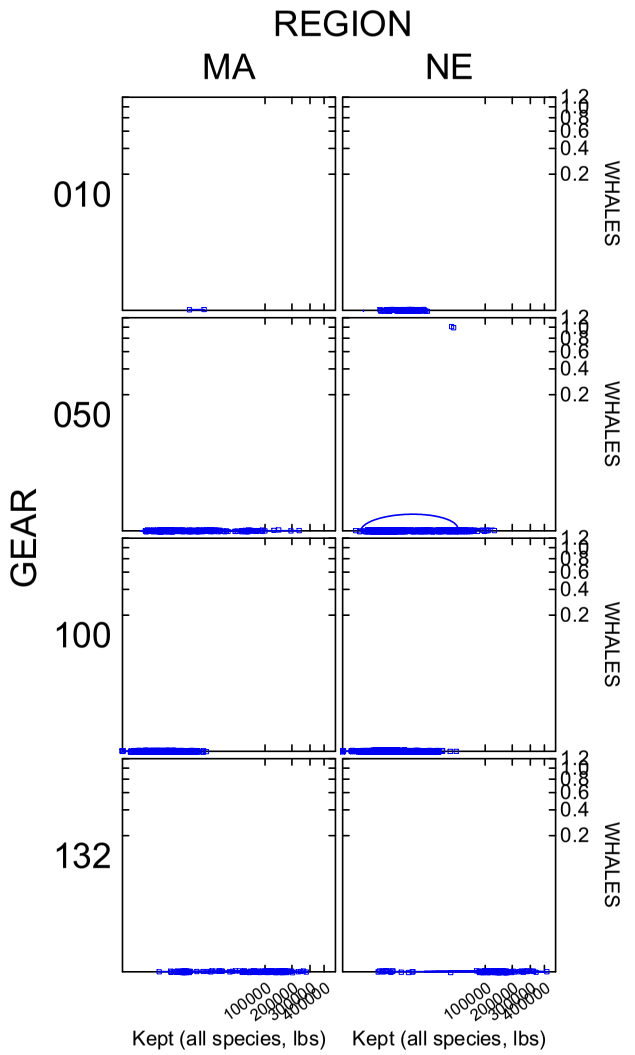


Figure 2f. Comparison of **whales** and **kept weight** of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

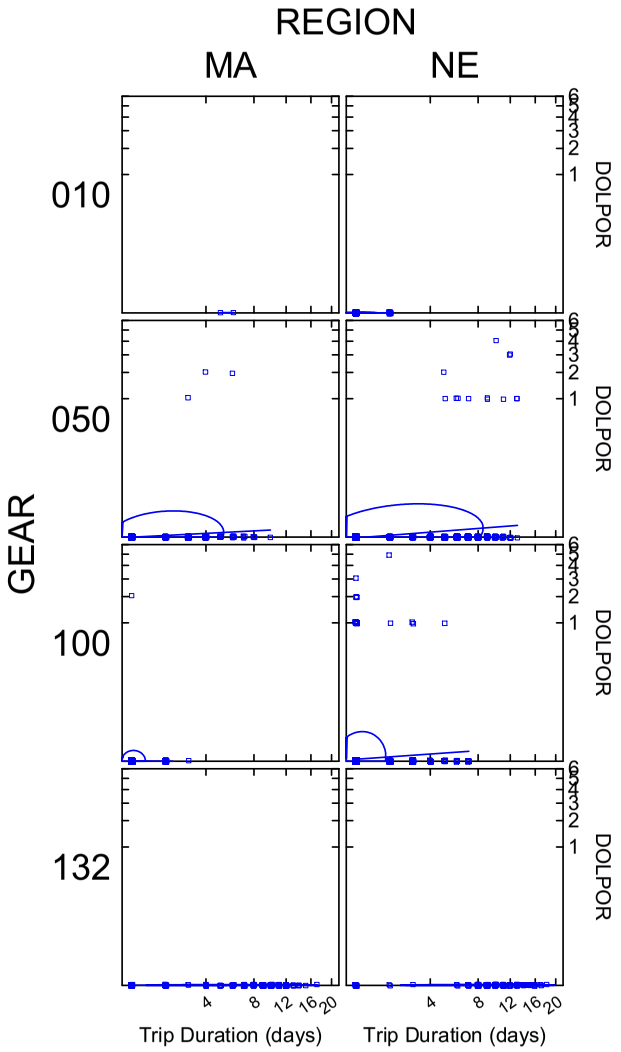


Figure 2g. Comparison of **dolphins/porpoises** and **trip duration** (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

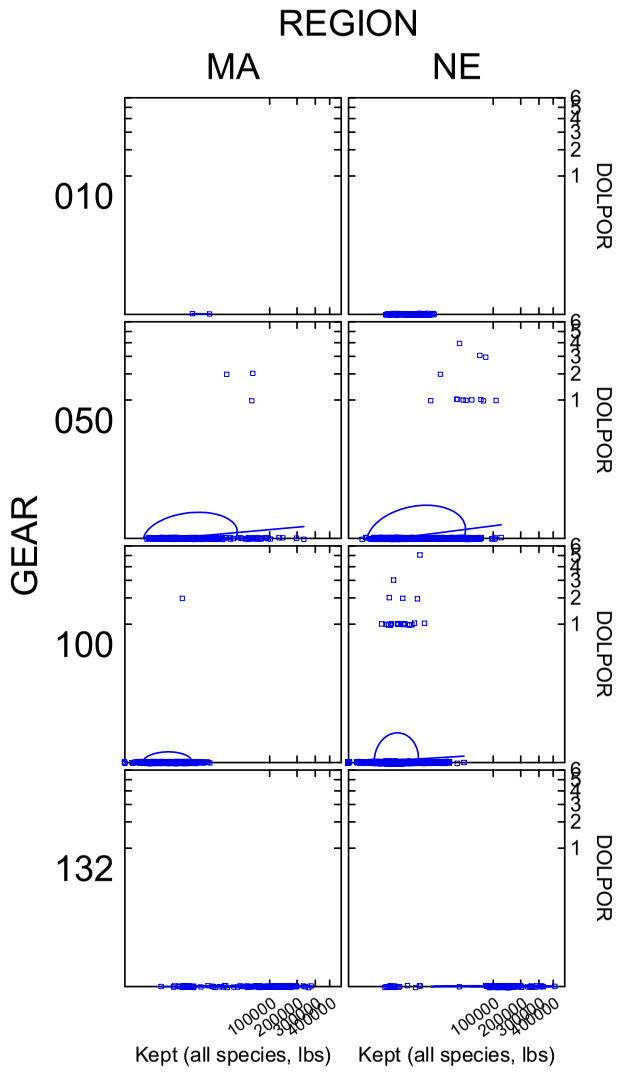


Figure 2h. Comparison of **dolphins/porpoises** and **kept weight** of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

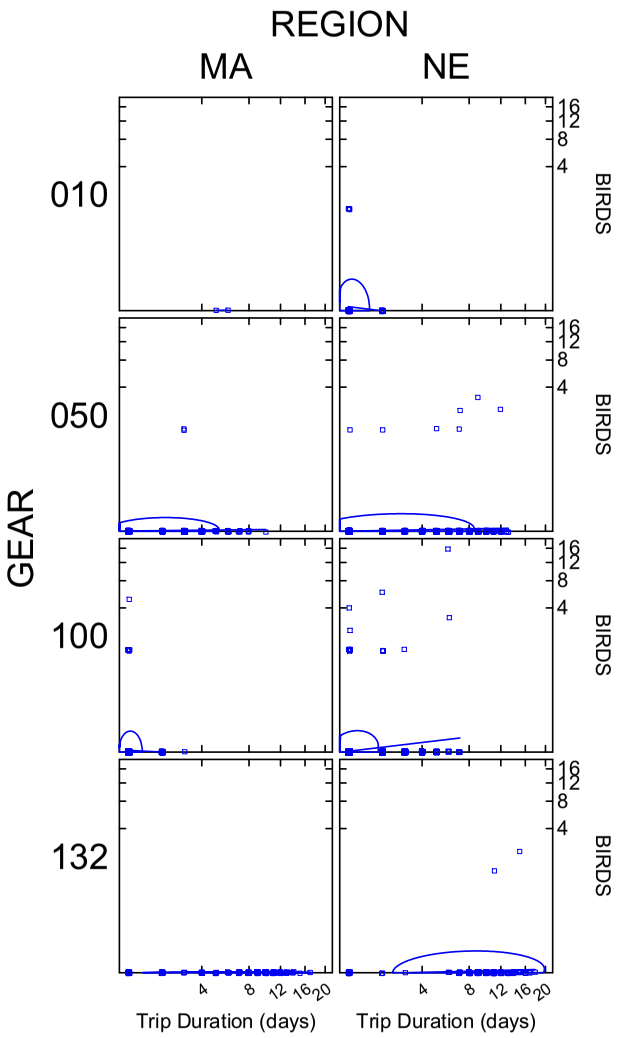


Figure 2i. Comparison of **birds** and **trip duration** (days) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

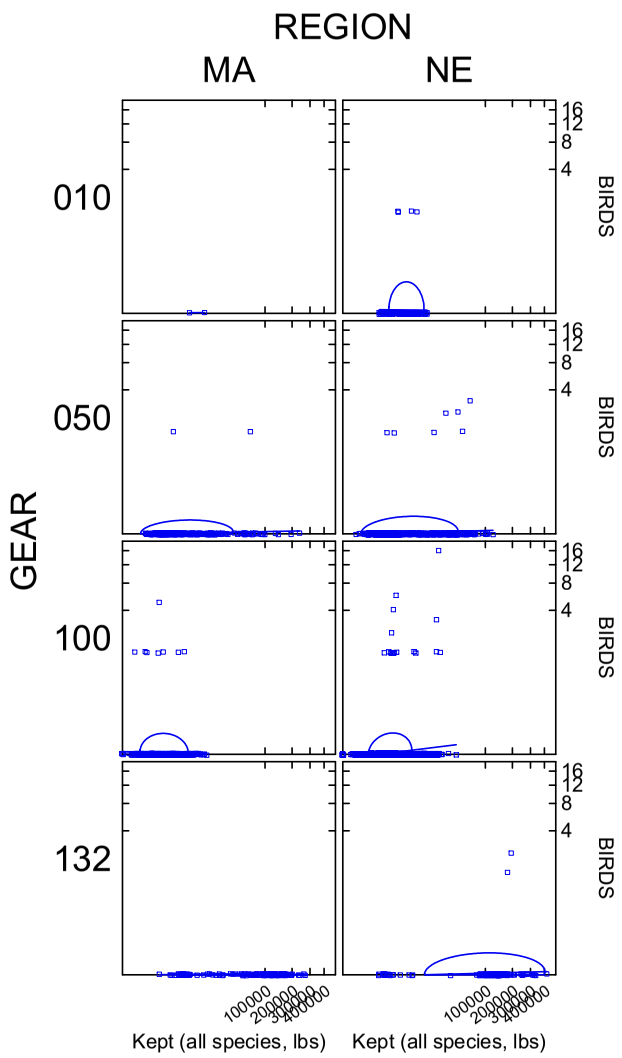


Figure 2j. Comparison of **birds** and **kept weight** of all species (pounds) from 2004 observed longline (010), otter trawl (050), gillnet (100) and scallop dredge (132) trips, by region; each dot represents a trip.

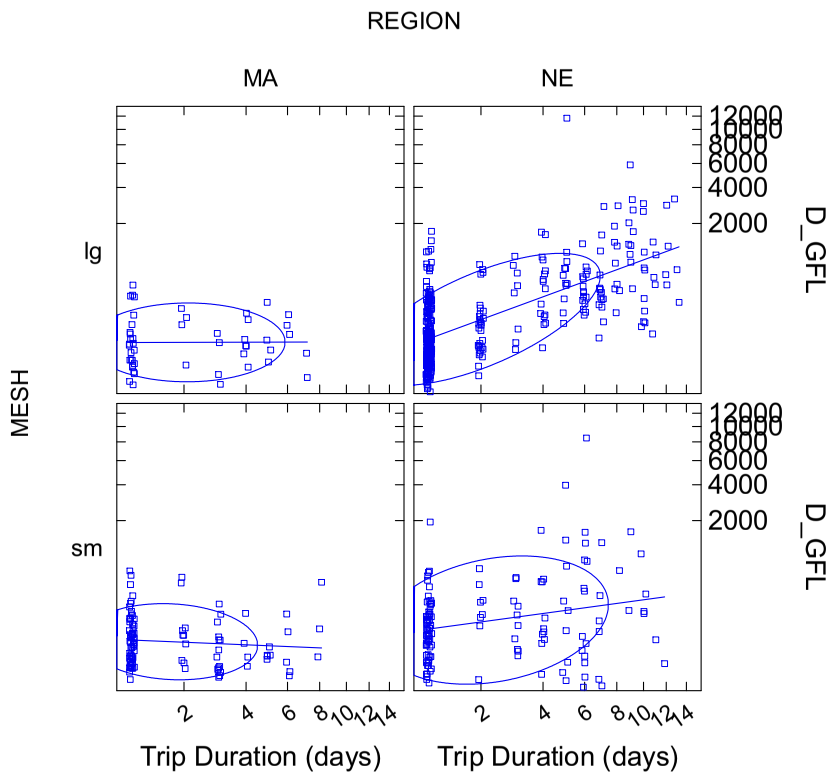


Figure 3a. Comparison of **NE multispecies (large mesh) discards** (pounds) and **trip duration** (days) from 2004 observed otter trawl trips, by region and mesh size group (sm <5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip. **Trips with zero discards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

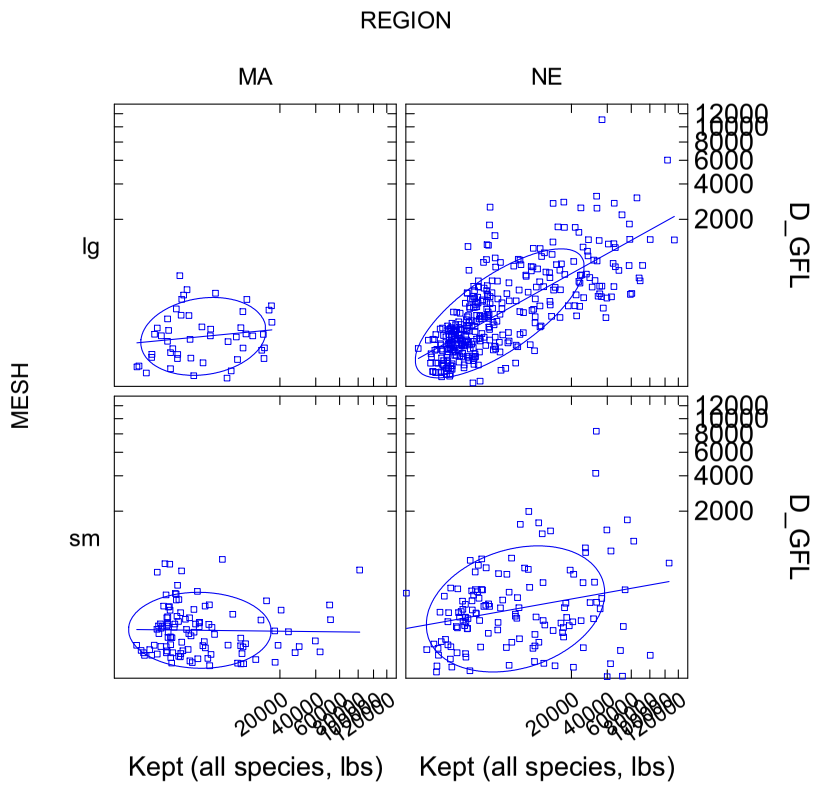


Figure 3b. Comparison of **NE multispecies (large mesh) discards** (pounds) and **kept weight of all** species (pounds) from 2004 observed otter trawl trips by region and mesh size group (sm < 5.5 inches, and lg => 5.5 inches); fourth root transformation used, each dot represents a trip. **Trips with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

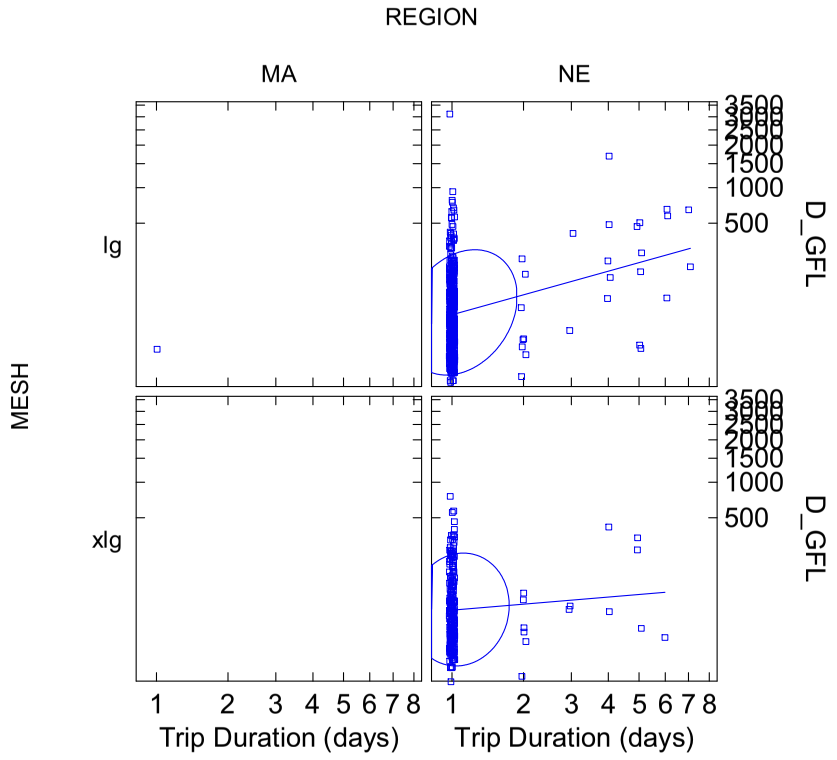


Figure 3c. Comparison of **NE multispecies (large mesh)** discards (pounds) and **trip duration** (days) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a trip. **Trips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

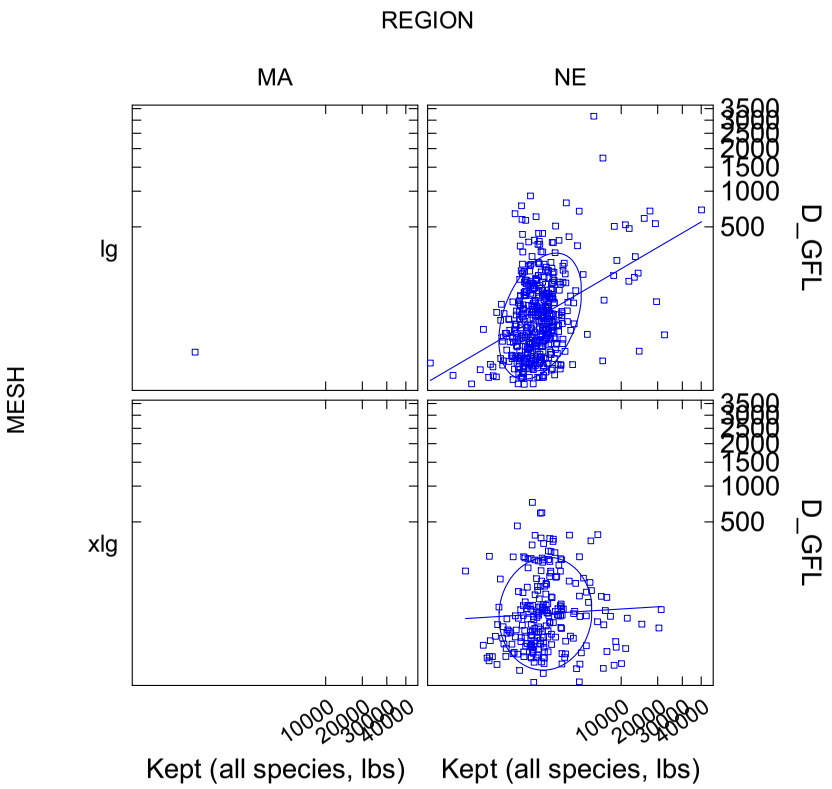


Figure 3d. Comparison of **NE multispecies (large mesh)** discards (pounds) and **kept weight of all** species (pounds) from 2004 observed gillnet trips by region and mesh size group (lg = 5.5 to 7.99 inches; sm < 5.5 inches, and xlg > 8 inches); fourth root transformation used, each dot represents a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

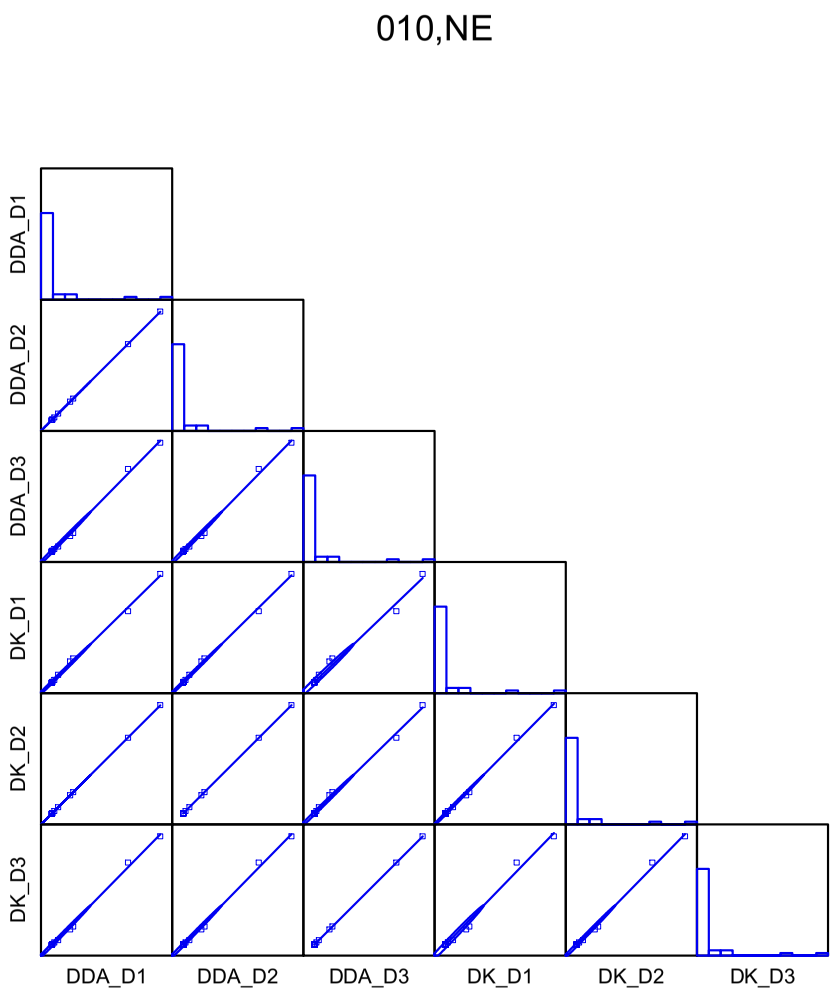


Figure 4a. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **New England longline;** each dot represents a species group and mesh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

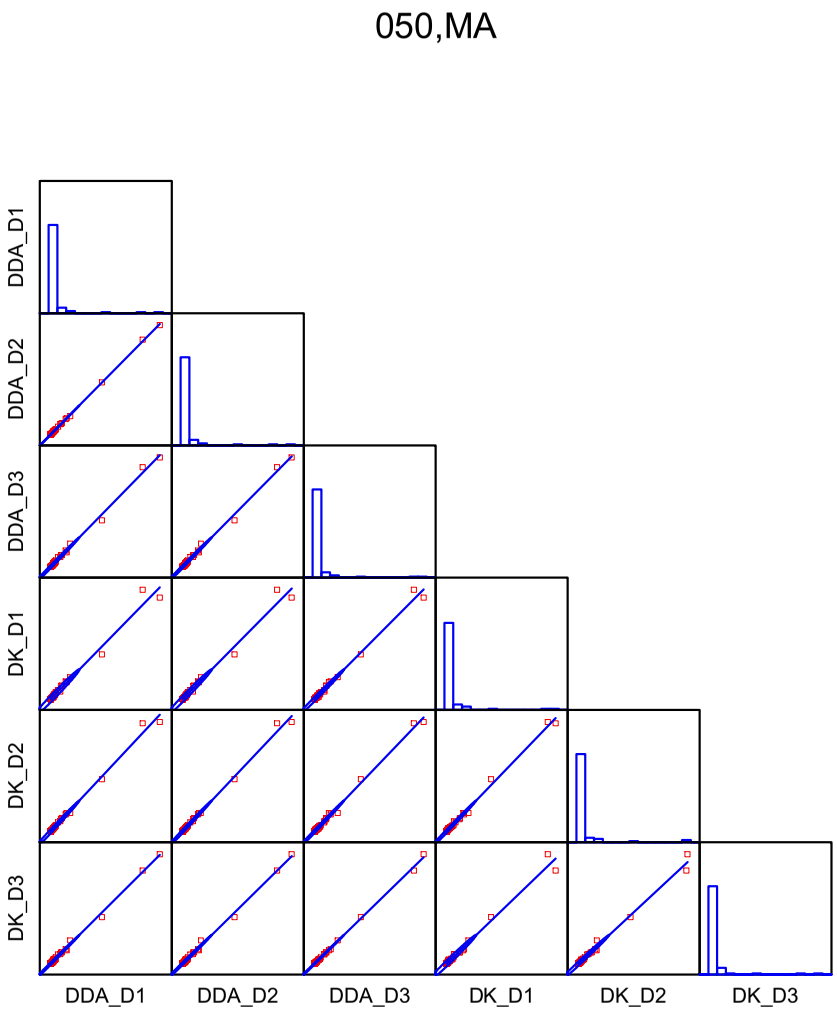


Figure 4b. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **Mid-Atlantic otter trawl;** each dot represents a species group and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

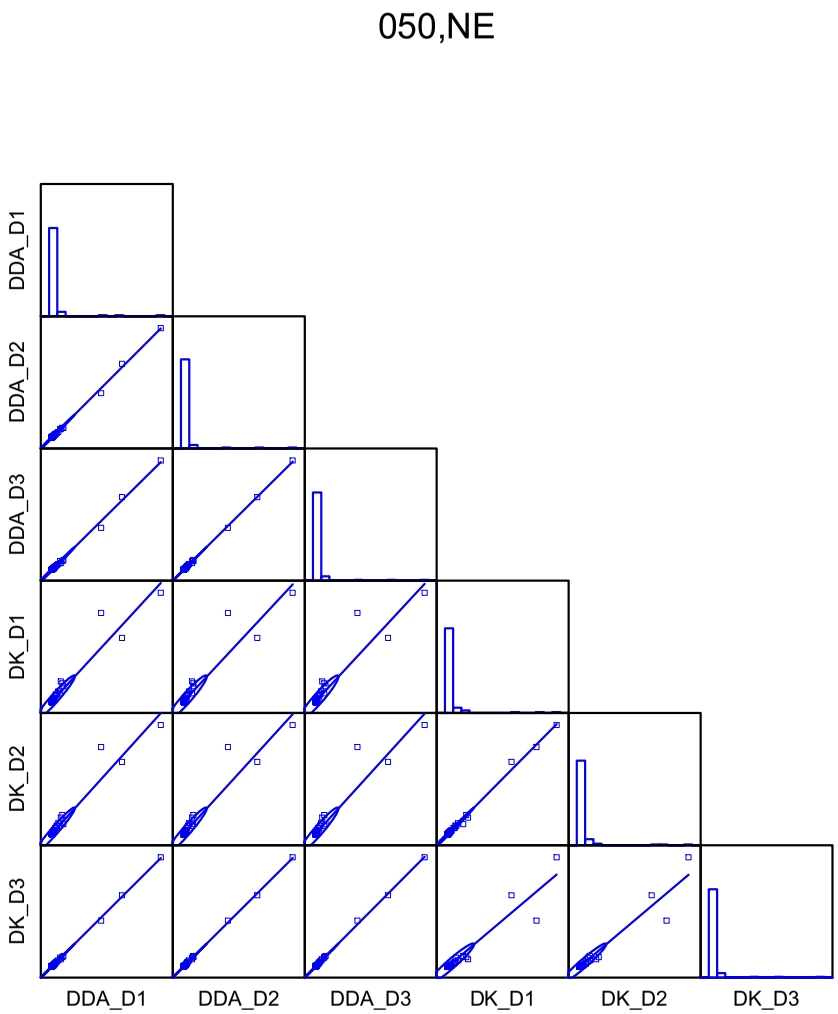


Figure 4c. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **New England otter trawl;** each dot represents a species group and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

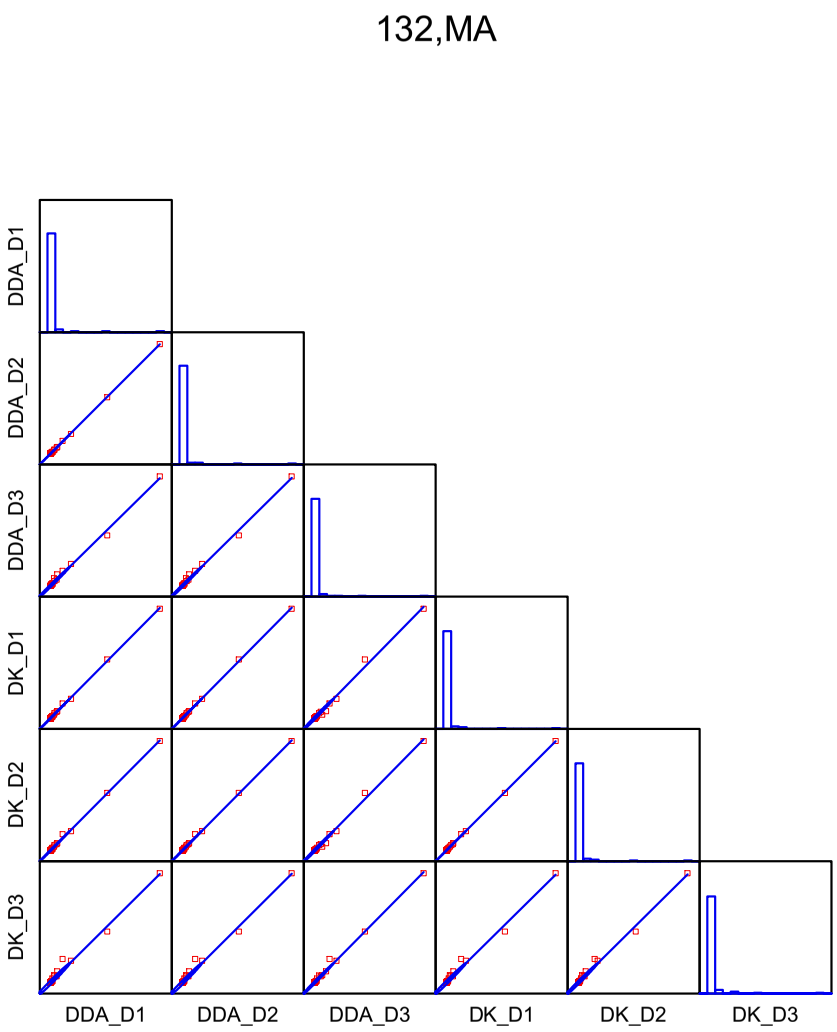


Figure 4d. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **Mid-Atlantic scallop dredge;** each dot represents a species group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

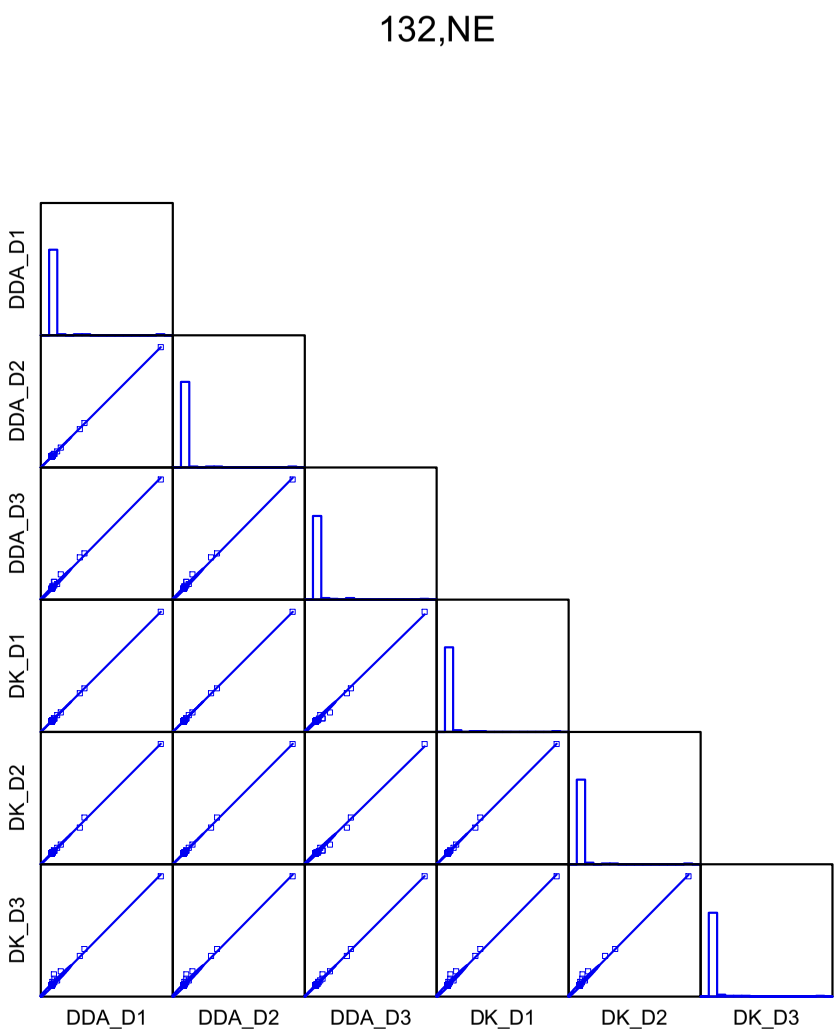


Figure 4e. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **New England scallop dredge;** each dot represents a species group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

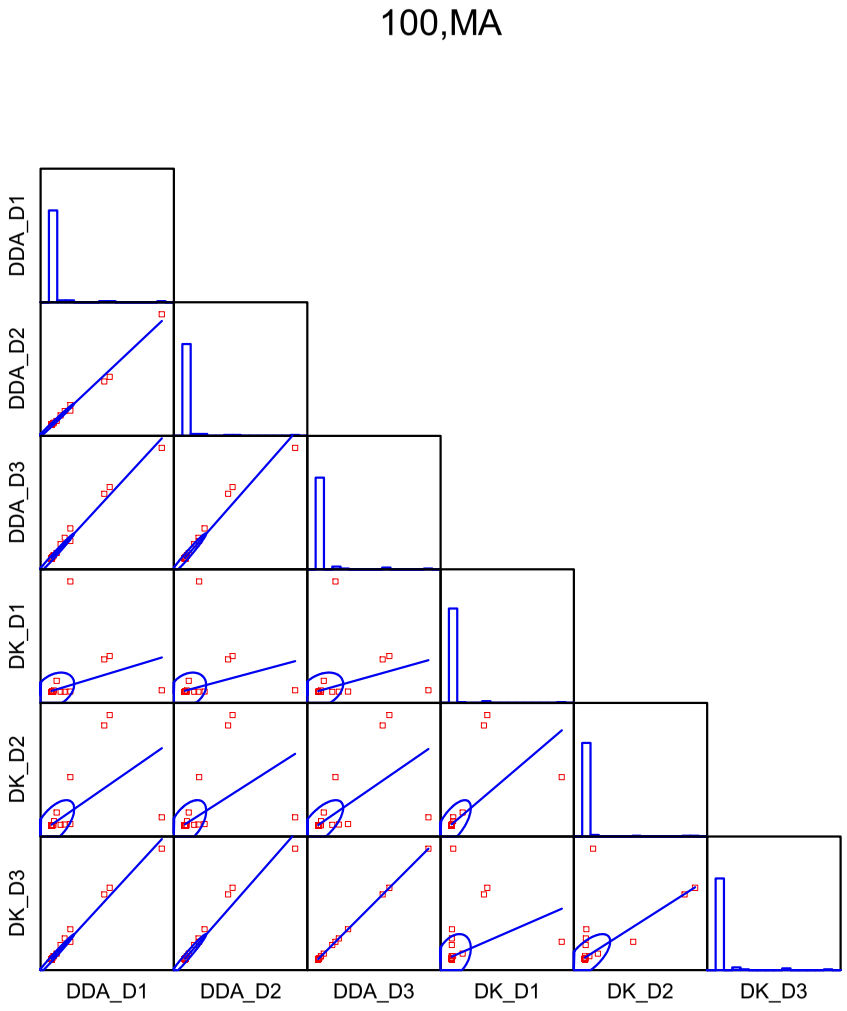


Figure 4f. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **Mid-Atlantic gillnet;** each dot represents a species group and mesh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

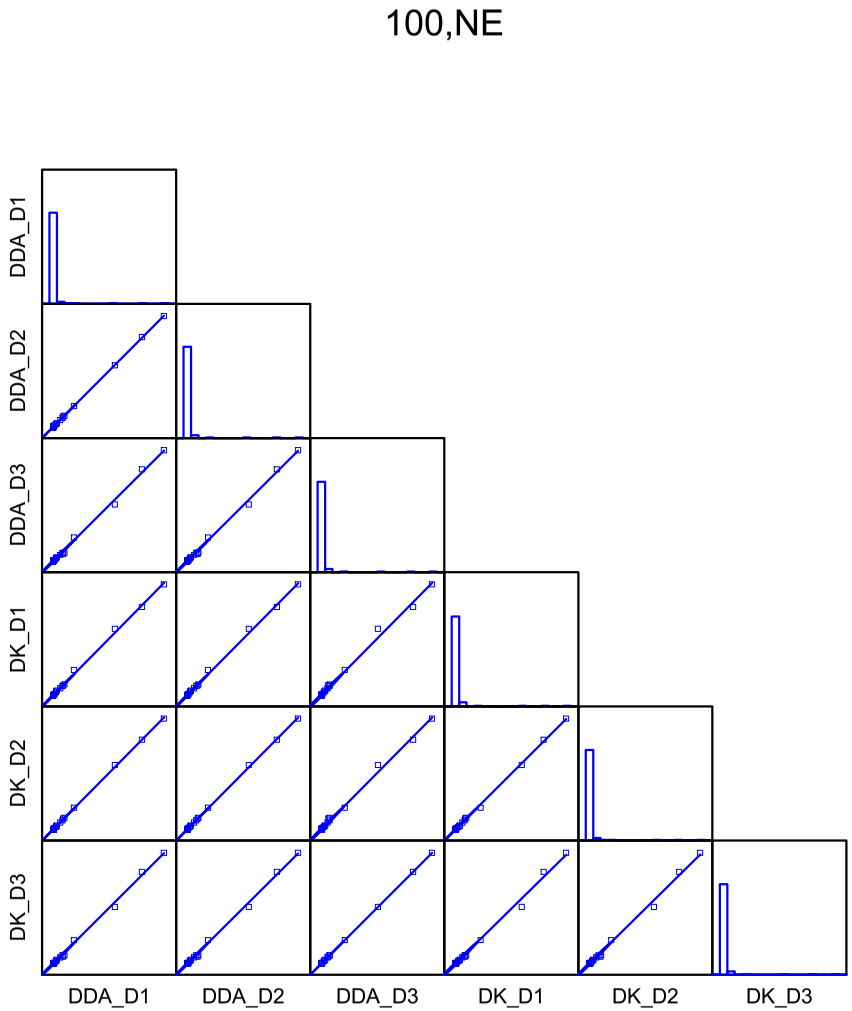


Figure 4g. Comparisons of the **total discards** derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **New England gillnet;** each dot represents a species group and mesh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

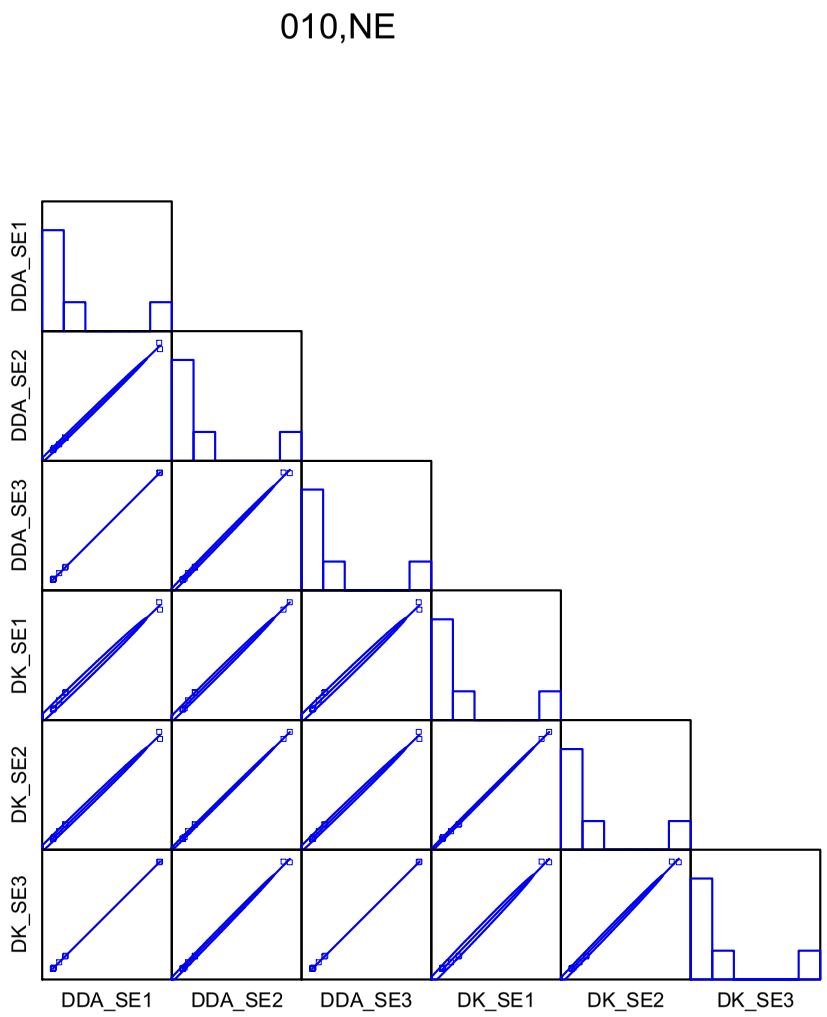


Figure 5a. Comparisons of the **standard error (SE)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **New England longline**; each dot represents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

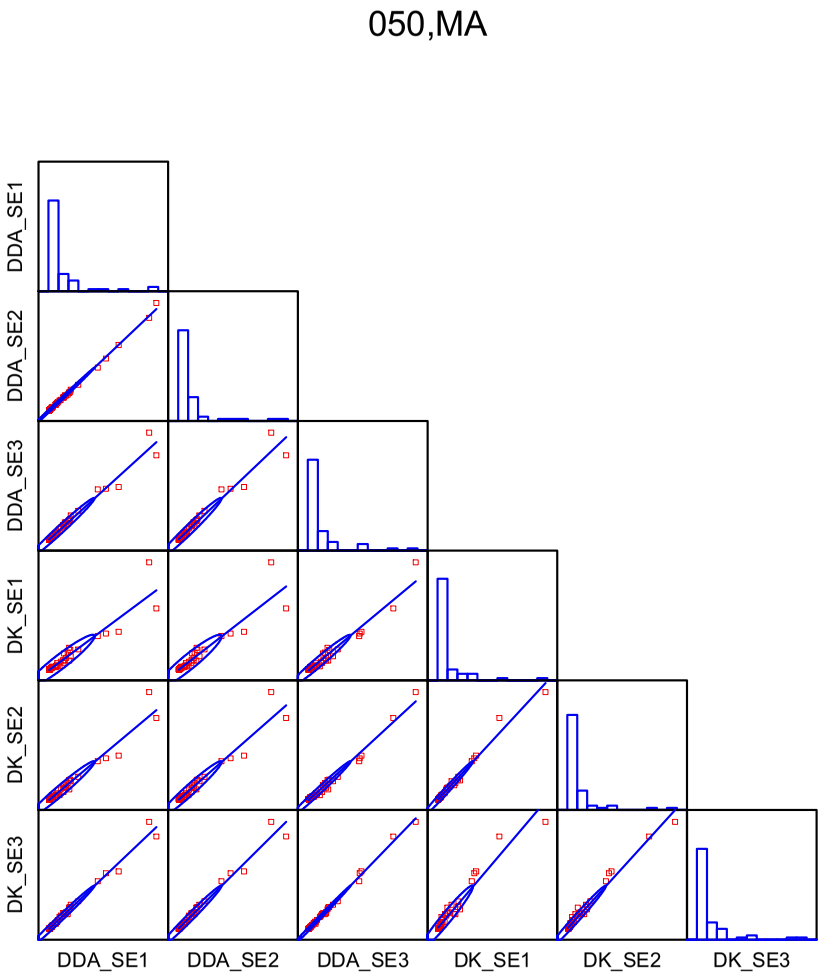


Figure 5b. Comparisons of the **standard error (SE)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **Mid-Atlantic otter trawl;** each dot represents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

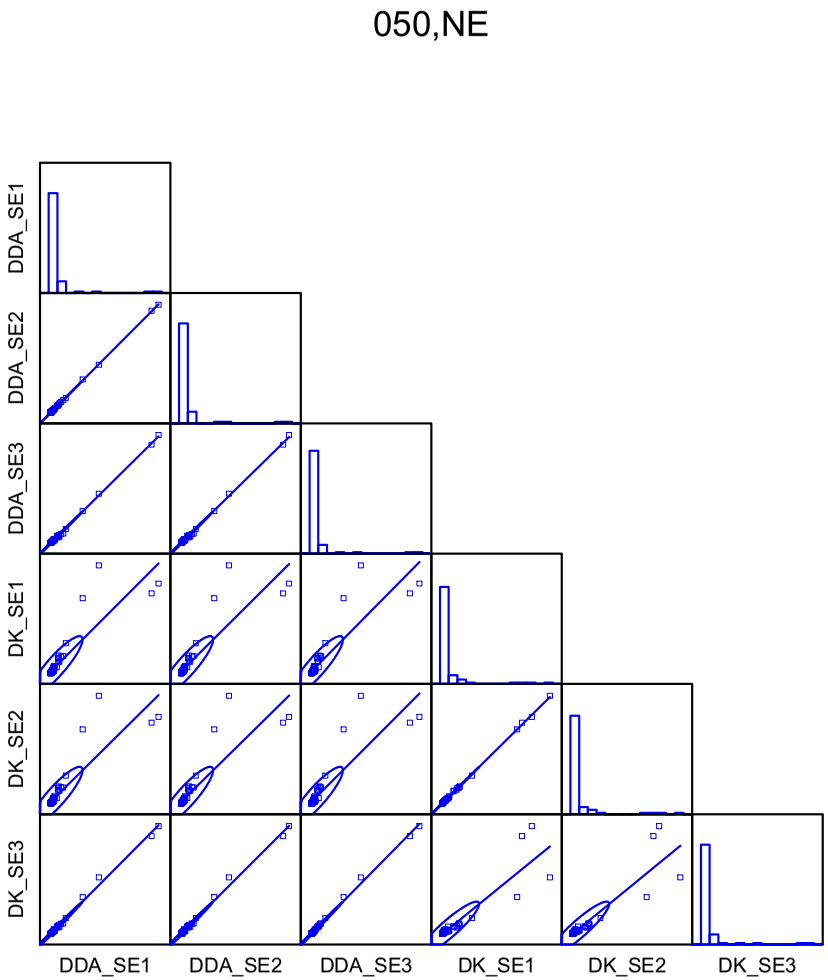


Figure 5c. Comparisons of the **standard error (SE)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **New England otter trawl;** each dot represents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

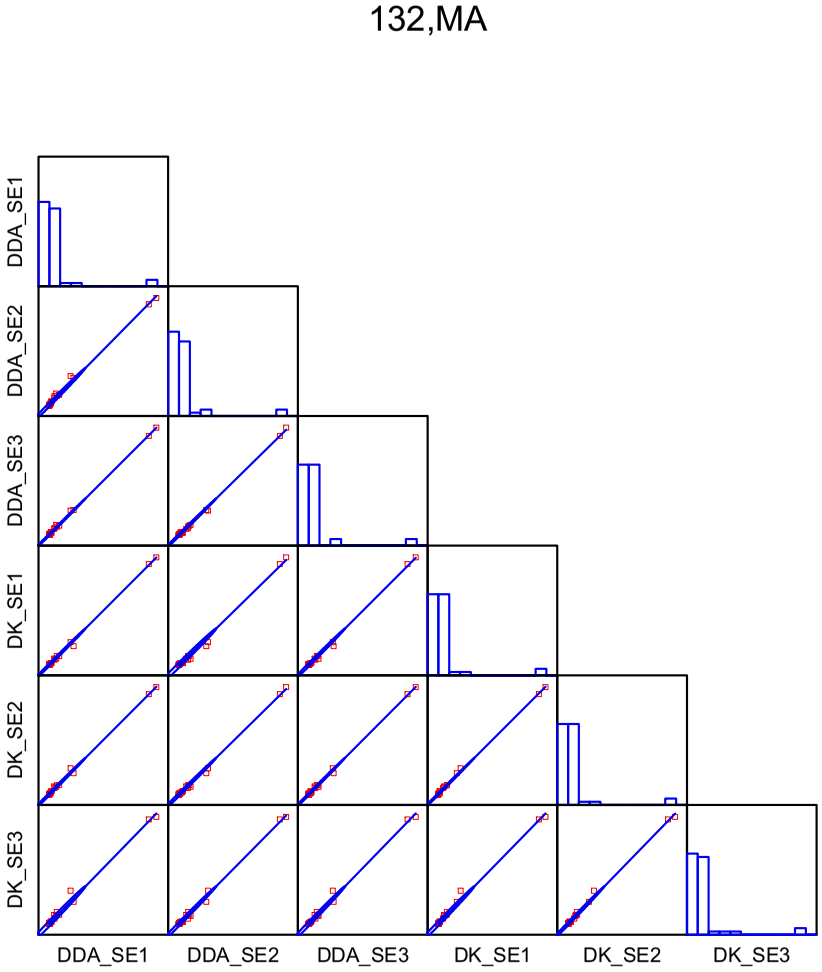


Figure 5d. Comparisons of the **standard error (SE)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **Mid-Atlantic scallop dredge;** each dot represents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

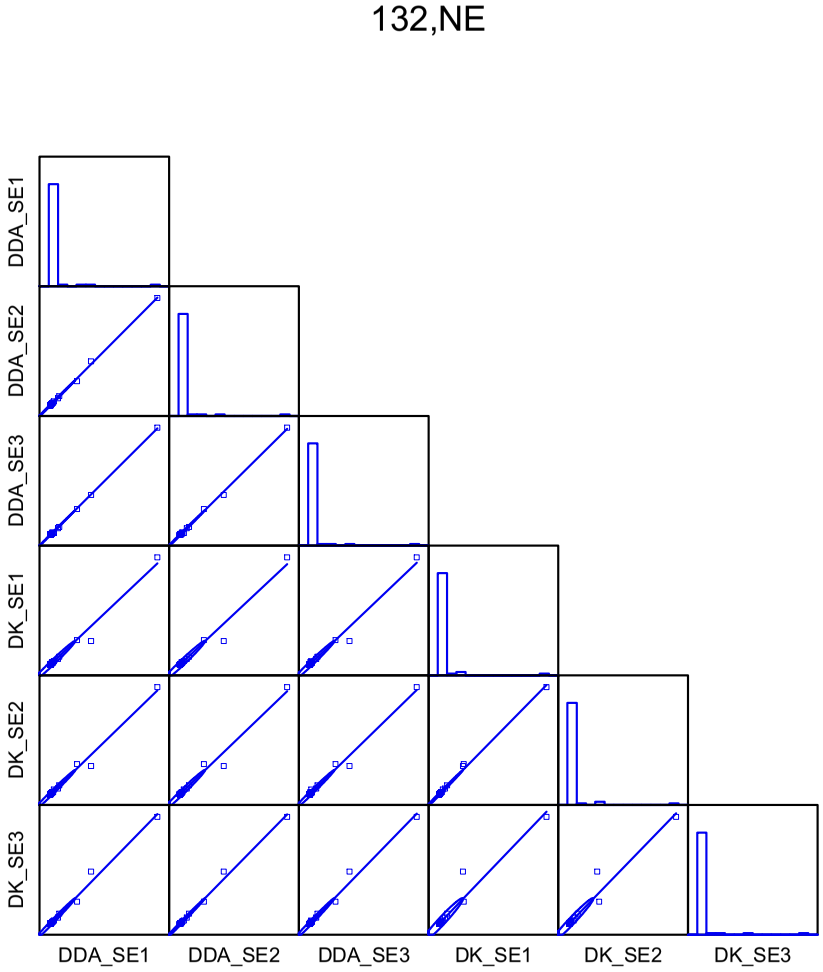


Figure 5e. Comparisons of the **standard error (SE)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **New England scallop dredge;** each dot represents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

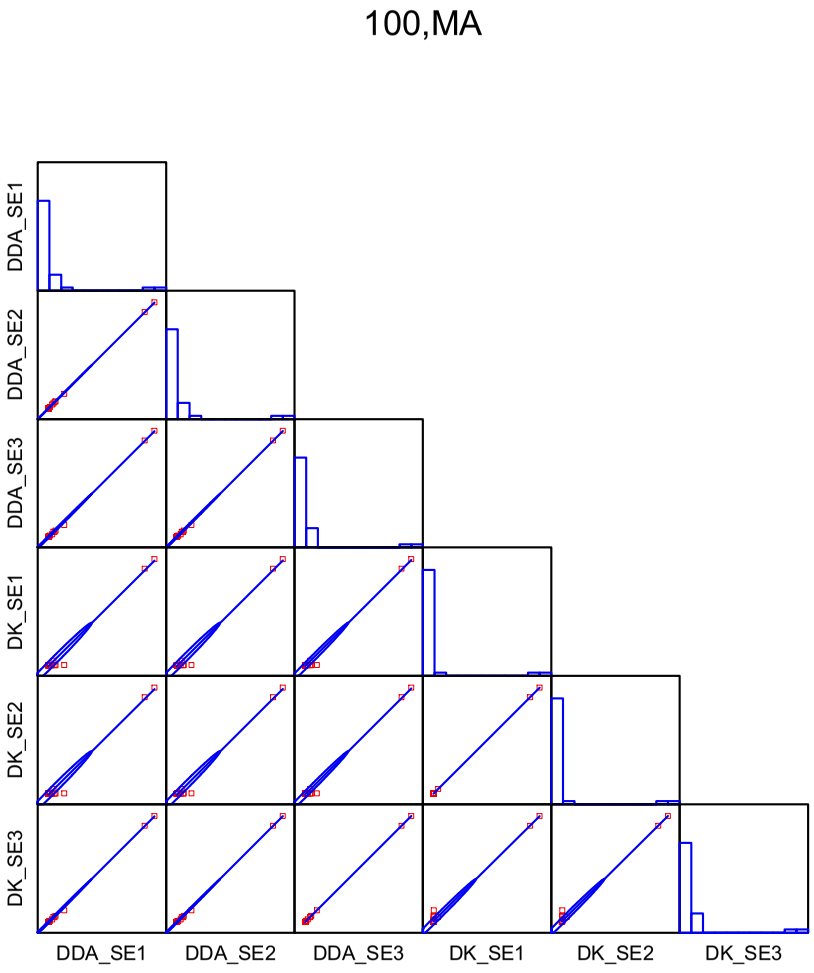


Figure 5f. Comparisons of the **standard error (SE)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **Mid-Atlantic gillnet;** each dot represents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

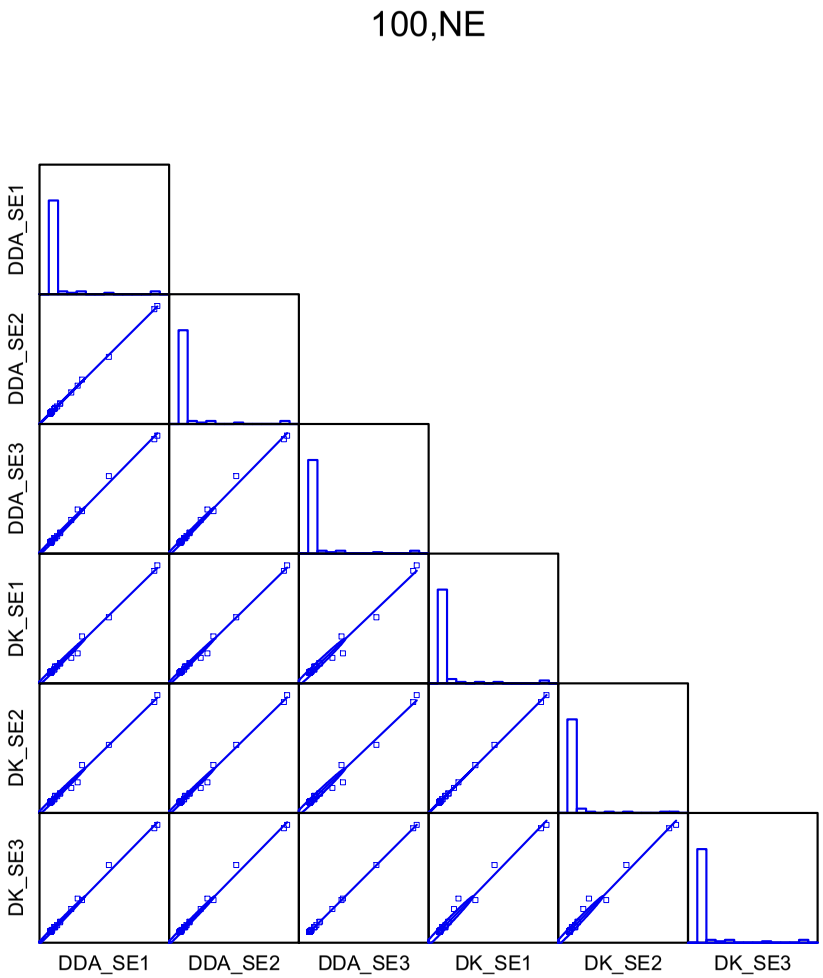


Figure 5g. Comparisons of the **standard error (SE)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **New England gillnet;** each dot represents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

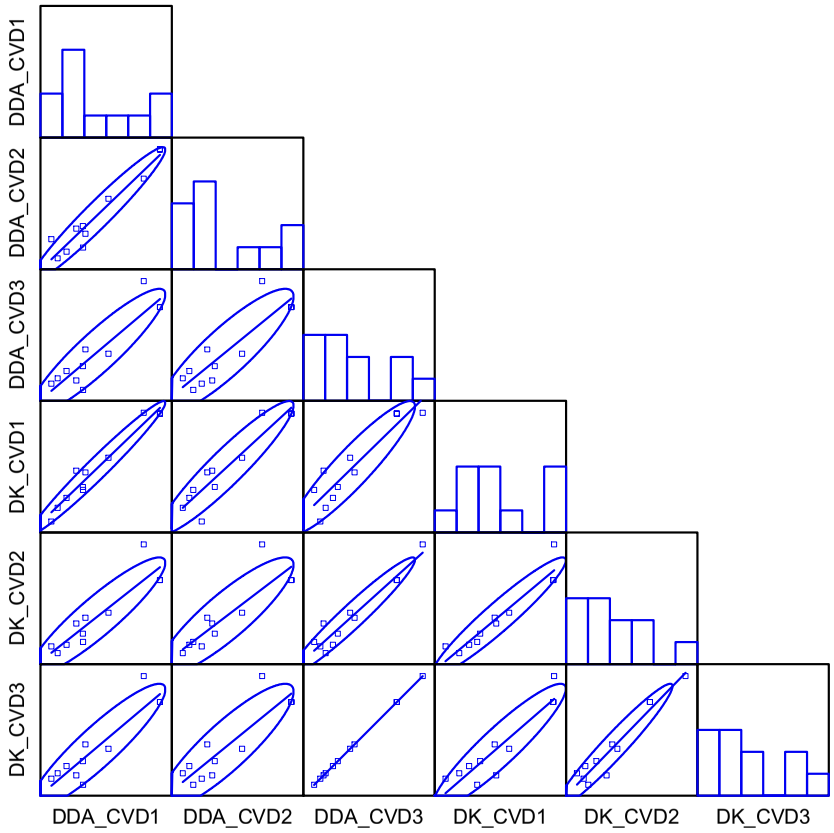


Figure 5h. Comparisons of the **coefficient of variation (CV)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **New England longline**; each dot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

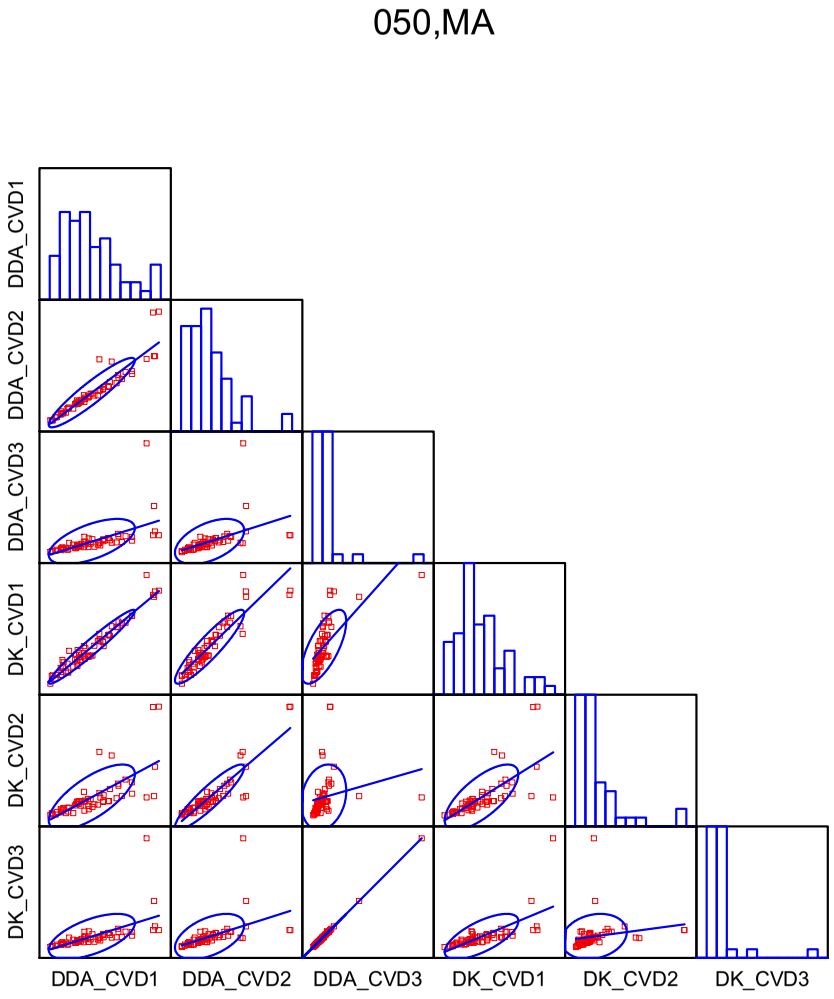


Figure 5i. Comparisons of the **coefficient of variation (CV)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **Mid-Atlantic otter trawl;** each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

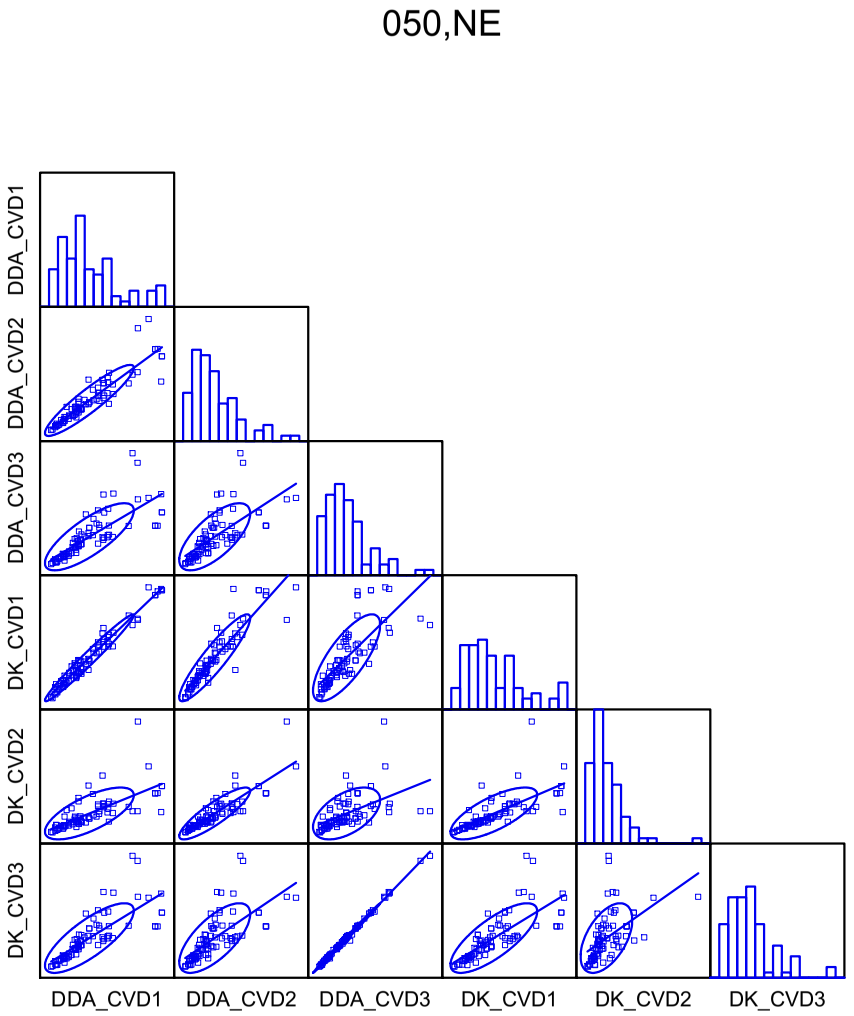


Figure 5j. Comparisons of the **coefficient of variation (CV)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **New England otter trawl;** each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

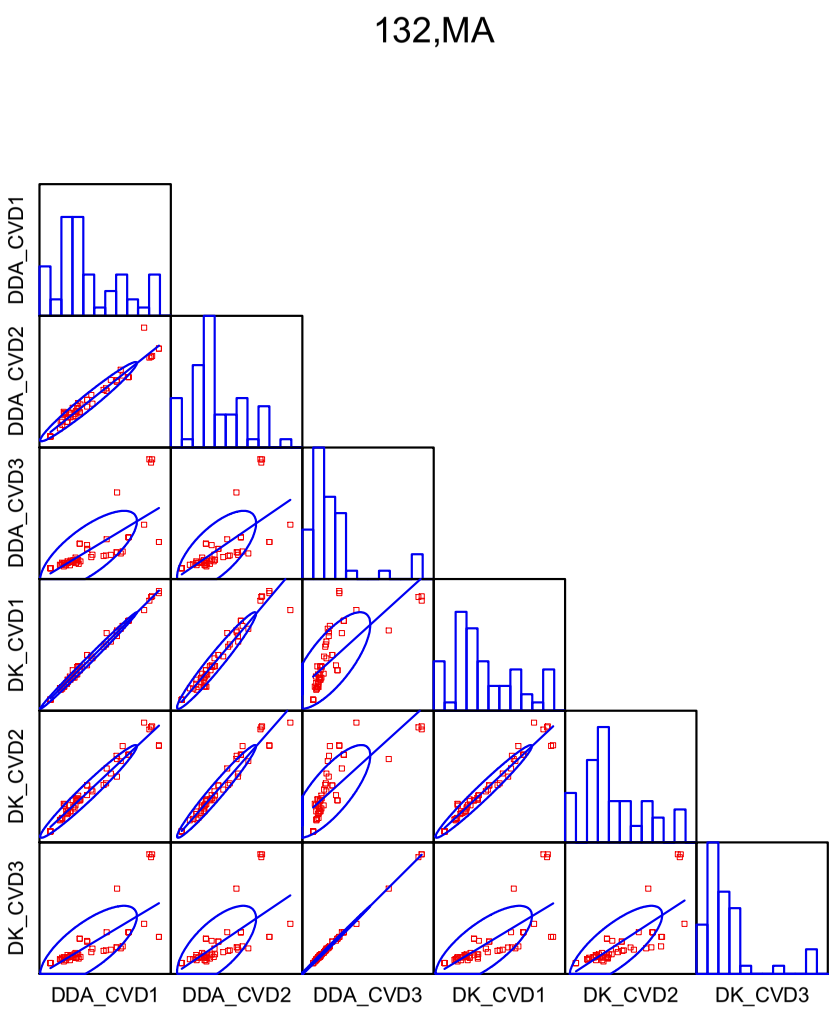


Figure 5k. Comparisons of the **coefficient of variation (CV)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **Mid-Atlantic scallop dredge;** each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

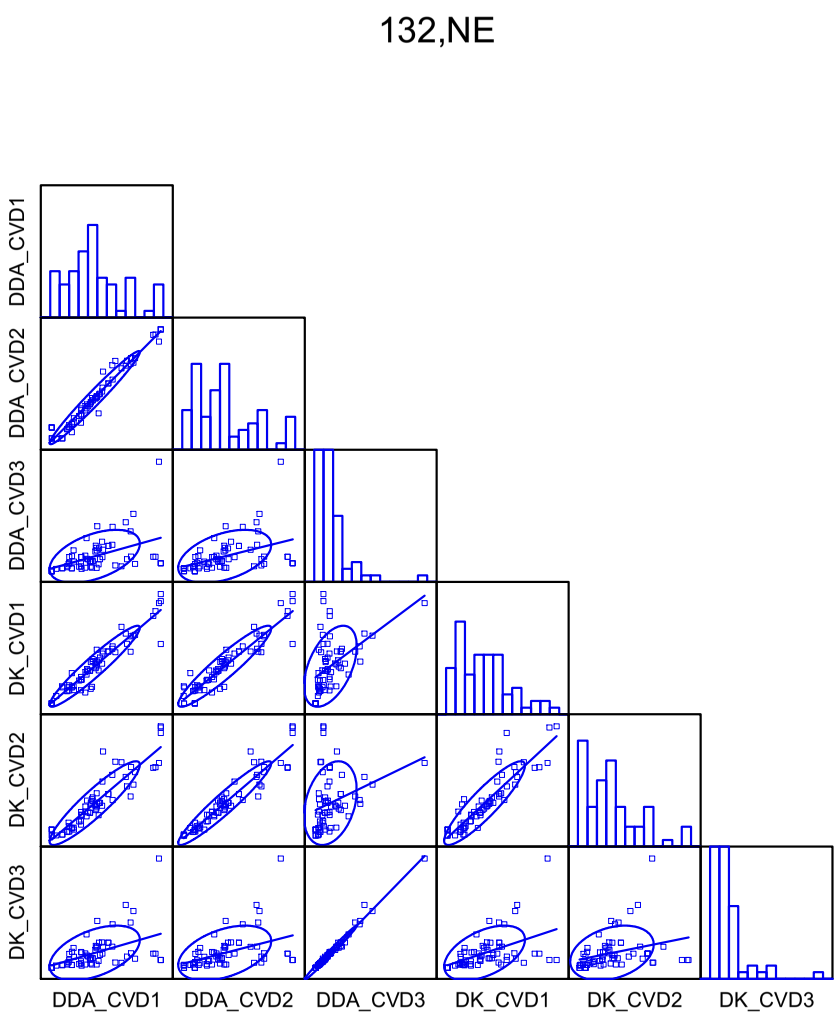


Figure 5l. Comparisons of the **coefficient of variation (CV)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **New England scallop dredge;** each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

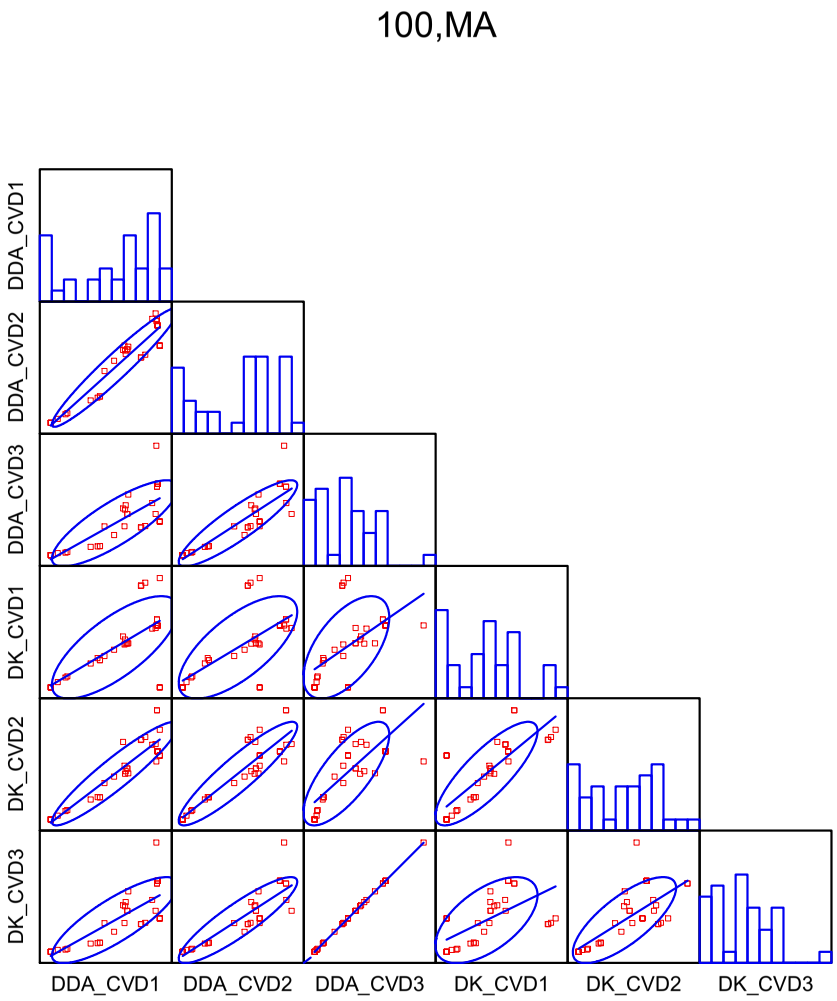


Figure 5m. Comparisons of the **coefficient of variation (CV)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **Mid-Atlantic gillnet;** each dot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

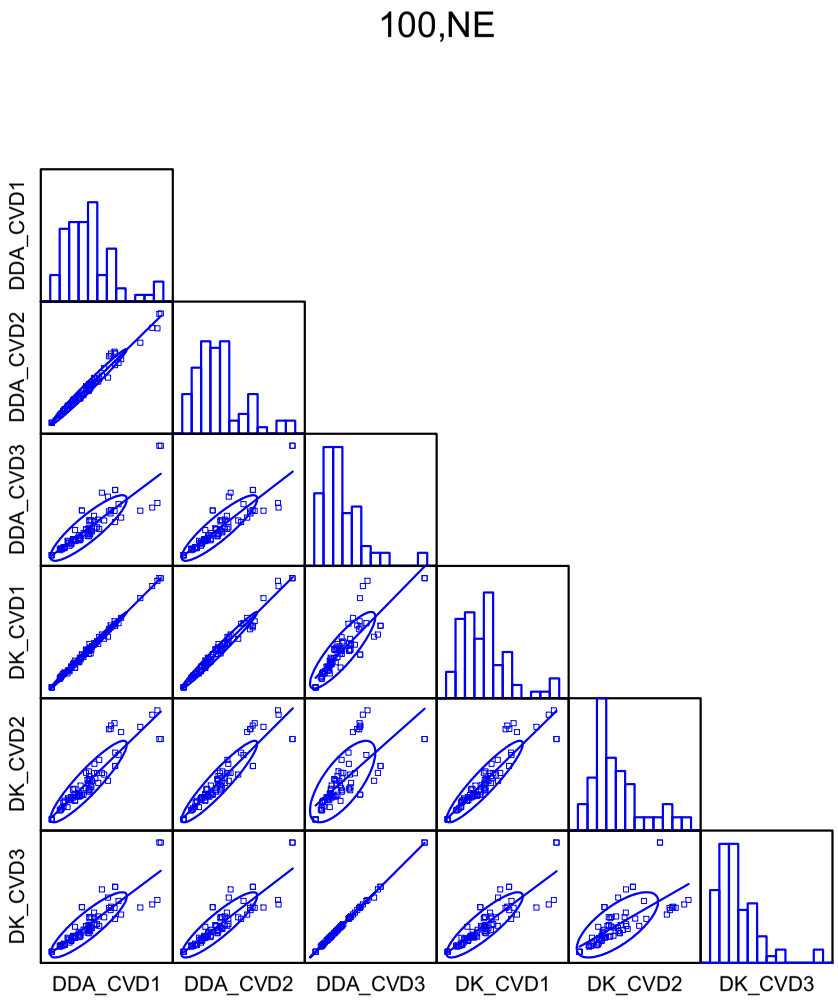


Figure 5n. Comparisons of the **coefficient of variation (CV)** of total discards derived by the two bycatch ratios (discard to days absent [DDA] and discard to kept [DK]) and the three methods (separate ratio [D1], combined ratio [D2] and simple expansion [D3]) for **New England gillnet;** each dot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

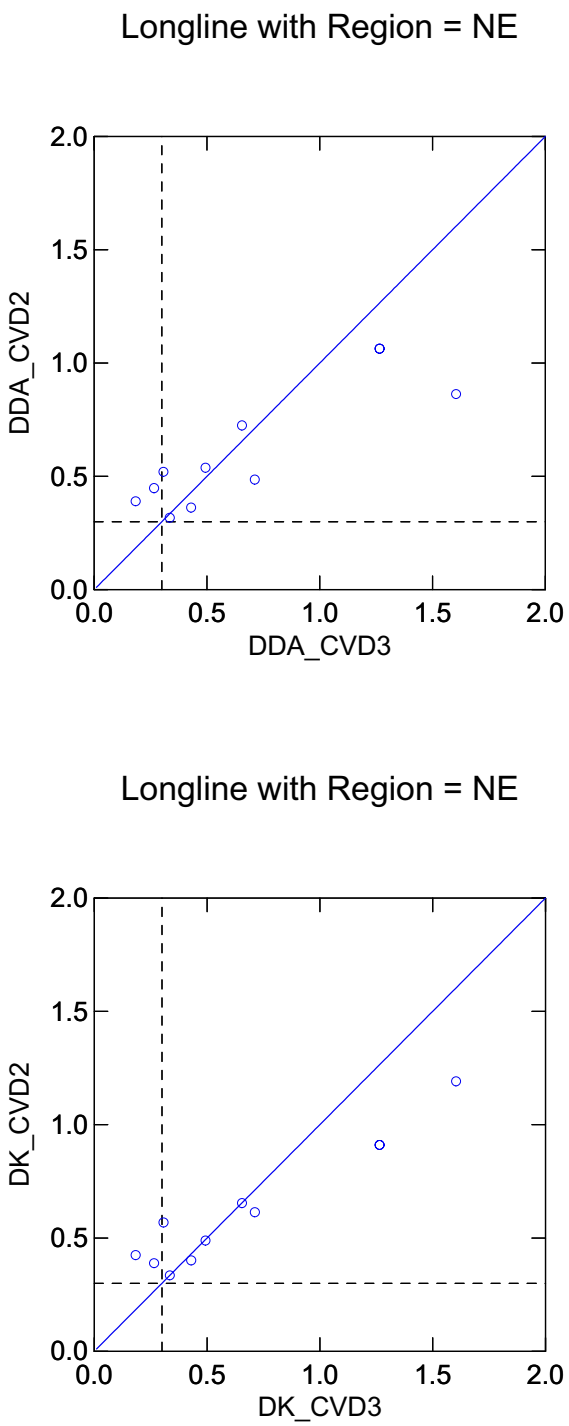
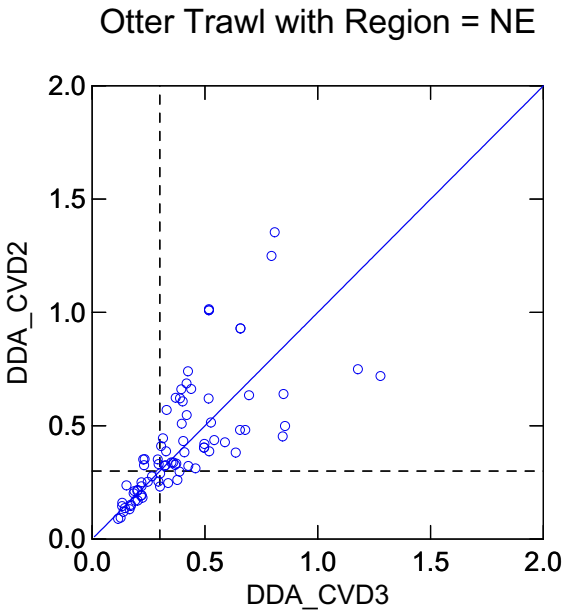
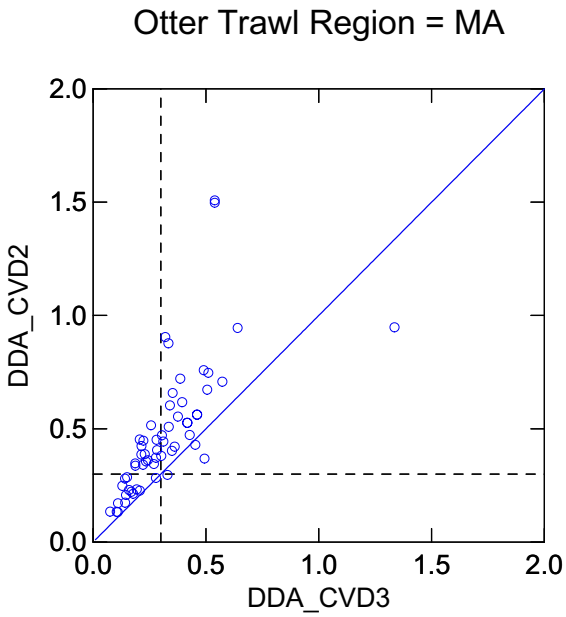
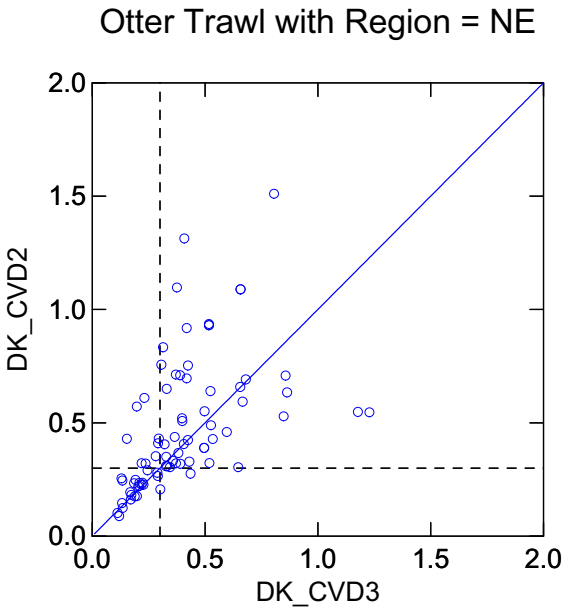


Figure 6a. Comparisons of **coefficient of variation (CV)** of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard to days absent (DDA), top panel, and discard to kept (DK), bottom panel, for **New England longline**; each dot represents a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







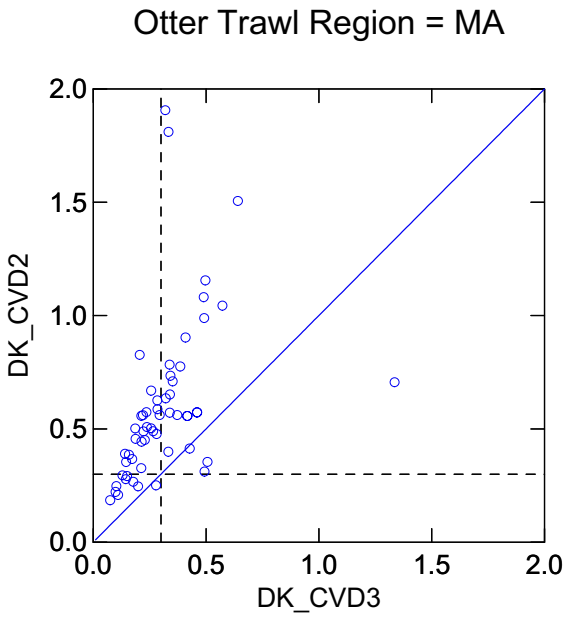
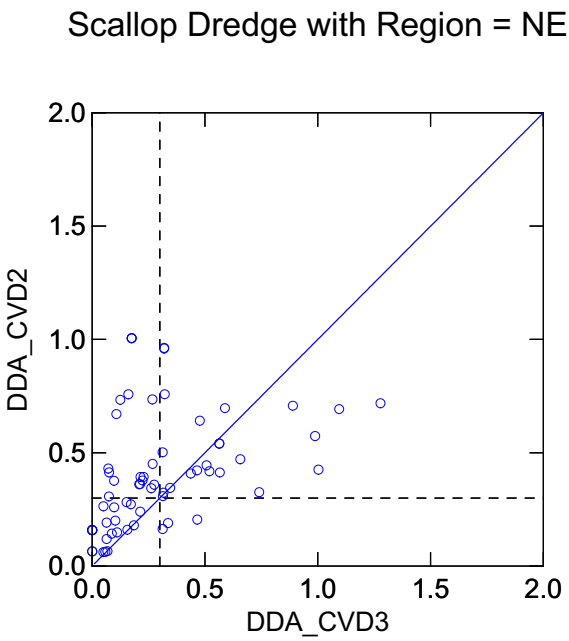
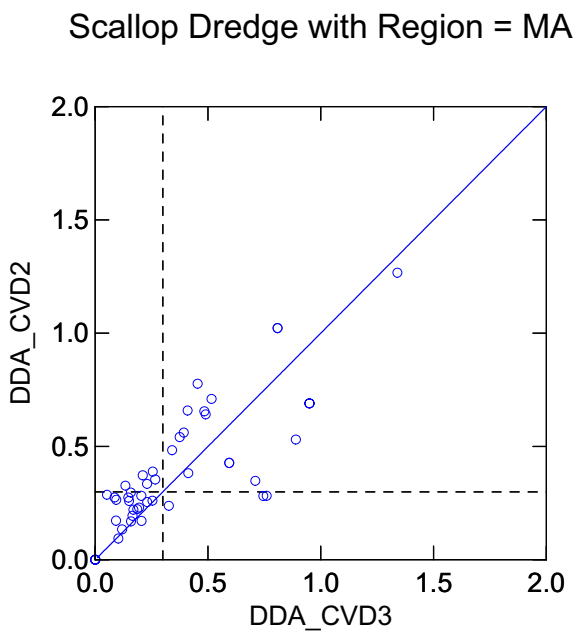
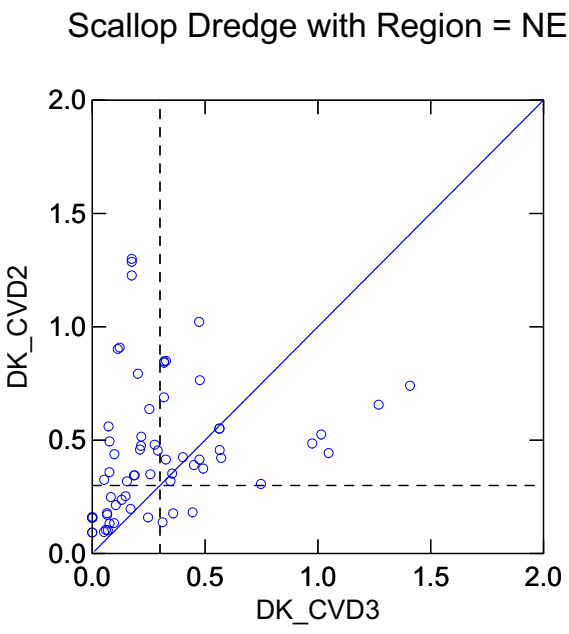


Figure 6b. Comparisons of **coefficient of variation (CV)** of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3)for discard to days absent (DDA), top panel, and discard to kept (DK), bottom panel, for **New England otter trawl**; each dot represents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

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







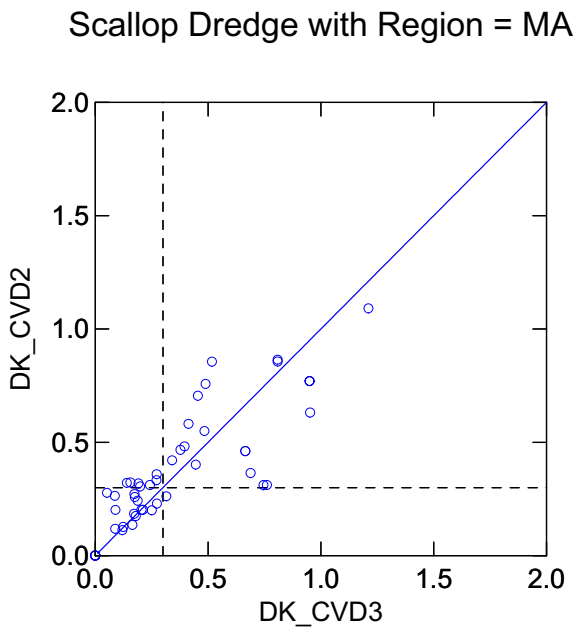
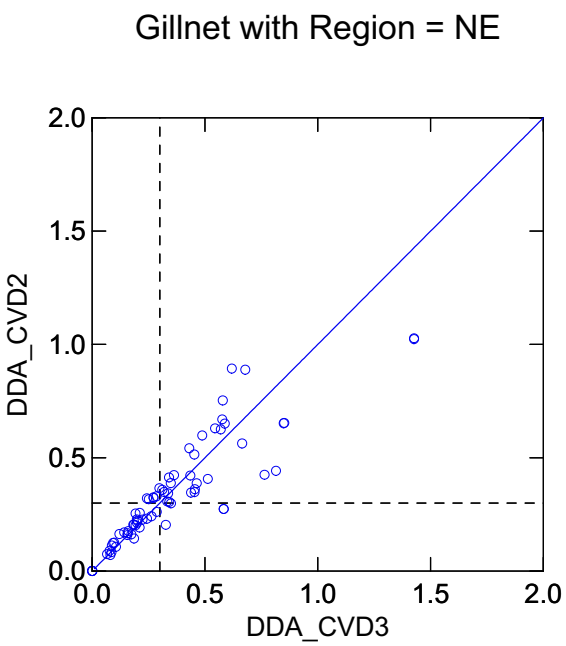
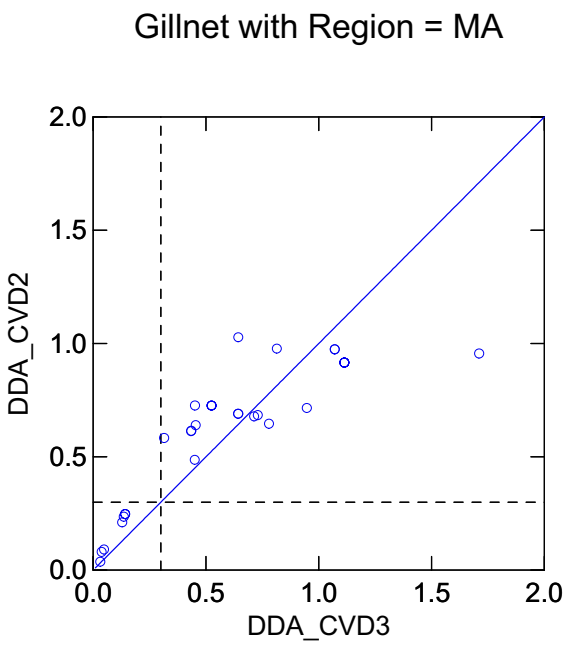
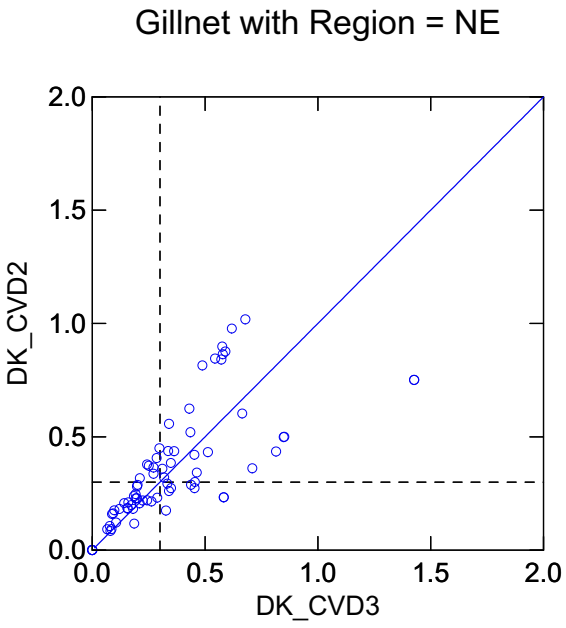


Figure 6d. Comparisons of **coefficient of variation (CV)** of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard to days absent (DDA), top panel, and discard to kept (DK), bottom panel, for **New England scallop dredge**; each dot represents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

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







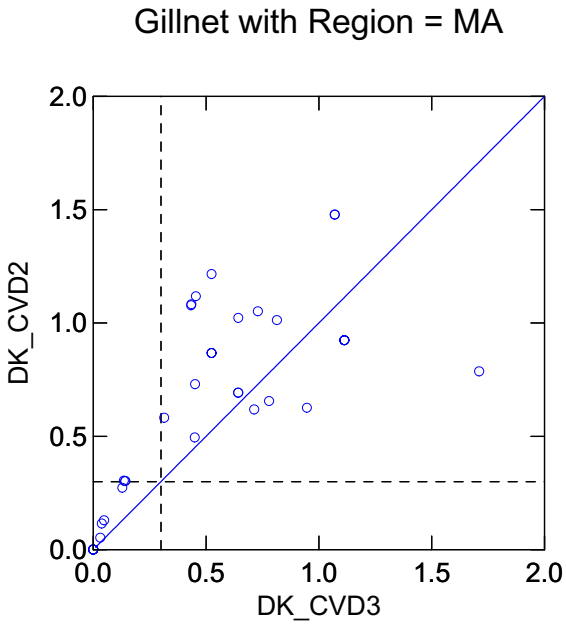
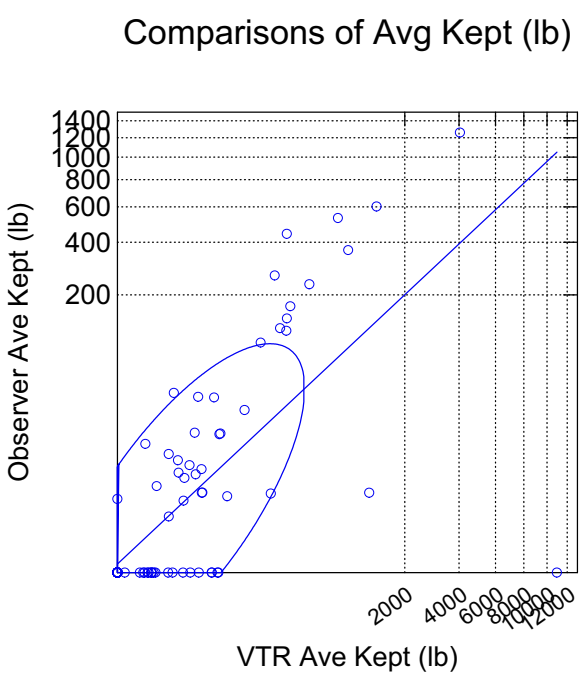


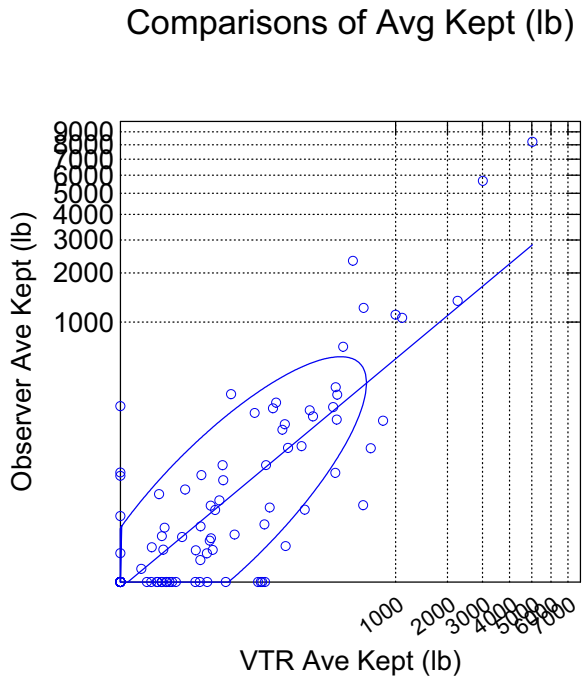
Figure 6f. Comparisons of coefficient of variation (CV) of total discards estimated via the combined ratio method (CVD2) and the simple expansion method (CVD3) for discard to days absent (DDA), top panel, and discard to kept (DK), bottom panel, for **New England gillnet**; each dot represents a species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

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

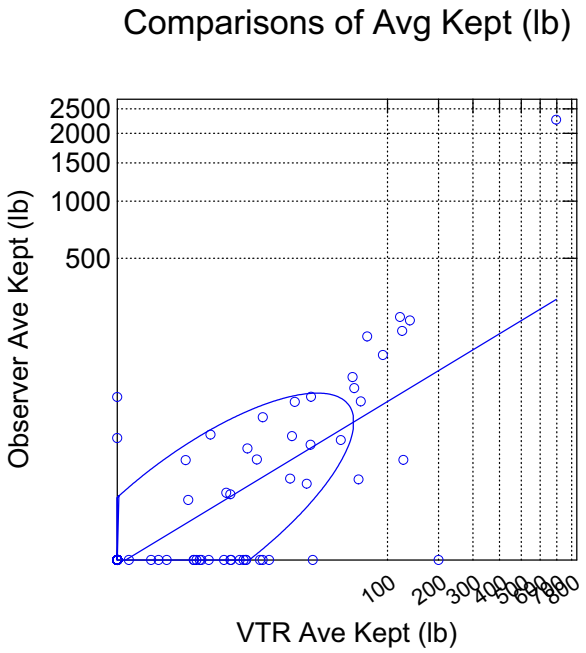
Bluefish



Fluke-Scup-Black Sea Bass



Spiny Dogfish



NE Multi-species (Large mesh)

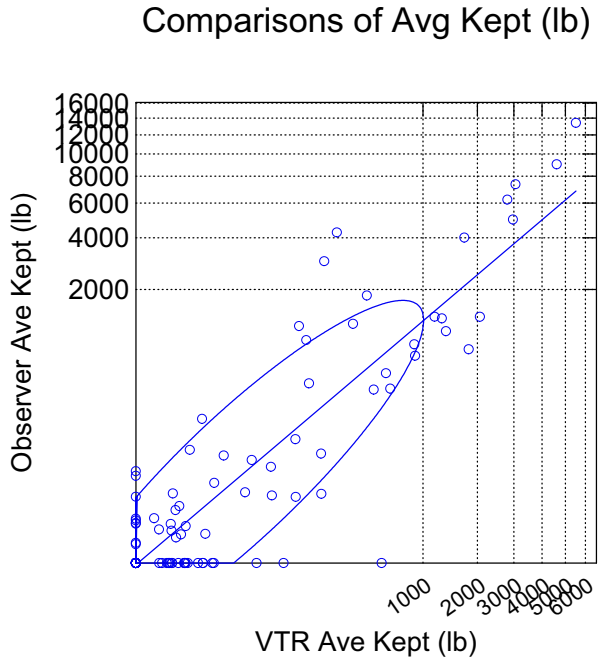
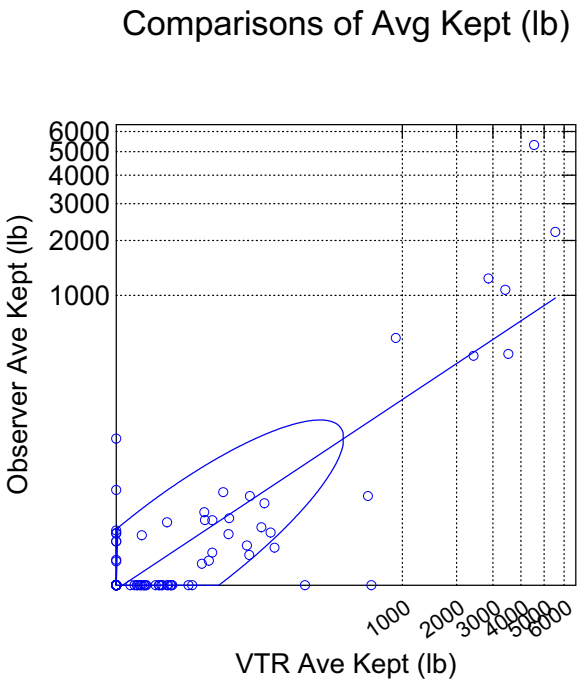
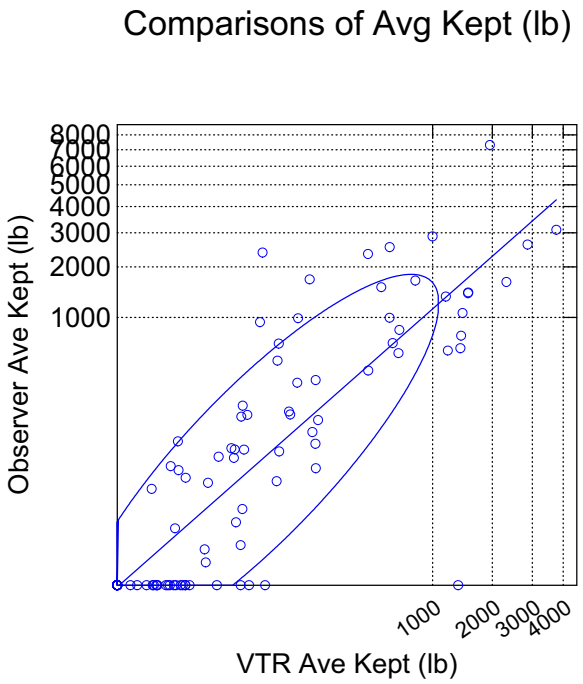


Figure 7. Comparisons of **average kept pounds** (fourth root transformation used), by species group, in the Northeast fisheries Observer Program and VTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

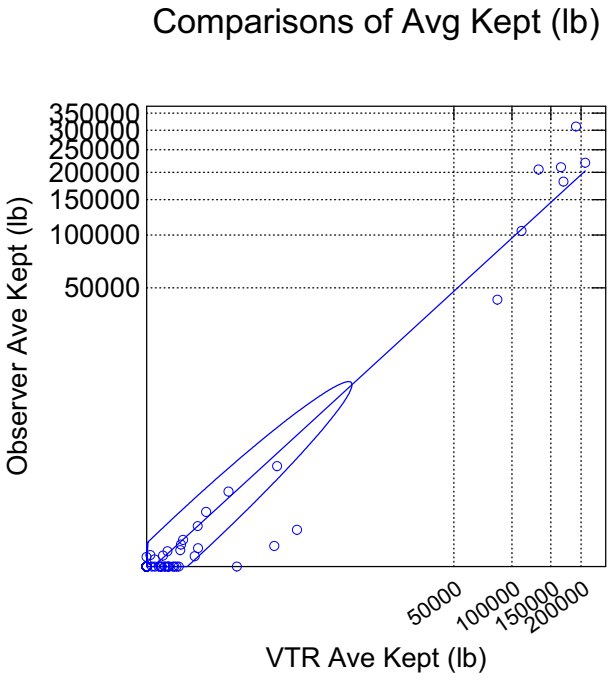
NE Multispecies (Small mesh)



Monkfish



Herring



Red Crab

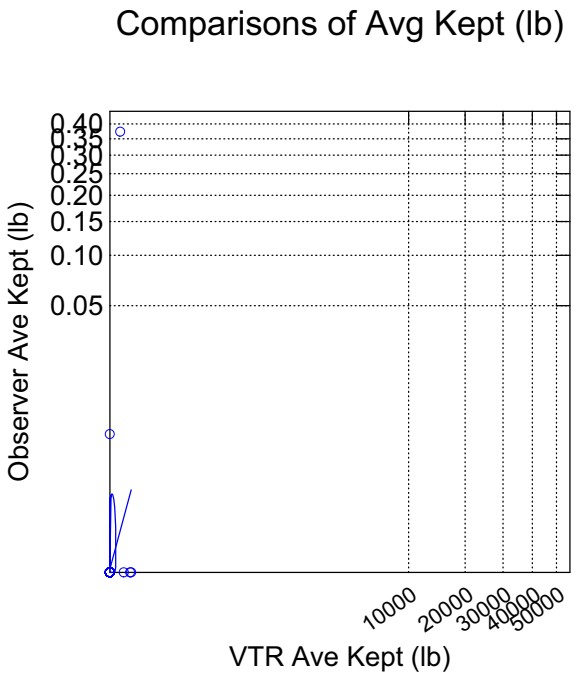
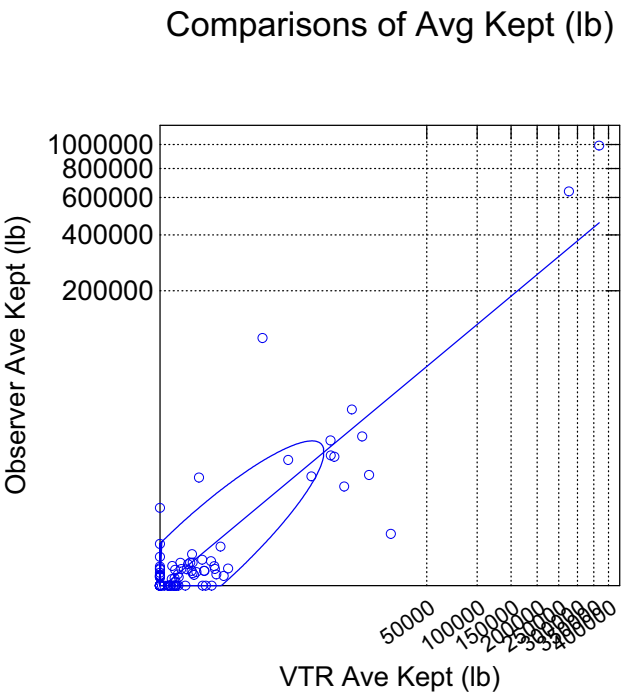
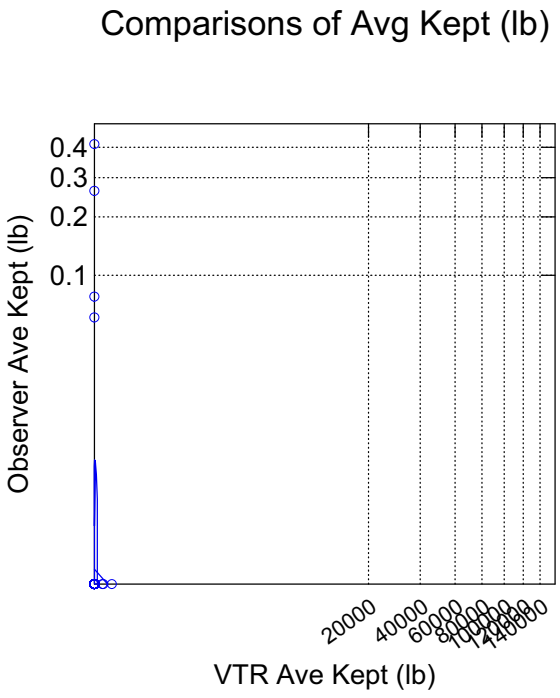


Figure 7 continued.

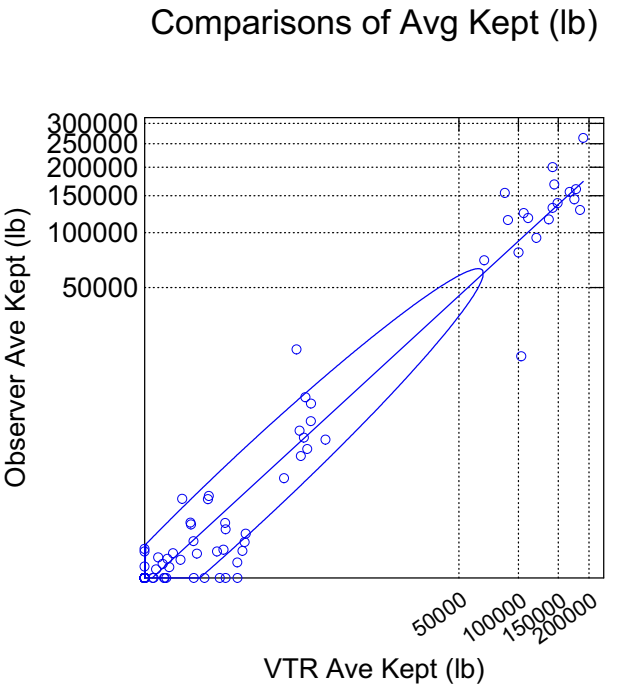
Mackerel-Squid-Butterfish



Surf Clam – Ocean Quahog



Scallops



Skate Complex

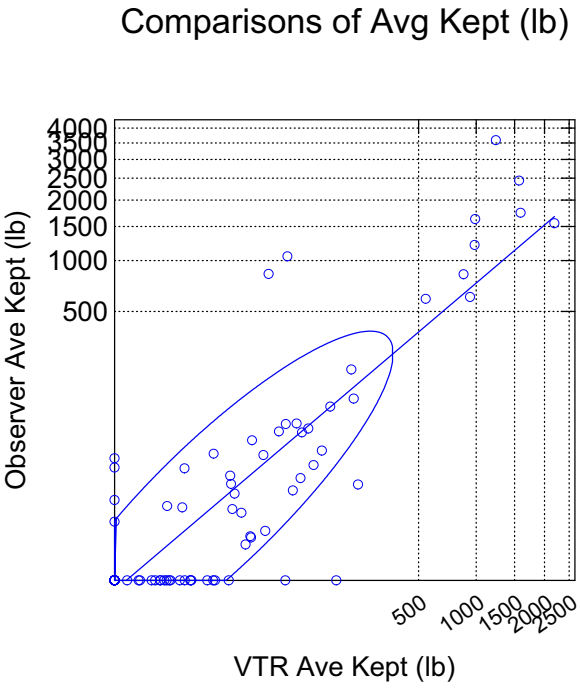
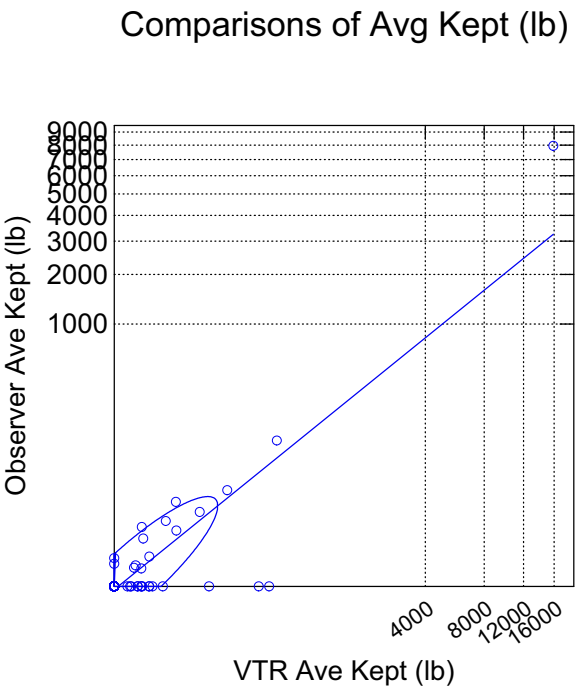


Figure 7 continued.

Tilefish



All Species

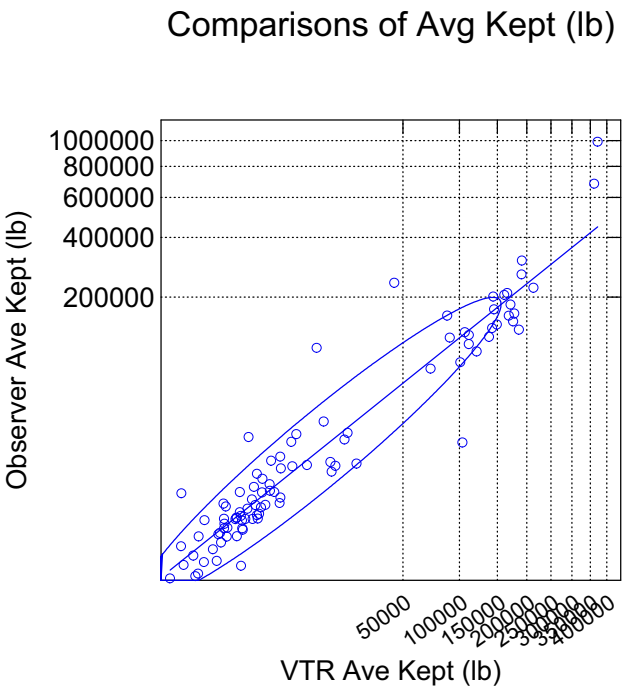
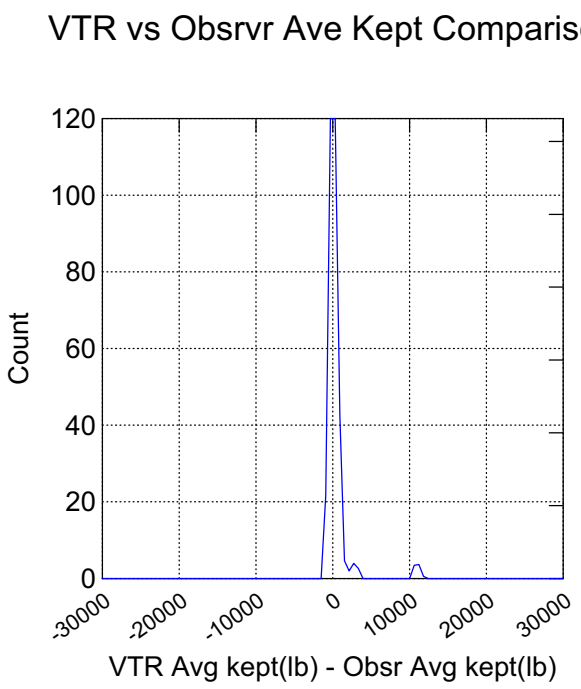
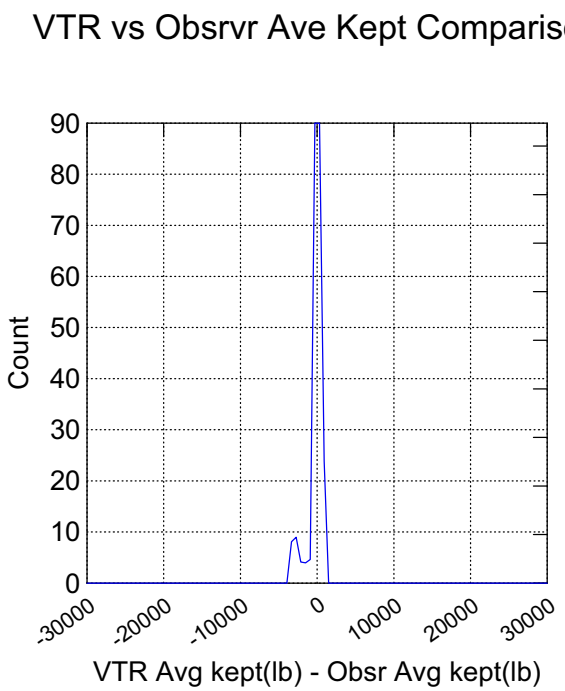


Figure 7 continued.

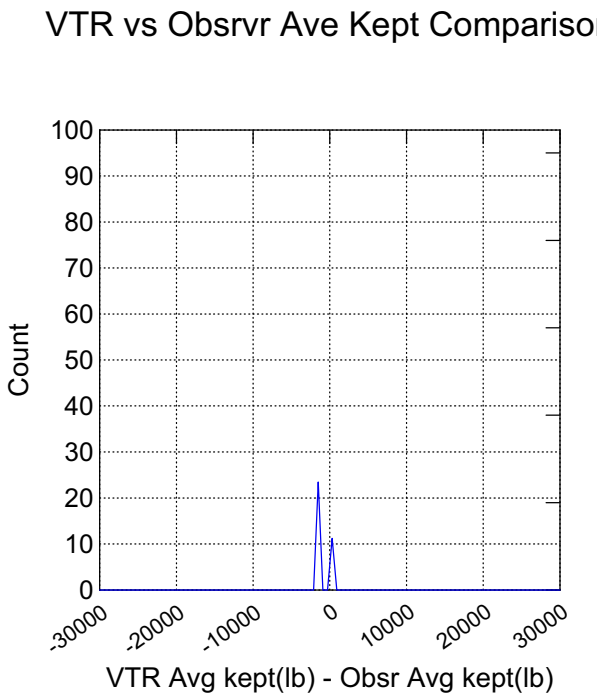
Bluefish



Fluke-Scup-Black Sea Bass



Spiny Dogfish



NE Multispecies (Large mesh)

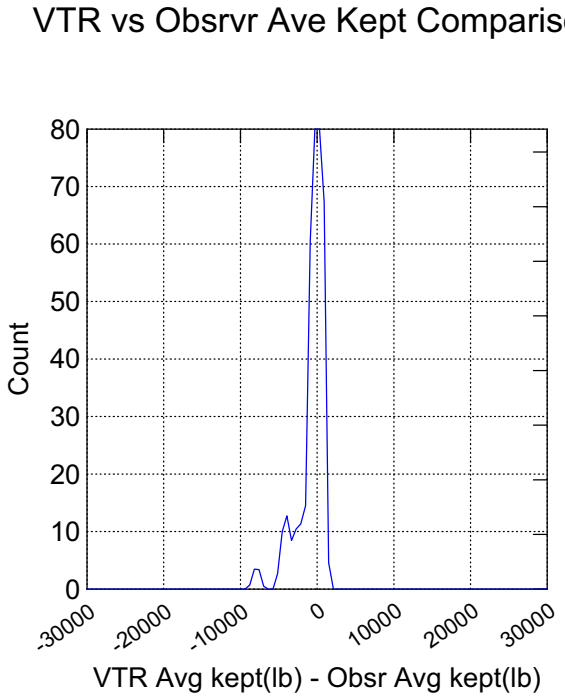
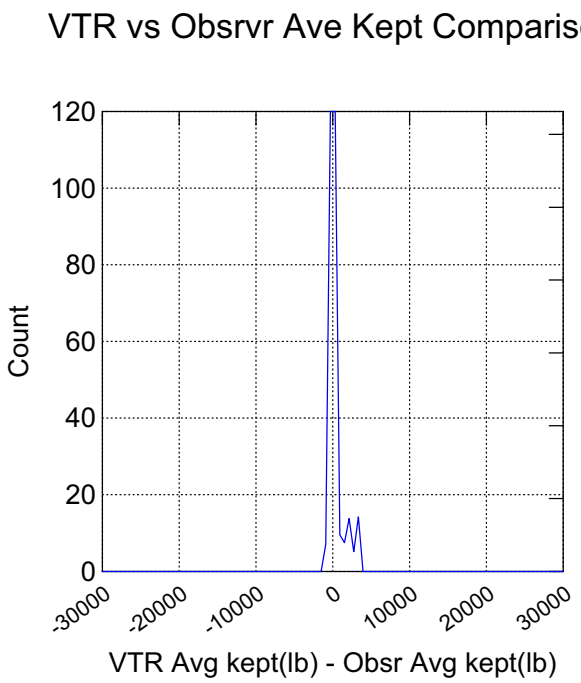
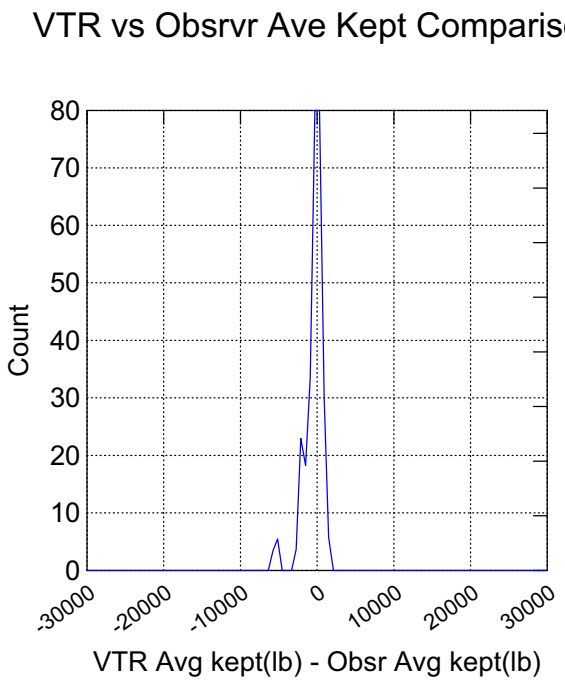


Figure 8. The distribution of differences in the **average kept pounds of species groups** in the Northeast Fisheries Observer Fisheries Program and the VTR data for 2004.

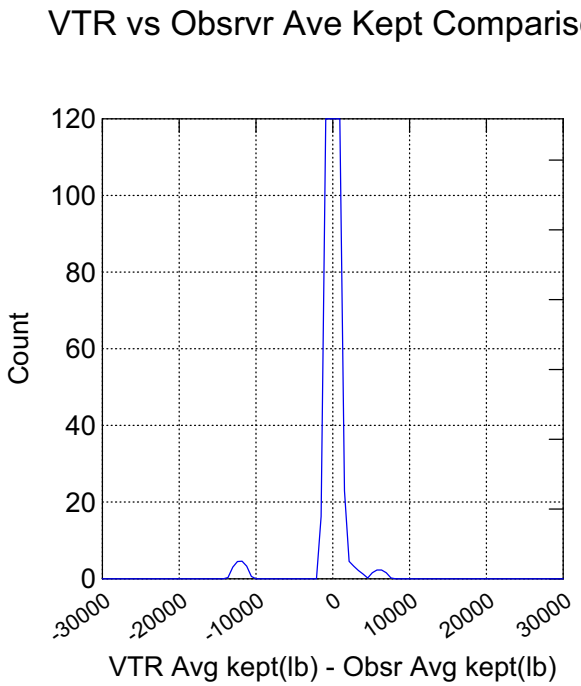
NE Multispecies (Small mesh)



Monkfish



Herring



Mackerel-Squid-Butterfish

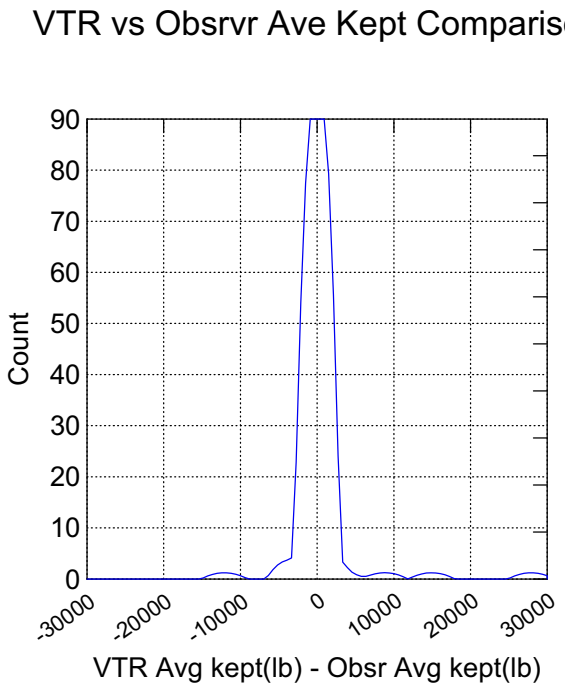
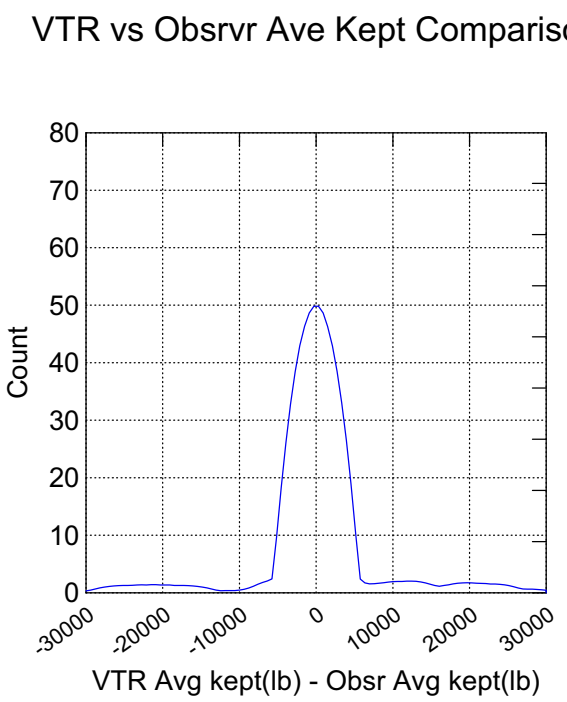
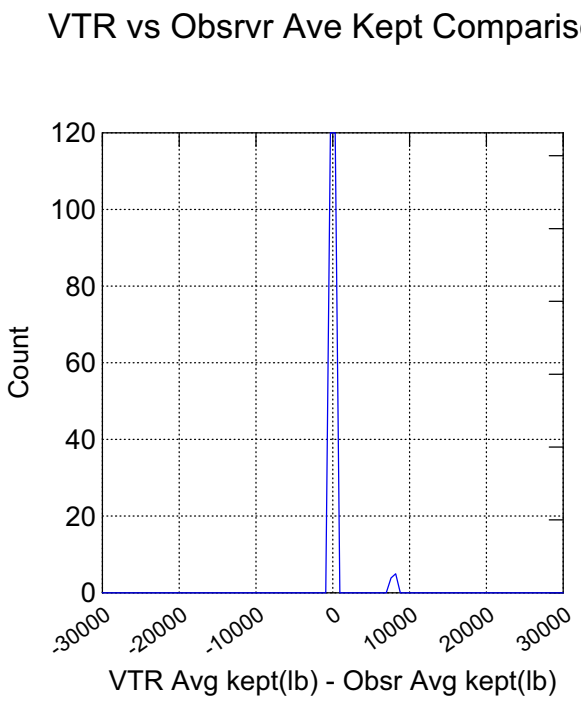


Figure 8 continued.

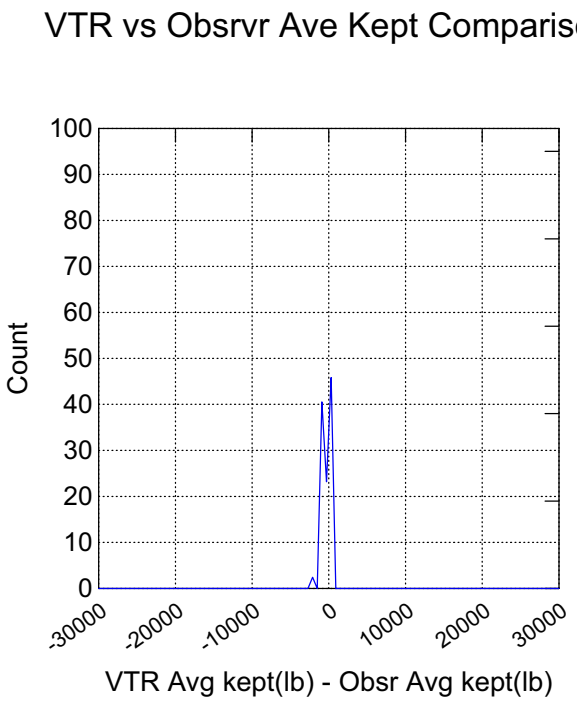
Scallops



Tilefish



Skate Complex



All species

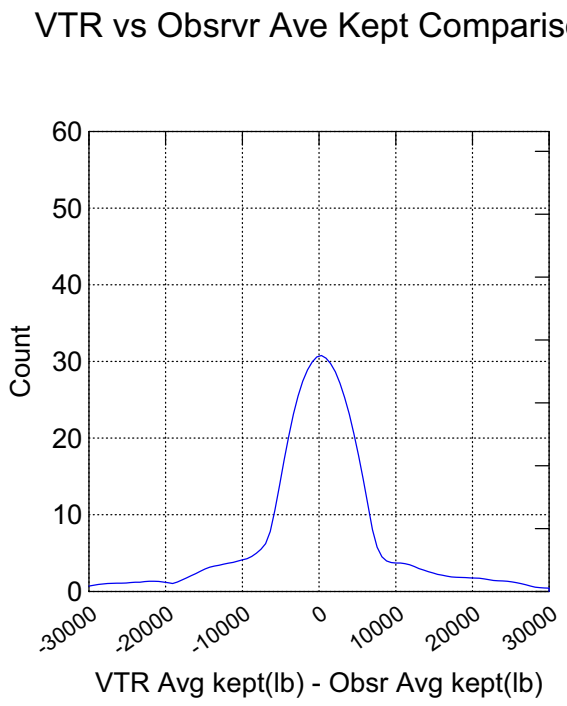
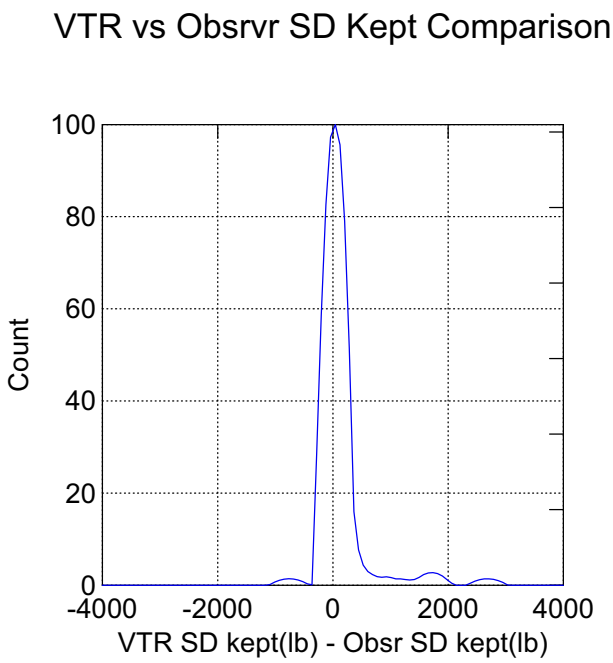
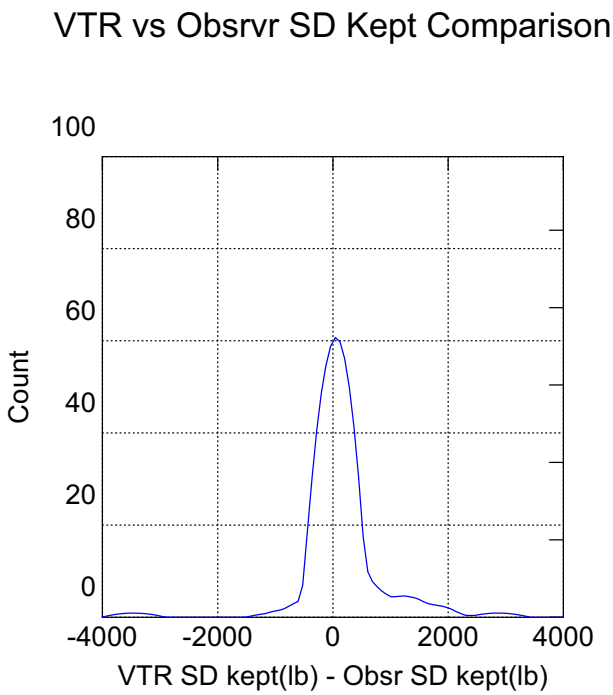


Figure 8 continued.

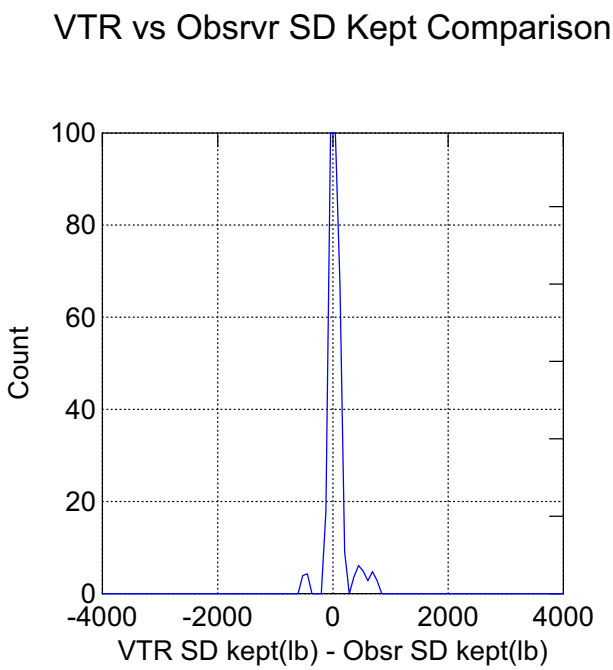
Bluefish



Fluke-Scup-Black Sea Bass



Spiny Dogfish



NE Multispecies (Large mesh)

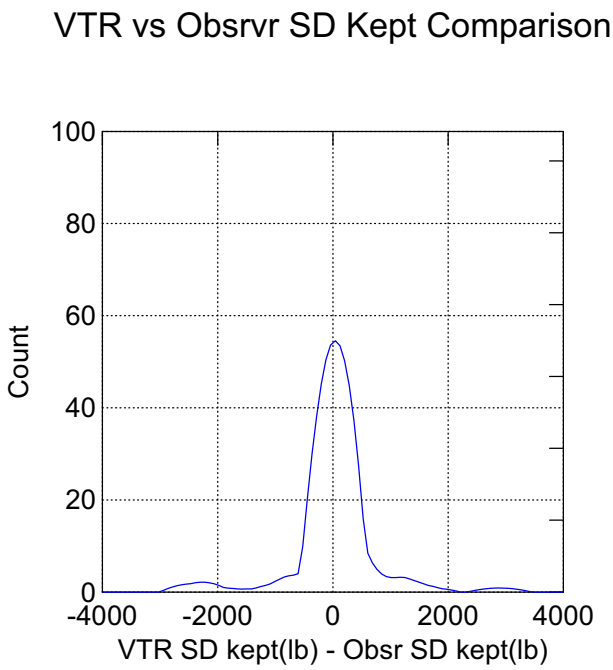
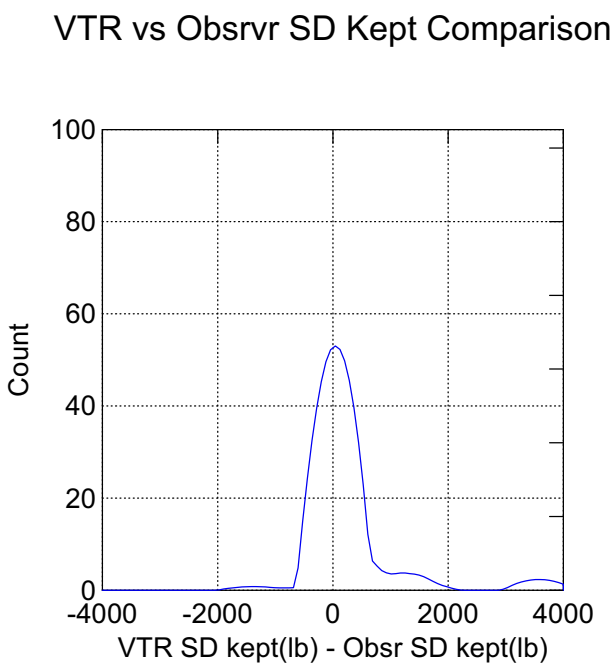
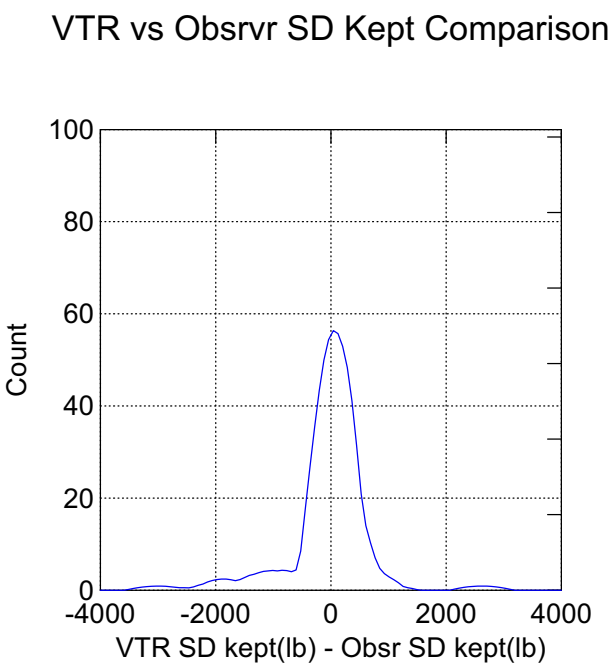


Figure 9. The distribution of difference between the **standard deviation of average kept pounds** of species groups in the Northeast Observer Fisheries Program and the VTR data for 2004.

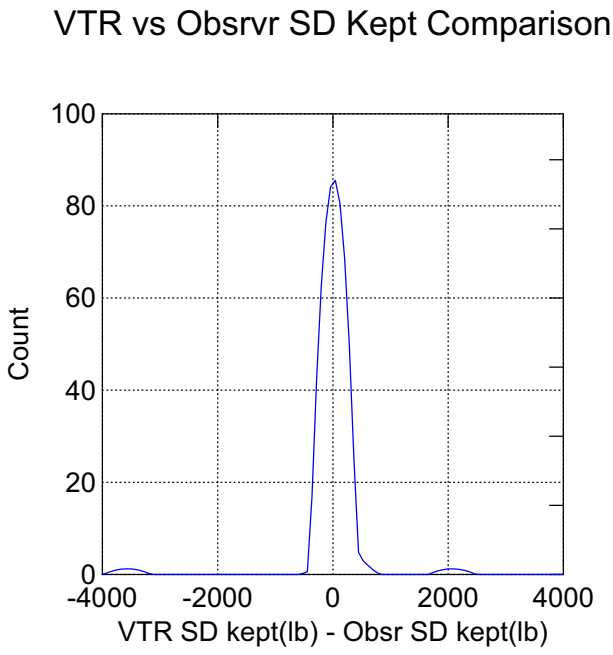
NE Multi-species (small mesh)



Monkfish



Herring



Mackerel Squid-butterfish

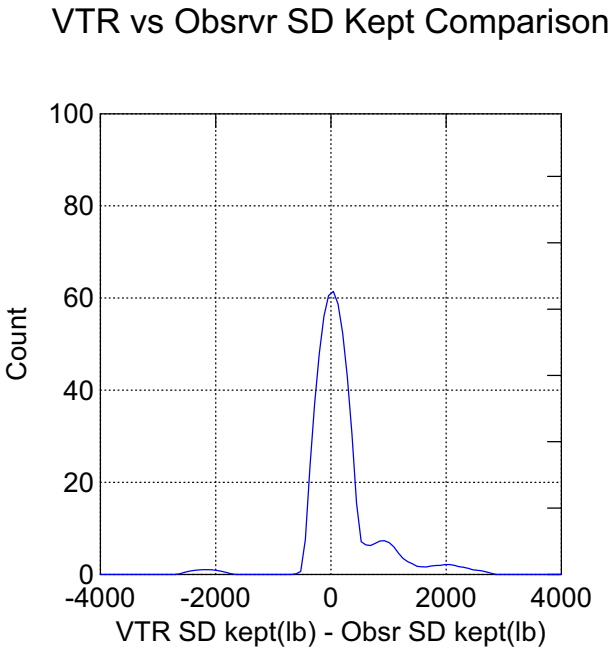
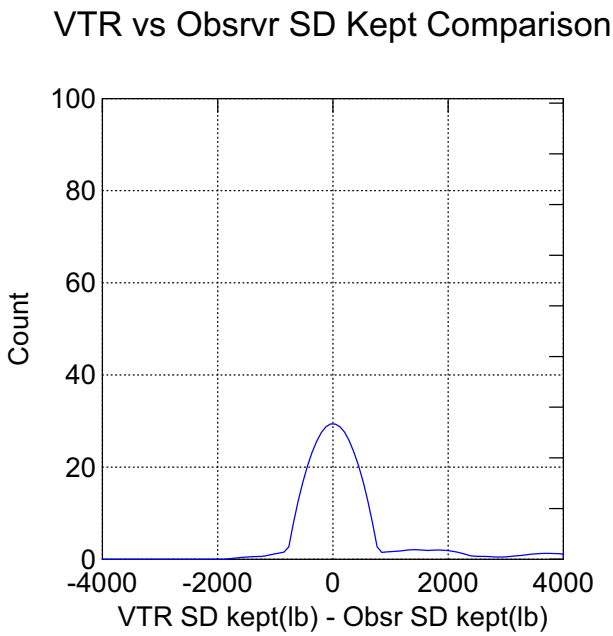
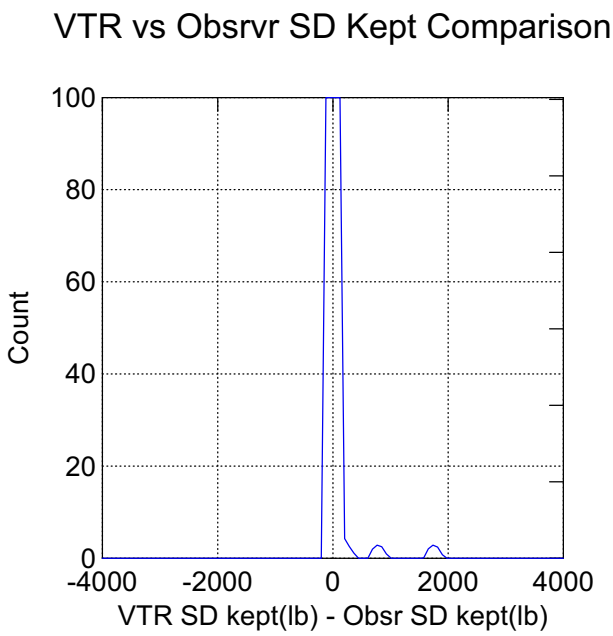


Figure 9 continued.

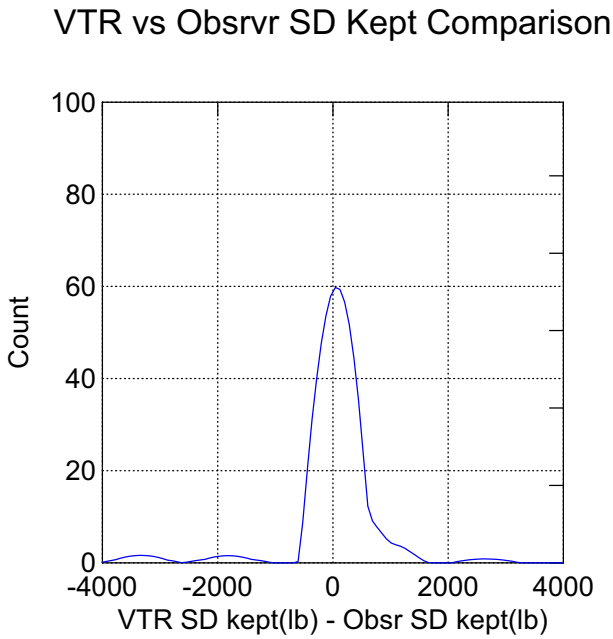
Scallop



Tilefish



Skate Complex



All Species

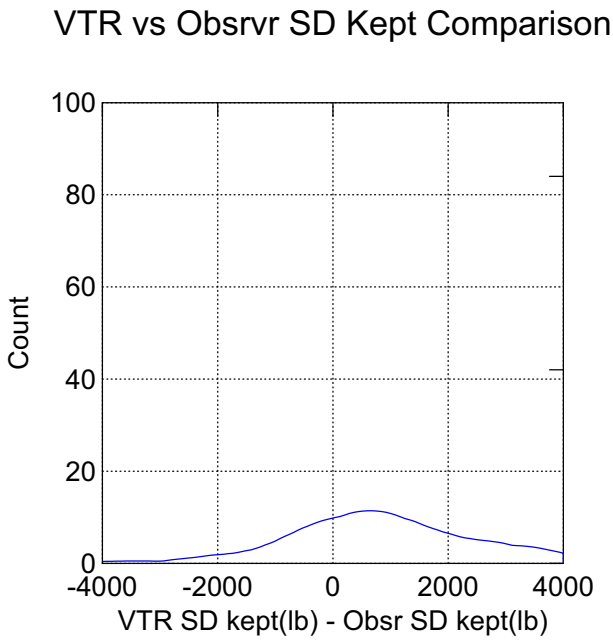


Figure 9 continued.

ALL TRIPS

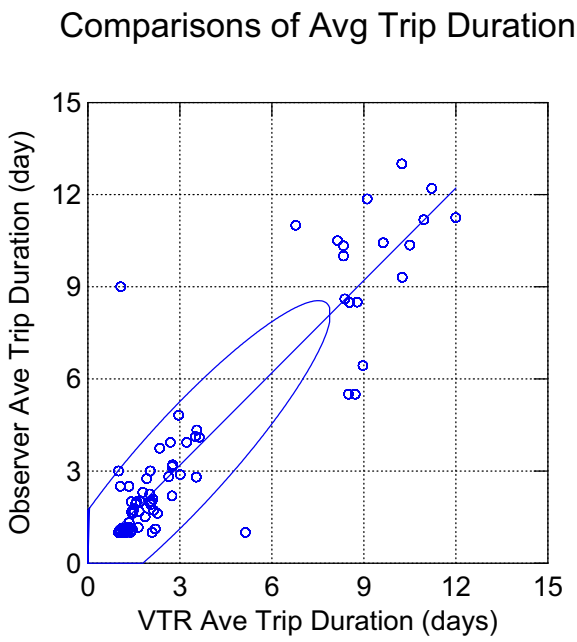


Figure 10. Comparison of **average trip duration** (days) for all trips in the Northeast Fisheries Observer Program and VTR data sets for 2004. Each dot represents the mean of an individual stratum (fleet).

ALL TRIPS

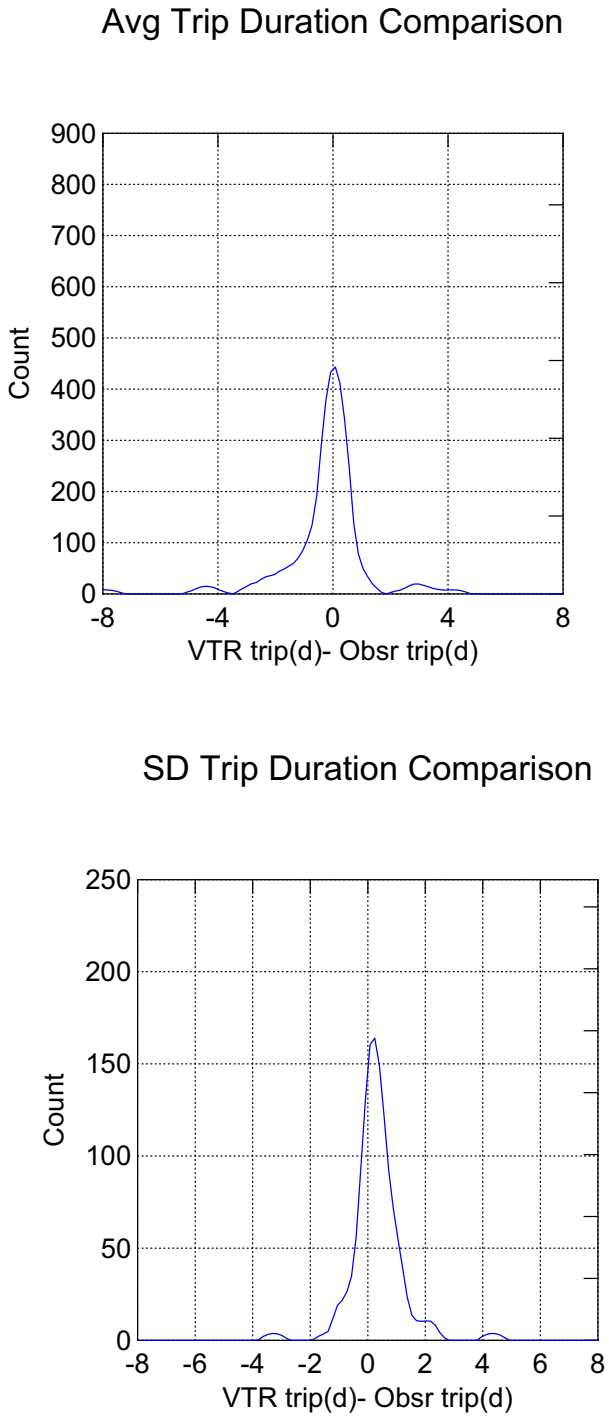


Figure 11. The distribution of differences between the **average trip duration** (top), and **standard deviation of average trip duration** (bottom) for trips in the Northeast Fisheries Observer Program and the VTR data for 2004.

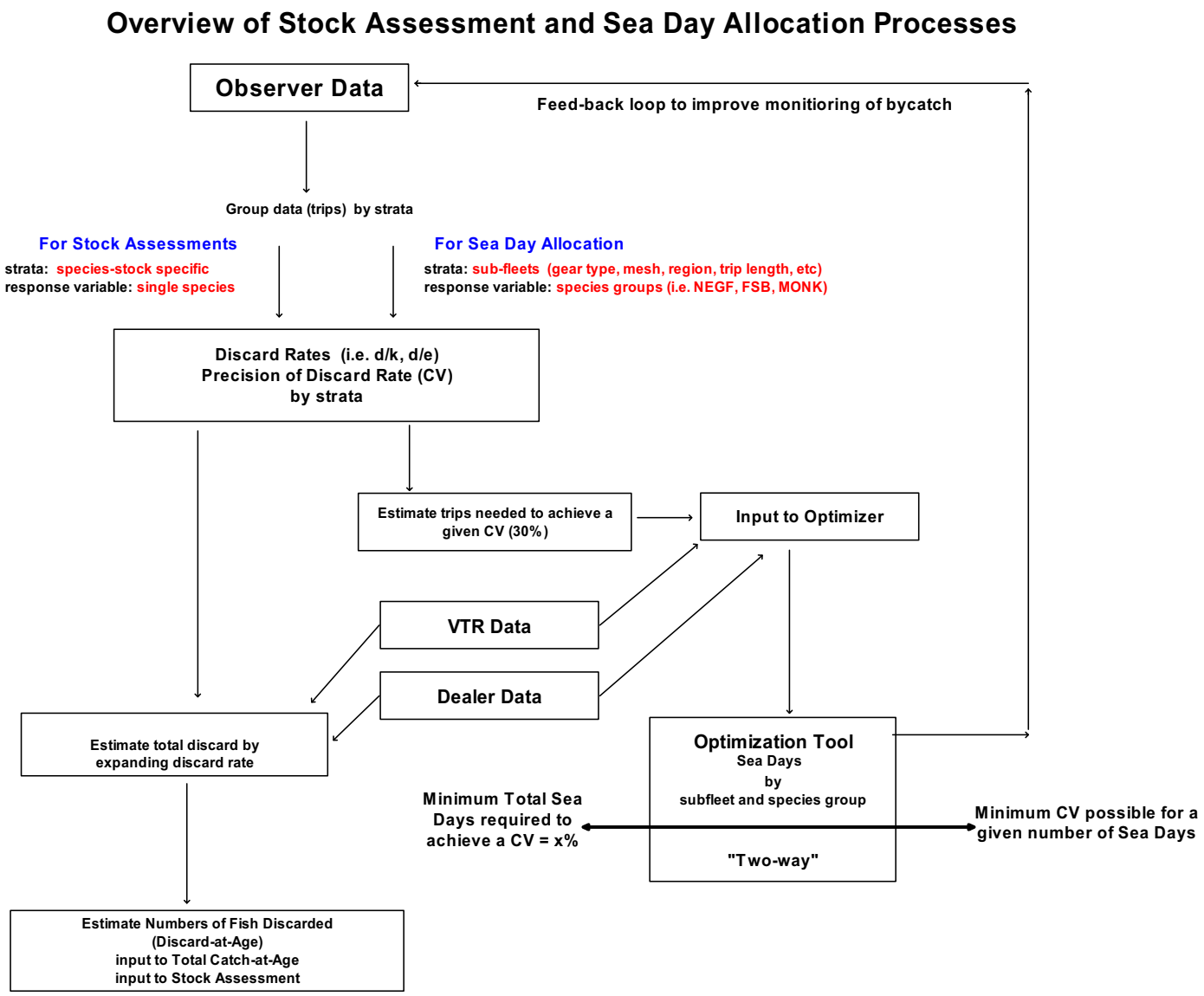


Figure 12. Overview of feed-back loop to improve monitoring of bycatch in the Northeast.

Appendix Table I. Precision (CV) of total discards, by species and fleet based on 2004 observer data.

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

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

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

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	NE MULTI-SPP (LARGE-MESH)	Cod	Had-dock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Window-pane	Halibut	Ocean pout	
Longline	all	all	NE	all	0.335	0.401	0.389	*	*	*	*	1.191	*	*	*	*	0.569	
Longline	all	all	MA	all														
Otter Trawl	all	all	NE	small	**0.233**	0.658	0.696	0.409	0.304	0.332	0.430	0.546	0.593	0.459	**0.291**	0.753	0.321	
Otter Trawl	all	all	NE	large	**0.101**	**0.176**	**0.265**	**0.222**	**0.254**	**0.145**	0.429	0.640	**0.248**	**0.235**	**0.206**	0.424	**0.161**	
Otter Trawl	all	all	MA	small	0.326	*	*	1.081	1.476	0.489	0.561	*	0.905	0.989	0.399	*	1.506	
Otter Trawl	all	all	MA	large	**0.251**	3.122	*	0.669	*	**0.292**	0.413	3.122	0.974	3.133	0.312	*	0.477	
Scallop Trawl	open	limited	MA	all	**0.000**	*	*	*	*	*	*	*	*	*	**0.000**	*	*	
Scallop Trawl	open	general	MA	all	**0.170**	*	*	1.036	*	0.471	0.464	*	*	0.640	**0.237**	*	*	
Shrimp Trawl	all	all	NE	all	**0.224**	0.352	0.659	0.552	0.305	0.928	**0.269**	0.473	0.374	**0.232**	**0.207**	*	0.960	
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	small	*	*	*	*	*	*	*	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	large	**0.092**	**0.121**	**0.186**	**0.198**	**0.281**	0.406	**0.288**	**0.182**	**0.261**	**0.231**	0.432	0.449	0.437	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	**0.159**	**0.175**	**0.246**	0.361	0.337	1.018	0.557	0.317	0.364	0.372	0.815	0.436	0.421	
Sink, Anchor, Drift Gillnet	all	all	MA	small	*	*	*	*	*	*	*	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	MA	large	0.868	*	*	*	*	*	*	*	*	*	0.868	*	*	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	*	*	*	*	*	*	*	*	*	*	*	*	*	
Scallop Dredge	open	limited	NE	all	0.480	0.850	0.848	0.637	0.848	0.485	1.022	0.848	*	0.525	0.454	*	0.656	
Scallop Dredge	open	limited	MA	all	**0.242**	*	*	0.705	0.809	0.496	0.581	*	*	0.521	0.323	*	1.091	
Scallop Dredge	open	general	NE	all	0.358	1.226	*	0.494	0.908	0.902	**0.213**	*	*	*	0.438	*	1.287	
Scallop Dredge	open	general	MA	all	0.311	*	*	0.865	0.857	0.650	0.421	*	*	0.653	0.333	*	*	
Scallop Dredge	closed	limited	NE	all	**0.137**	0.443	0.366	**0.181**	0.740	**0.249**	**0.177**	*	*	0.456	0.306	**0.160**	0.414	
Scallop Dredge	closed	limited	MA	all	0.631	*	*	1.044	**0.295**	0.356	1.053	*	*	0.624	0.726	*	1.023	
Scallop Dredge	closed	general	NE	all														
Scallop Dredge	closed	general	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*	
Mid-water paired & single Trawl	all	all	NE	all	0.669	1.198	0.951	*	1.155	1.203	1.298	0.967	0.996	1.604	*	*	*	
Mid-water paired & single Trawl	all	all	MA	all	0.742	*	*	*	*	1.166	*	*	*	0.542	*	*	*	
Fish Pots/ Traps	all	all	NE	all														
Fish Pots/ Traps	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	*	
Purse Seine	all	all	NE	all	0.973	*	*	*	*	*	*	*	0.973	*	*	*	*	
Purse Seine	all	all	MA	all														
Hand Line	all	all	NE	all	4.030	4.030	*	*	*	*	*	*	*	*	*	*	*	
Hand Line	all	all	MA	all														
Scottish Seine	all	all	NE	all	**0.289**	**0.279**	**0.279**	*	**0.279**	*	0.543	*	*	**0.279**	0.354	*	*	
Clam Quahog Dredge	all	all	NE	all														
Clam Quahog Dredge	all	all	MA	all														
Crab Pots	all	all	NE	all														
Crab Pots	all	all	MA	all														
Lobster Pots	all	all	NE	all														
Lobster Pots	all	all	MA	all														

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

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

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	NE MULTI-SPP (SMALL-MESH)	Silver hake	Offshore hake	Red hake	SKATE	DOGFISH	FLUKE/-SCUP/- BLK SEA BASS	Fluke	Scup	Black sea bass	SURF CLAM/- OCEAN QUAHOG	TILEFISH	
Longline	all	all	NE	all	0.910	*	*	0.910	0.614	0.654	*	*	*	*	*	*	
Longline	all	all	MA	all													
Otter Trawl	all	all	NE	small	**0.235**	**0.219**	1.511	0.406	0.691	0.322	0.309	**0.276**	0.551	0.708	1.028	0.304	
Otter Trawl	all	all	NE	large	**0.182**	**0.227**	0.322	0.353	**0.175**	**0.245**	0.319	0.328	0.918	0.833	1.512	0.529	
Otter Trawl	all	all	MA	small	0.508	0.625	0.683	0.587	**0.222**	0.367	0.386	**0.278**	0.560	0.502	0.464	1.155	
Otter Trawl	all	all	MA	large	0.827	0.451	*	1.811	**0.209**	0.557	**0.246**	**0.266**	0.354	0.652	0.609	*	
Scallop Trawl	open	limited	MA	all	*	*	*	*	**0.000**	*	**0.000**	**0.000**	*	**0.000**	*	*	
Scallop Trawl	open	general	MA	all	0.496	0.508	*	1.141	0.347	0.675	0.505	0.608	0.731	0.638	*	*	
Shrimp Trawl	all	all	NE	all	0.557	0.567	*	0.537	0.799	0.960	*	*	*	*	*	*	
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	small	*	*	*	*	*	**0.000**	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	large	**0.183**	**0.238**	*	**0.219**	**0.228**	**0.106**	0.845	0.898	*	1.602	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	0.624	**0.207**	*	0.864	**0.117**	**0.162**	**0.233**	**0.233**	0.904	*	*	**0.256**	
Sink, Anchor, Drift Gillnet	all	all	MA	small	*	*	*	*	*	**0.000**	**0.000**	**0.000**	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	MA	large	*	*	*	*	1.118	1.083	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	*	*	*	*	**0.115**	**0.129**	0.303	0.303	*	*	*	*	
Scallop Dredge	open	limited	NE	all	0.414	0.764	1.173	0.352	**0.236**	0.515	0.458	0.474	0.322	0.622	0.391	*	
Scallop Dredge	open	limited	MA	all	0.758	0.856	0.738	0.402	**0.126**	**0.230**	**0.259**	**0.272**	0.704	0.558	0.771	*	
Scallop Dredge	open	general	NE	all	**0.104**	1.300	*	**0.103**	**0.177**	0.318	**0.092**	**0.092**	*	*	1.287	*	
Scallop Dredge	open	general	MA	all	0.482	0.467	*	0.857	**0.202**	0.550	0.461	0.461	*	*	0.830	*	
Scallop Dredge	closed	limited	NE	all	0.374	0.390	0.649	0.421	**0.134**	0.349	0.344	0.345	0.450	**0.160**	0.412	*	
Scallop Dredge	closed	limited	MA	all	**0.264**	0.321	*	**0.277**	**0.135**	0.364	0.311	0.312	0.921	0.365	**0.295**	*	
Scallop Dredge	closed	general	NE	all													
Scallop Dredge	closed	general	MA	all	*	*	*	*	**0.000**	*	**0.000**	**0.000**	*	*	*	*	
Mid-water paired & single Trawl	all	all	NE	all	0.994	1.000	*	0.748	1.177	0.418	0.628	*	0.671	1.626	*	*	
Mid-water paired & single Trawl	all	all	MA	all	0.539	0.539	*	0.539	*	**0.246**	1.172	1.164	*	1.176	*	*	
Fish Pots/ Traps	all	all	NE	all													
Fish Pots/ Traps	all	all	MA	all	*	*	*	*	*	*	**0.161**	*	**0.163**	**0.161**	*	*	
Purse Seine	all	all	NE	all	*	*	*	*	*	0.972	*	*	*	*	*	*	
Purse Seine	all	all	MA	all													
Hand Line	all	all	NE	all	*	*	*	*	*	*	*	*	*	*	*	*	
Hand Line	all	all	MA	all													
Scottish Seine	all	all	NE	all	**0.279**	**0.279**	*	**0.279**	0.319	*	**0.253**	**0.259**	0.808	0.808	*	*	
Clam Quahog Dredge	all	all	NE	all													
Clam Quahog Dredge	all	all	MA	all													
Crab Pots	all	all	NE	all													
Crab Pots	all	all	MA	all													
Lobster Pots	all	all	NE	all													
Lobster Pots	all	all	MA	all													

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

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

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

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

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

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

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

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.* Ranking of total discards **within fleet** (fish and protected species ranked separately) based on 2004 observer data.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	Cod	Had-dock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Window-pane	Halibut	Ocean pout	
Longline	all	all	NE	all	2	4	8	8	8	8	6	8	8	8	8	5	
Longline	all	all	MA	all													
Otter Trawl	all	all	NE	small	18	13	22	20	14	15	28	24	17	26	30	21	
Otter Trawl	all	all	NE	large	8	10	7	9	5	14	16	13	18	4	21	11	
Otter Trawl	all	all	MA	small	28	28	24	25	17	16	28	21	23	12	28	19	
Otter Trawl	all	all	MA	large	22	26	17	26	9	10	19	25	23	7	26	11	
Scallop Trawl	open	limited	MA	all	8	8	8	8	8	8	8	8	8	3	8	8	
Scallop Trawl	open	general	MA	all	20	20	18	20	17	8	20	20	13	5	20	20	
Shrimp Trawl	all	all	NE	all	8	15	7	3	13	5	6	12	11	9	20	16	
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	small	3	3	3	3	3	3	3	3	3	3	3	3	
Sink, Anchor, Drift Gillnet	all	all	NE	large	2	10	5	13	21	7	4	11	6	20	18	17	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	4	13	10	20	26	15	7	22	9	25	17	12	
Sink, Anchor, Drift Gillnet	all	all	MA	small	4	4	4	4	4	4	4	4	4	4	4	4	
Sink, Anchor, Drift Gillnet	all	all	MA	large	5	5	5	5	5	5	5	5	5	4	5	5	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	7	7	7	7	7	7	7	7	7	7	7	7	
Scallop Dredge	open	limited	NE	all	19	22	11	23	7	6	25	26	20	10	26	15	
Scallop Dredge	open	limited	MA	all	24	24	16	21	8	15	24	24	10	6	24	17	
Scallop Dredge	open	general	NE	all	13	17	4	12	10	5	17	17	17	8	17	14	
Scallop Dredge	open	general	MA	all	16	16	13	13	11	6	16	16	10	4	16	16	
Scallop Dredge	closed	limited	NE	all	15	14	4	10	11	9	29	29	16	6	26	21	
Scallop Dredge	closed	limited	MA	all	25	25	6	18	7	11	25	25	16	8	25	22	
Scallop Dredge	closed	general	NE	all													
Scallop Dredge	closed	general	MA	all	5	5	5	5	5	5	5	5	5	5	5	5	
Mid-water paired & single Trawl	all	all	NE	all	16	6	23	13	18	19	8	5	14	23	23	23	
Mid-water paired & single Trawl	all	all	MA	all	15	15	15	15	13	15	15	15	12	15	15	15	
Fish Pots/ Traps	all	all	NE	all													
Fish Pots/ Traps	all	all	MA	all	4	4	4	4	4	4	4	4	4	4	4	4	
Purse Seine	all	all	NE	all	5	5	5	5	5	5	5	3	5	5	5	5	
Purse Seine	all	all	MA	all													
Hand Line	all	all	NE	all	1	2	2	2	2	2	2	2	2	2	2	2	
Hand Line	all	all	MA	all													
Scottish Seine	all	all	NE	all	7	11	13	8	13	9	13	13	11	2	13	13	
Clam Quahog Dredge	all	all	NE	all													
Clam Quahog Dredge	all	all	MA	all													
Crab Pots	all	all	NE	all													
Crab Pots	all	all	MA	all													
Lobster Pots	all	all	NE	all													
Lobster Pots	all	all	MA	all													

Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Appendix Table II *continued*. Ranking of total discards **within fleet** (fish and protected species ranked separately) based on 2004 observer data.

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

Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Appendix Table II *continued*. Ranking of total discards **within fleet** (fish and protected species ranked separately) based on 2004 observer data.

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

Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Appendix Table II *continued.* Ranking of total discards **within fleet** (fish and protected species ranked separately) based on 2004 observer data.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	WHALE, PILOT, LONG-FIN	WHALE, MINKE	WHALE, NK	DOLPHIN WHITE-SIDED	DOLPHIN-COMMON	DOLPHIN-BOTTLE-NOSE	PORPOISE, HARBOR	PORPOISE/DOLPHIN, NK	SEA BIRDS (ALL)	PILOT coverage
Longline	all	all	NE	all	2	*	*	2	2	2	2	*	1	
Longline	all	all	MA	all	*	*	*	*	*	*	*	*	*	pilot
Otter Trawl	all	all	NE	small	3	*	*	3	1	5	5	*	2	
Otter Trawl	all	all	NE	large	3	*	*	1	4	4	4	*	2	
Otter Trawl	all	all	MA	small	4	*	*	4	1	4	4	*	3	
Otter Trawl	all	all	MA	large	2	*	*	2	2	2	2	*	1	
Scallop Trawl	open	limited	MA	all	2	*	*	2	2	2	2	*	2	pilot
Scallop Trawl	open	general	MA	all	*	*	*	*	*	*	*	*	*	pilot
Shrimp Trawl	all	all	NE	all	*	*	*	*	*	*	*	*	*	
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	small	*	*	*	*	*	*	*	*	*	pilot
Sink, Anchor, Drift Gillnet	all	all	NE	large	7	*	*	6	7	7	5	*	1	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	8	*	*	8	8	6	2	*	5	
Sink, Anchor, Drift Gillnet	all	all	MA	small	4	*	*	4	4	4	4	*	1	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	large	4	*	*	4	4	4	4	*	1	pilot for fish
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	7	*	*	7	7	7	1	*	3	pilot for fish
Scallop Dredge	open	limited	NE	all	3	*	*	3	3	3	3	*	2	
Scallop Dredge	open	limited	MA	all	2	*	*	2	2	2	2	*	2	
Scallop Dredge	open	general	NE	all	*	*	*	*	*	*	*	*	*	pilot
Scallop Dredge	open	general	MA	all	*	*	*	*	*	*	*	*	*	
Scallop Dredge	closed	limited	NE	all	3	*	*	3	3	3	3	*	1	
Scallop Dredge	closed	limited	MA	all	*	*	*	*	*	*	*	*	*	
Scallop Dredge	closed	general	NE	all										pilot
Scallop Dredge	closed	general	MA	all	*	*	*	*	*	*	*	*	*	pilot
Mid-water paired & single Trawl	all	all	NE	all	3	*	*	2	4	4	4	*	1	
Mid-water paired & single Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	
Fish Pots/ Traps	all	all	NE	all										pilot
Fish Pots/ Traps	all	all	MA	all	*	*	*	*	*	*	*	*	*	pilot
Purse Seine	all	all	NE	all	*	*	*	*	*	*	*	*	*	
Purse Seine	all	all	MA	all	*	*	*	*	*	*	*	*	*	pilot
Hand Line	all	all	NE	all	*	*	*	*	*	*	*	*	*	pilot
Hand Line	all	all	MA	all	*	*	*	*	*	*	*	*	*	pilot
Scottish Seine	all	all	NE	all	*	*	*	*	*	*	*	*	*	pilot
Clam Quahog Dredge	all	all	NE	all										pilot
Clam Quahog Dredge	all	all	MA	all										pilot
Crab Pots	all	all	NE	all										pilot
Crab Pots	all	all	MA	all										pilot
Lobster Pots	all	all	NE	all	*	*	*	*	*	*	*	*	*	pilot
Lobster Pots	all	all	MA	all										pilot

Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

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.* Ranking of total discards **within species group** (fish and protected species ranked separately) based on 2004 observer data.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	Cod	Had-dock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Window-pane	Halibut	Ocean pout	
Longline	all	all	NE	all	3	3	15	15	17	17	8	10	17	18	6	5	
Longline	all	all	MA	all													
Otter Trawl	all	all	NE	small	5	1	3	2	2	1	4	2	1	10	3	2	
Otter Trawl	all	all	NE	large	1	2	1	1	1	2	1	1	2	1	1	1	
Otter Trawl	all	all	MA	small	14	11	12	10	6	4	10	5	7	4	6	6	
Otter Trawl	all	all	MA	large	10	11	9	15	4	5	7	9	13	3	6	3	
Scallop Trawl	open	limited	MA	all	14	11	15	15	17	17	10	10	17	2	6	14	
Scallop Trawl	open	general	MA	all	14	11	14	15	14	13	10	10	12	11	6	14	
Shrimp Trawl	all	all	NE	all	7	8	7	3	10	7	5	6	6	14	6	10	
Shrimp Trawl	all	all	MA	all	*	*	*	*	*	*	*	*	*	*	*	*	
Sink, Anchor, Drift Gillnet	all	all	NE	small	14	11	15	15	17	17	10	10	17	18	6	14	
Sink, Anchor, Drift Gillnet	all	all	NE	large	2	5	4	5	12	10	2	4	4	16	4	8	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	4	6	8	8	16	12	3	8	5	17	2	7	
Sink, Anchor, Drift Gillnet	all	all	MA	small	14	11	15	15	17	17	10	10	17	18	6	14	
Sink, Anchor, Drift Gillnet	all	all	MA	large	14	11	15	15	17	17	10	10	17	6	6	14	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	14	11	15	15	17	17	10	10	17	18	6	14	
Scallop Dredge	open	limited	NE	all	8	9	5	13	3	3	9	10	9	9	6	4	
Scallop Dredge	open	limited	MA	all	14	11	11	12	5	11	10	10	3	5	6	9	
Scallop Dredge	open	general	NE	all	13	11	6	7	9	8	10	10	17	12	6	11	
Scallop Dredge	open	general	MA	all	14	11	13	11	11	9	10	10	10	8	6	14	
Scallop Dredge	closed	limited	NE	all	9	7	2	4	7	6	10	10	11	7	5	12	
Scallop Dredge	closed	limited	MA	all	14	11	10	14	8	14	10	10	14	15	6	13	
Scallop Dredge	closed	general	NE	all													
Scallop Dredge	closed	general	MA	all	14	11	15	15	17	17	10	10	17	18	6	14	
Mid-water paired & single Trawl	all	all	NE	all	11	4	15	6	13	16	6	3	8	18	6	14	
Mid-water paired & single Trawl	all	all	MA	all	14	11	15	15	15	17	10	10	15	18	6	14	
Fish Pots/ Traps	all	all	NE	all													
Fish Pots/ Traps	all	all	MA	all	14	11	15	15	17	17	10	10	17	18	6	14	
Purse Seine	all	all	NE	all	14	11	15	15	17	17	10	7	17	18	6	14	
Purse Seine	all	all	MA	all													
Hand Line	all	all	NE	all	6	11	15	15	17	17	10	10	17	18	6	14	
Hand Line	all	all	MA	all													
Scottish Seine	all	all	NE	all	12	10	15	9	17	15	10	10	16	13	6	14	
Clam Quahog Dredge	all	all	NE	all													
Clam Quahog Dredge	all	all	MA	all													
Crab Pots	all	all	NE	all													
Crab Pots	all	all	MA	all													
Lobster Pots	all	all	NE	all													
Lobster Pots	all	all	MA	all													

Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Appendix Table III *continued*. Ranking of total discards **within species group**(fish and protected species ranked separately) based on 2004 observer data.

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

Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Appendix Table III *continued*. Ranking of total discards **within species group**(fish and protected species ranked separately) based on 2004 observer data.

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

Gray-shaded cells indicate unlikely combinations of species/gear; * indicate no discards of these species.

Appendix Table III *continued*. Ranking of total discards **within species group** (fish and protected species ranked separately) based on 2004 observer data.

Gear Type	Access Area (Open-Closed)	Trip Category (General/ Limited)	Region	mesh groups	WHALE, PILOT, LONG-FIN	WHALE, MINKE	WHALE, NK	DOLPHIN WHITE-SIDED	DOLPHIN-COMMON	DOLPHIN-BOTTLE-NOSE	PORPOISE, HARBOR	PORPOISE/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% CV.

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

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

Appendix Table IV *continued*. Number of sea days needed to achieve a 30% CV.

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

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

Appendix Table IV *continued*. Number of sea days needed to achieve a 30% CV.

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

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

Appendix Table IV *continued*. Number of sea days needed to achieve a 30% CV.

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

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

Appendix Table IV *continued*. Number of sea days needed to achieve a 30% CV.

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

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

Appendix Table V. Number of trips needed to achieve a 30% CV.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	BLUEFISH	HERRING	SALMON	RED CRAB	SCALLOP	MACK-/SQUID-/BUTTERFISH	Mackerel	Illex	Loligo	Butterfish	MONKFISH	
Longline	all	all	NE	all	26	26	26	26	26	26	26	26	26	26	26	
Longline	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	
Otter Trawl	all	all	NE	small	677	615	70	900	859	217	496	343	523	387	268	
Otter Trawl	all	all	NE	large	1917	1671	304	1378	1269	483	1319	1344	999	1240	151	
Otter Trawl	all	all	MA	small	706	664	104	392	877	749	1126	1072	1127	766	595	
Otter Trawl	all	all	MA	large	249	305	177	177	384	294	214	279	364	396	203	
Scallop Trawl	open	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12	
Scallop Trawl	open	general	MA	all	73	25	25	201	58	87	25	136	97	133	56	
Shrimp Trawl	all	all	NE	all	42	101	42	42	388	400	42	42	42	400	25	
Shrimp Trawl	all	all	MA	all	13	13	13	13	13	13	13	13	13	13	13	
Sink, Anchor, Drift Gillnet	all	all	NE	small	12	12	12	12	12	12	12	12	12	12	12	
Sink, Anchor, Drift Gillnet	all	all	NE	large	1160	634	104	2503	365	1875	1448	620	104	1751	1040	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	479	937	94	1043	1122	1809	1810	94	94	587	324	
Sink, Anchor, Drift Gillnet	all	all	MA	small	58	58	58	58	58	58	58	58	58	58	58	
Sink, Anchor, Drift Gillnet	all	all	MA	large	101	27	27	27	27	27	27	27	27	27	27	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	96	51	51	51	216	51	51	51	51	51	77	
Scallop Dredge	open	limited	NE	all	25	25	25	98	68	141	25	140	144	79	52	
Scallop Dredge	open	limited	MA	all	36	36	36	98	65	134	98	244	217	219	53	
Scallop Dredge	open	general	NE	all	71	71	71	71	150	131	71	131	71	71	90	
Scallop Dredge	open	general	MA	all	69	69	69	69	183	184	69	69	184	69	46	
Scallop Dredge	closed	limited	NE	all	182	326	15	405	49	147	292	378	246	420	48	
Scallop Dredge	closed	limited	MA	all	42	167	12	143	47	71	166	169	120	171	15	
Scallop Dredge	closed	general	NE	all	12	12	12	12	12	12	12	12	12	12	12	
Scallop Dredge	closed	general	MA	all	15	15	15	15	15	15	15	15	15	15	15	
Mid-water paired & single Trawl	all	all	NE	all	166	244	21	21	160	305	271	325	157	367	199	
Mid-water paired & single Trawl	all	all	MA	all	20	86	12	12	12	14	50	16	10	15	118	
Fish Pots/ Traps	all	all	NE	all	19	19	19	19	19	19	19	19	19	19	19	
Fish Pots/ Traps	all	all	MA	all	37	37	37	37	37	37	37	37	37	37	98	
Purse Seine	all	all	NE	all	10	85	10	10	10	79	10	79	10	10	10	
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9	
Hand Line	all	all	NE	all	68	68	68	68	68	68	68	68	68	68	68	
Hand Line	all	all	MA	all	126	126	126	126	126	126	126	126	126	126	126	
Scottish Seine	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12	
Clam Quahog Dredge	all	all	NE	all	69	69	69	69	69	69	69	69	69	69	69	
Clam Quahog Dredge	all	all	MA	all	69	69	69	69	69	69	69	69	69	69	69	
Crab Pots	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12	
Crab Pots	all	all	MA	all	27	27	27	27	27	27	27	27	27	27	27	
Lobster Pots	all	all	NE	all	353	353	353	353	353	353	353	353	353	353	353	
Lobster Pots	all	all	MA	all	75	75	75	75	75	75	75	75	75	75	75	
Total Trips					7,160	7,175	2,306	8,679	7,348	8,236	8,648	6,597	5,624	8,196	4,495	
Total Trips excluding shaded cells					5,826	5,580	2,306	3,386	4,200	7,000	7,551	4,571	4,059	4,785	3,699	

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

Appendix Table V *continued*. Number of trips needed to achieve a 30% CV.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	NE MULTI-SPP (LARGE-MESH)	Cod	Had-dock	Yellowtail fld	American plaice	Witch fld	Winter fld	Pollock	Redfish	White hake	Window-pane	Halibut	Ocean pout	
Longline	all	all	NE	all	54	71	41	26	26	26	26	75	26	26	26	26	100	
Longline	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	12	12	
Otter Trawl	all	all	NE	small	288	461	886	564	390	445	359	939	600	791	464	627	659	
Otter Trawl	all	all	NE	large	168	562	662	774	334	331	514	2917	517	708	579	960	293	
Otter Trawl	all	all	MA	small	399	104	104	875	394	815	667	104	663	1468	566	104	689	
Otter Trawl	all	all	MA	large	182	398	177	590	177	348	336	398	382	416	325	177	401	
Scallop Trawl	open	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12	12	12	
Scallop Trawl	open	general	MA	all	43	25	25	251	25	129	213	25	25	201	83	25	25	
Shrimp Trawl	all	all	NE	all	22	55	188	133	41	360	32	98	62	24	19	42	384	
Shrimp Trawl	all	all	MA	all	13	13	13	13	13	13	13	13	13	13	13	13	13	
Sink, Anchor, Drift Gillnet	all	all	NE	small	12	12	12	12	12	12	12	12	12	12	12	12	12	
Sink, Anchor, Drift Gillnet	all	all	NE	large	246	422	632	814	658	1162	984	786	1628	1586	1699	2166	1796	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	356	447	747	1556	884	1059	1865	1170	594	1343	1656	1699	797	
Sink, Anchor, Drift Gillnet	all	all	MA	small	58	58	58	58	58	58	58	58	58	58	58	58	58	
Sink, Anchor, Drift Gillnet	all	all	MA	large	17	27	27	27	27	27	27	27	27	27	17	27	27	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	51	51	51	51	51	51	51	51	51	51	51	51	51	
Scallop Dredge	open	limited	NE	all	109	139	103	185	103	147	128	103	25	125	130	25	205	
Scallop Dredge	open	limited	MA	all	130	36	36	221	381	259	351	36	36	352	192	36	310	
Scallop Dredge	open	general	NE	all	64	92	71	67	84	110	71	71	71	71	70	71	141	
Scallop Dredge	open	general	MA	all	139	69	69	184	179	122	67	69	69	123	143	69	69	
Scallop Dredge	closed	limited	NE	all	41	83	64	537	359	62	448	15	15	385	267	105	477	
Scallop Dredge	closed	limited	MA	all	55	12	12	326	118	51	45	12	12	246	316	12	44	
Scallop Dredge	closed	general	NE	all	12	12	12	12	12	12	12	12	12	12	12	12	12	
Scallop Dredge	closed	general	MA	all	15	15	15	15	15	15	15	15	15	15	15	15	15	
Mid-water paired & single Trawl	all	all	NE	all	254	279	195	21	270	302	142	337	214	290	21	21	21	
Mid-water paired & single Trawl	all	all	MA	all	132	12	12	12	12	113	12	12	12	50	12	12	12	
Fish Pots/ Traps	all	all	NE	all	19	19	19	19	19	19	19	19	19	19	19	19	19	
Fish Pots/ Traps	all	all	MA	all	37	37	37	37	37	37	37	37	37	37	37	37	37	
Purse Seine	all	all	NE	all	82	10	10	10	10	10	10	10	82	10	10	10	10	
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9	9	9	
Hand Line	all	all	NE	all	130	130	68	68	68	68	68	68	68	68	68	68	68	
Hand Line	all	all	MA	all	126	126	126	126	126	126	126	126	126	126	126	126	126	
Scottish Seine	all	all	NE	all	14	12	12	12	12	12	19	12	12	12	15	12	12	
Clam Quahog Dredge	all	all	NE	all	69	69	69	69	69	69	69	69	69	69	69	69	69	
Clam Quahog Dredge	all	all	MA	all	69	69	69	69	69	69	69	69	69	69	69	69	69	
Crab Pots	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12	12	12	
Crab Pots	all	all	MA	all	27	27	27	27	27	27	27	27	27	27	27	27	27	
Lobster Pots	all	all	NE	all	353	353	353	353	353	353	353	353	353	353	353	353	353	
Lobster Pots	all	all	MA	all	75	75	75	75	75	75	75	75	75	75	75	75	75	
Total Trips					3,908	4,428	5,122	8,235	5,535	6,941	7,366	8,266	6,123	9,305	7,660	7,277	7,521	
Total Trips excluding shaded cells					3,731	3,999	3,757	7,281	3,181	5,442	6,644	6,455	3,856	7,442	6,767	5,788	6,965	

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

Appendix Table V *continued.* Number of trips needed to achieve a 30% CV.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	NE MULTI-SPP (SMALL-MESH)	Silver hake	Offshore hake	Red hake	SKATE	DOGFISH	FLUKE/-SCUP/-BLK SEA BASS	Fluke	Scup	Black sea bass	SURF CLAM/-OCEAN QUAHOG	TILEFISH	
Longline	all	all	NE	all	47	26	26	47	84	187	26	26	26	26	26	26	
Longline	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	12	
Otter Trawl	all	all	NE	small	317	332	779	756	391	371	453	326	734	754	608	565	
Otter Trawl	all	all	NE	large	343	537	1696	965	296	355	1050	1168	1847	2063	2231	897	
Otter Trawl	all	all	MA	small	556	779	504	805	326	513	424	374	672	825	1364	287	
Otter Trawl	all	all	MA	large	342	364	177	323	110	272	158	164	437	372	488	177	
Scallop Trawl	open	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12	12	
Scallop Trawl	open	general	MA	all	147	149	25	73	40	222	206	36	49	200	25	25	
Shrimp Trawl	all	all	NE	all	136	141	42	126	272	384	42	42	42	42	42	42	
Shrimp Trawl	all	all	MA	all	13	13	13	13	13	13	13	13	13	13	13	13	
Sink, Anchor, Drift Gillnet	all	all	NE	small	12	12	12	12	12	12	12	12	12	12	12	12	
Sink, Anchor, Drift Gillnet	all	all	NE	large	914	1082	104	1254	673	375	1736	1768	104	602	104	104	
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	1497	950	94	1460	197	314	1052	1052	583	94	94	263	
Sink, Anchor, Drift Gillnet	all	all	MA	small	58	58	58	58	58	58	58	58	58	58	58	58	
Sink, Anchor, Drift Gillnet	all	all	MA	large	27	27	27	27	95	91	27	27	27	27	27	27	
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	51	51	51	51	43	45	89	89	51	51	51	51	
Scallop Dredge	open	limited	NE	all	92	127	190	106	25	111	96	103	111	143	138	25	
Scallop Dredge	open	limited	MA	all	347	386	319	309	35	283	67	116	263	135	288	36	
Scallop Dredge	open	general	NE	all	102	150	71	111	92	92	71	71	71	71	141	71	
Scallop Dredge	open	general	MA	all	82	79	69	179	55	94	180	180	69	69	162	69	
Scallop Dredge	closed	limited	NE	all	139	169	301	168	21	291	123	154	492	274	458	15	
Scallop Dredge	closed	limited	MA	all	92	179	12	87	32	170	95	110	73	175	258	12	
Scallop Dredge	closed	general	NE	all	12	12	12	12	12	12	12	12	12	12	12	12	
Scallop Dredge	closed	general	MA	all	15	15	15	15	15	15	15	15	15	15	15	15	
Mid-water paired & single Trawl	all	all	NE	all	350	351	21	207	298	114	198	21	56	163	21	21	
Mid-water paired & single Trawl	all	all	MA	all	25	25	12	20	12	18	113	113	12	105	12	12	
Fish Pots/ Traps	all	all	NE	all	19	19	19	19	19	19	19	19	19	19	19	19	
Fish Pots/ Traps	all	all	MA	all	37	37	37	37	37	37	37	37	69	37	37	37	
Purse Seine	all	all	NE	all	10	10	10	10	10	87	10	10	10	10	10	10	
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9	9	
Hand Line	all	all	NE	all	68	68	68	68	68	68	68	68	68	68	68	68	
Hand Line	all	all	MA	all	126	126	126	126	126	126	126	126	126	126	126	126	
Scottish Seine	all	all	NE	all	12	12	12	12	12	12	30	30	30	30	12	12	
Clam Quahog Dredge	all	all	NE	all	69	69	69	69	69	69	69	69	69	69	69	69	
Clam Quahog Dredge	all	all	MA	all	69	69	69	69	69	69	69	69	69	69	69	69	
Crab Pots	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12	12	
Crab Pots	all	all	MA	all	27	27	27	27	27	27	27	27	27	27	27	27	
Lobster Pots	all	all	NE	all	353	353	353	353	353	353	353	353	353	353	353	353	
Lobster Pots	all	all	MA	all	75	75	75	75	75	75	75	75	75	75	75	75	
Total Trips					6,626	6,924	5,540	8,099	4,117	5,400	7,245	6,979	6,789	7,231	7,559	3,746	
Total Trips excluding shaded cells					5,679	5,951	2,550	7,066	3,008	4,216	6,113	6,023	3,958	4,403	139	2,021	

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

Appendix Table V *continued.* Number of trips needed to achieve a 30% CV.

Gear Type	Access Area (Open-Closed)	Trip Category (General/Limited)	Region	mesh groups	TURTLES	TURTLE, GREEN	TURTLE, LEATHERBACK	TURTLE, LOGGERHEAD	TURTLE, KEMP'S RIDLEY	TURTLE, NK	SEALS	SEAL, HARP	SEAL, HOODED	SEAL, HARBOR	SEAL, GRAY	SEAL, NK
Longline	all	all	NE	all	26	26	26	26	26	26	26	26	26	26	26	26
Longline	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	12
Otter Trawl	all	all	NE	small	70	70	70	70	70	70	70	70	70	70	70	70
Otter Trawl	all	all	NE	large	304	304	304	304	304	304	304	304	304	304	304	304
Otter Trawl	all	all	MA	small	901	104	104	901	104	104	104	104	104	104	104	104
Otter Trawl	all	all	MA	large	177	177	177	177	177	177	177	177	177	177	177	177
Scallop Trawl	open	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12	12
Scallop Trawl	open	general	MA	all	25	25	25	25	25	25	25	25	25	25	25	25
Shrimp Trawl	all	all	NE	all	42	42	42	42	42	42	42	42	42	42	42	42
Shrimp Trawl	all	all	MA	all	13	13	13	13	13	13	13	13	13	13	13	13
Sink, Anchor, Drift Gillnet	all	all	NE	small	12	12	12	12	12	12	12	12	12	12	12	12
Sink, Anchor, Drift Gillnet	all	all	NE	large	104	104	104	104	104	104	844	293	104	1212	2088	104
Sink, Anchor, Drift Gillnet	all	all	NE	xlg	94	94	94	94	94	94	995	180	689	1281	1124	94
Sink, Anchor, Drift Gillnet	all	all	MA	small	977	58	548	58	58	487	58	58	58	58	58	58
Sink, Anchor, Drift Gillnet	all	all	MA	large	105	141	27	140	27	27	27	27	27	27	27	27
Sink, Anchor, Drift Gillnet	all	all	MA	xlg	519	51	302	268	51	51	793	51	51	427	418	51
Scallop Dredge	open	limited	NE	all	206	25	25	206	25	25	25	25	25	25	25	25
Scallop Dredge	open	limited	MA	all	378	36	36	378	36	36	36	36	36	36	36	36
Scallop Dredge	open	general	NE	all	71	71	71	71	71	71	71	71	71	71	71	71
Scallop Dredge	open	general	MA	all	69	69	69	69	69	69	69	69	69	69	69	69
Scallop Dredge	closed	limited	NE	all	243	15	15	243	15	15	15	15	15	15	15	15
Scallop Dredge	closed	limited	MA	all	12	12	12	12	12	12	12	12	12	12	12	12
Scallop Dredge	closed	general	NE	all	12	12	12	12	12	12	12	12	12	12	12	12
Scallop Dredge	closed	general	MA	all	15	15	15	15	15	15	15	15	15	15	15	15
Mid-water paired & single Trawl	all	all	NE	all	21	21	21	21	21	21	21	21	21	21	21	21
Mid-water paired & single Trawl	all	all	MA	all	12	12	12	12	12	12	12	12	12	12	12	12
Fish Pots/ Traps	all	all	NE	all	19	19	19	19	19	19	19	19	19	19	19	19
Fish Pots/ Traps	all	all	MA	all	37	37	37	37	37	37	37	37	37	37	37	37
Purse Seine	all	all	NE	all	10	10	10	10	10	10	10	10	10	10	10	10
Purse Seine	all	all	MA	all	9	9	9	9	9	9	9	9	9	9	9	9
Hand Line	all	all	NE	all	68	68	68	68	68	68	68	68	68	68	68	68
Hand Line	all	all	MA	all	126	126	126	126	126	126	126	126	126	126	126	126
Scottish Seine	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12	12
Clam Quahog Dredge	all	all	NE	all	69	69	69	69	69	69	69	69	69	69	69	69
Clam Quahog Dredge	all	all	MA	all	69	69	69	69	69	69	69	69	69	69	69	69
Crab Pots	all	all	NE	all	12	12	12	12	12	12	12	12	12	12	12	12
Crab Pots	all	all	MA	all	27	27	27	27	27	27	27	27	27	27	27	27
Lobster Pots	all	all	NE	all	353	353	353	353	353	353	353	353	353	353	353	353
Lobster Pots	all	all	MA	all	75	75	75	75	75	75	75	75	75	75	75	75
Total Trips					5,318	2,420	3,046	4,185	2,306	2,735	4,689	2,581	2,901	4,977	5,686	2,306
Total Trips excluding shaded cells					5,318	1,391	2,673	4,185	1,933	2,735	4,352	2,244	1,772	4,358	5,067	1,969

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

Appendix Table V *continued.* Number of trips needed to achieve a 30% CV.

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

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

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