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# A Brief Description of Northeast Region Fish and Invertebrate Discard Estimation for the 2013 Update to the National Bycatch Report

by J. Blaylock, S.E. Wigley, P.J. Rago, M. Mood, and M.C. Palmer

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<sup>1</sup> Integrated Statistics, 16 Sumner St., Woods Hole, MA 02543, USA

<sup>2</sup> National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA 02543, USA

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## LIST OF ACRONYMS AND ABBREVIATIONS

AA = access area  
B = B-day program  
CV = coefficient of variation  
d/k = discard/kept  
GEN = general  
HOOK = haddock longline hook sector  
lg = large  
LIM = limited  
MA = Mid-Atlantic  
NBR = National Bycatch Report  
NE = New England  
NEFOP = Northeast Fisheries Observer Program  
NEFSC = Northeast Fisheries Science Center  
NMFS = National Marine Fisheries Service  
OPEN = non-access area  
sm = small  
USCAN = US/Canada Resource Sharing Area  
VMS = Vessel Monitoring System  
VTR = Vessel Trip Report  
xlg = extra large

## **EXECUTIVE SUMMARY**

This report describes the discard estimation analysis performed for the 2013 Update to the National Bycatch Report. Estimates of discards that occurred during the January to December 2010 period in all federally managed fisheries in the northeast United States were derived for 34 species of finfish and invertebrates using a combined discard-to-kept ratio estimator. Based on this analysis, approximately 64,557 mt (live weight) of discards occurred across the 34 species and 29 fleets considered. The predominant species groups discarded were skates, Atlantic sea scallops and dogfish. The discards reported in this document may not necessarily correspond directly with the discard estimates derived for individual stock assessments due to differences in stratification and data.

# INTRODUCTION

In 2011, the National Marine Fisheries Service (NMFS) published the First Edition of the National Bycatch Report (NBR; Wigley et al. 2008, NMFS 2011), which summarizes estimates of discards, by species, that occurred in 2005 in all federally managed fisheries in the United States. New comprehensive editions of the NBR are scheduled to occur every six years, with online updates produced on a biennial basis, starting in 2013. This document describes the methods used to estimate the 2010 discards of finfish and invertebrates in fisheries of the Northeast region that will be included in the 2013 Update to the NBR. The Northeast regional analysis involved 34 species and 63 fleets (Tables 1 and 2). The analysis did not consider stock components and only included fleets with sufficient data to derive discard estimates.

The discard estimation process used a stratification approach broad enough to encompass all species, and employed a combined ratio method using a discard-to-kept weight ratio. The discard estimates reported in this document will not necessarily correspond directly with those contained in individual stock assessments due to differences in stratification and data. However, the various estimates should be of the same order of magnitude.

## METHODS

### Data Sources and Stratification

The data used include January through December 2010 data from the Northeast Fisheries Observer Program (NEFOP) database, the Vessel Trip Report (VTR; including logbooks from the surfclam and ocean quahog fishery) database, the Vessel Monitoring System (VMS) and the Northeast Fisheries Science Center (NEFSC) commercial landings (i.e., Dealer) database.

#### *Northeast Fisheries Observer Program (NEFOP)*

The NEFOP is a comprehensive multi-purpose program that collects a broad range of data on all species that are encountered during a fishing trip as well as gear characteristics data, economic information, and biological samples (NEFOP 2010; NEFOP 2011). The NEFOP employs trained sea-going observers and monitors to collect these data<sup>1</sup> that also include weight, by species and disposition (retained and discarded), of the entire catch. Fish and invertebrate species are recorded in weight. Conversion factors were applied to convert any dressed weight data to live weight<sup>2</sup> equivalents.

For this analysis, only observed hauls from NEFOP trips with a “complete” sampling protocol were used. A “complete” sampling protocol includes obtaining species weights for both kept and discarded portions of all species in the catch. NEFOP training trips have been included in the analysis. Aborted trips, “set only” trips, carrier trips, and trips associated with a groundfish sentinel fishery (NEFOP program code = 127) were excluded from the analysis. Additionally, offwatch hauls, hauls with missing fleet information (e.g., unknown gear/mesh/area), and hauls

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<sup>1</sup> A comparison of discard rates derived from observer and at-sea monitor data revealed there were generally no statistical differences in discard rates between the two data collection programs for 18 species associated with Amendment 16 to the Northeast Multispecies Fishery Management Plan for four gear types (longline, large-mesh otter trawl, large-mesh gillnet, and extra-large-mesh gillnet) where at-sea monitor data exist (Wigley et al. 2011b). See NEFOP (2011) for more information on at-sea monitoring.

<sup>2</sup> In this document, “live” is equivalent to “round” grade.

with missing catch reported were excluded. Records of species hail weight with discard reason “039” (“previously discarded”), unknown species, or unknown catch disposition, were also excluded, as was any catch of non-living items.

A broad stratification scheme was used in this analysis, with trips partitioned into fleets using six classification variables: calendar quarter, gear type, access area, trip category, area fished, and mesh size. Calendar quarter was based on landed date and used to capture seasonal variations in fishing activity and discard rates. Gear type was based on Northeast fishing gear codes (*negear*). Some gear codes were combined: troll line and longline, handline and auto jig handline, scallop trawl and twin trawl, sink, anchored, and drift gillnets, herring and other purse seines, single and paired mid-water trawls, and clam and quahog dredges. Two access area categories were formed based on gear and program code: access area (AA) and open (OPEN). Additional categories referring to the US/Canada Resource Sharing area (USCAN) and Haddock longline hook sector (HOOK) that were used in First Edition of the NBR (NMFS 2011) were discontinued in this analysis because Special Access Programs were difficult to identify and were deemed outdated with the onset of groundfish sector-based management. The B-day access area category (B) was also discontinued due to minimal occurrence of such trips. Trips associated with the US/Canada access area, and B-day category have been grouped by other stratification variables (e.g., gear and mesh size). The sea scallop fishery was divided into General (GEN) and Limited (LIM) category trips based on trip length as a surrogate for permit category (single day is general category, multi-day is limited access). All other fisheries were combined into a trip category called “all.” Two regional areas were defined based on area fished: New England (NE), which includes statistical reporting areas < “600” (encompassing Southern New England, Georges Bank, and the Gulf of Maine), and Mid-Atlantic (MA), comprised of statistical areas  $\geq$  “600.” This area fished definition applied to all trips except shrimp trawl trips fishing in Southern New England (statistical areas 530-539), which were assigned to the MA area to separate shrimp trips using a Nordmore grate in the northern shrimp fishery from other trips using turtle excluder devices in the Mid-Atlantic. Mesh size groups were defined for otter trawl and gillnet gear types. For otter trawls, two mesh groups were formed: small (sm; mesh less than 5.5 inches) and large (lg; 5.5 inch mesh and greater). For gillnets, three mesh groups were formed: small (sm; mesh less than 5.5 inches), large (lg; mesh between 5.5 and 7.99 inches), and extra large (xlg; mesh 8 inches and greater). All other fisheries were classified into a mesh category called “all.”

### *Vessel Trip Report (VTR)*

The VTR data constitute the basis of the fishing activity of the commercial fleets and are used for defining the sampling frame. Dealer data do not contain mesh size and area fished information and thus could not be used for this purpose in the analyses. The VTR data were used as a surrogate for Dealer data to expand the NEFOP discard ratios to total discards by fleet. VTR data are self-reported<sup>3</sup> and all federally permitted vessels are required to file a VTR for each fishing trip<sup>4</sup>. For this analysis, all commercial VTR trips (excluding NY state [non-federal] vessels) were used. Conversion factors were applied to convert various units of measure to pounds and all weight to live weight. VTR trip data were collapsed into fleets as defined above. However, access area determination for VTR trips using scallop gear (*negear* 052 and 132) was based on Vessel Monitoring System (VMS) activity declaration code. A description of the

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<sup>3</sup> See Wigley et al. 2007 for more details on self-reported VTR data.

<sup>4</sup> See NMFS-Northeast Regional Office [http://www.nero.noaa.gov/ro/fso/vtr\\_inst.pdf](http://www.nero.noaa.gov/ro/fso/vtr_inst.pdf)



methods used to assemble the VMS analytical dataset is provided in the Appendix; VMS trip information was linked to VTR trip data based on matching trip identifier (*tripid*). Trips with VMS program code<sup>5</sup> “SAA” (Special Access Area) and “SCG” (Limited Access General Category) were assigned to access area category (AA). When linking the VTR and VMS databases, only 76% of scallop trawl trips (*negear* 052) and 87% of scallop dredge trips (*negear* 132) could successfully be matched to determine VMS activity code and access area classification. Trips without VMS activity code were classified as OPEN.

### Other Data Sources

The clam fishery has a separate logbook system from the VTR logbook. The commercial clam logbook data were used to augment the VTR data for the clam dredge fishery.

As mentioned above, the VMS data were used to stratify VTR data into fleets. See the Appendix for further details.

The Dealer data (i.e., NEFSC commercial landings) for federally managed species were used only in the validation stage of the analysis.

### Discard Estimation

Total discards of each of the 34 federally managed species were estimated for the January-December 2010 time period using a combined discard/kept (d/k) ratio estimator (Cochran 1963), where d = discarded pounds of a given species group, and k = the kept pounds of all species. Total discards (in weight) were derived by multiplying the estimated discard rate of each fleet by the corresponding fleet landings in the VTR database, and then summing over fleets.

Simple imputation methods were used to fill quarterly cells for which there were zero or one observed trips. Data from adjoining strata were pooled to impute estimates for cells with zero or one trip. In this imputation only the temporal stratification, calendar quarter, was relaxed to the annual level. This simple imputation could not be applied to fleets where observer coverage was low or missing throughout the year (i.e., too few data to support the simple imputation approach), in which case discard estimates for the fleet were not derived.

Total discarded pounds for species *j* is defined as:

$$(1) \quad \hat{D}_j = \sum_{h=1}^Q K_h r_{c,j}$$

where

$$(2) \quad r_{c,j} = \frac{\sum_{h=1}^Q N_h \sum_{i=1}^{n_h} \frac{d_{jih}}{n_h}}{\sum_{h=1}^Q N_h \sum_{i=1}^{n_h} \frac{k_{ih}}{n_h}}$$

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<sup>5</sup> The format of a VMS activity declaration code is: CCC-PPP-AADGTB, where PPP represents the program code description. For more details about VMS activity declaration codes, see <http://www.nero.noaa.gov/nero/vms/doc/DECLARATION%20CODE%20FORMAT%20NOV%202012.pdf>.

where  $\hat{D}_j$  is total discarded pounds for species  $j$ ;  $K_h$  is VTR total kept pounds in stratum  $h$ ;  $r_{c,j}$  is the combined ratio of species  $j$ ;  $d_{jih}$  is discards of species  $j$  from trip  $i$  in stratum  $h$ ;  $k_{ih}$  is kept pounds of all species on trip  $i$  in stratum  $h$ ;  $N_h$  is the number of VTR trips in stratum  $h$ ; and  $n_h$  is the number of observed trips in stratum  $h$ . In Eq. 2 the summation over strata  $h = 1$  to  $Q$  is over calendar quarters and the other strata values are held constant. Equation 3 (below) requires a more explicit definition of the stratum designation since the summation over quarter relies on an annual average ratio defined in Eq. 2.

Variance of  $\hat{D}_j$  for species  $j$  is defined as:

$$(3) \quad V(\hat{D}_j) = \sum_{q=1}^4 K_{qh}^2 \left( \frac{N_{qh} - n_{qh}}{n_{qh} N_{qh}} \right) \frac{1}{\left( \frac{\sum_{i=1}^{n_h} k_{iqh}}{n_{qh}} \right)^2} \left[ \frac{\sum_{i=1}^{n_{qh}} \left( d_{jih}^2 + (r_{c,j})^2 k_{iqh}^2 - 2r_{c,j} d_{jih} k_{iqh} \right)}{n_{qh} - 1} \right]$$

where  $\hat{D}_j$  is total discarded pounds for species  $j$ ;  $K_{qh}$  is VTR total kept pounds in quarter  $q$  and stratum  $h$ ;  $r_{c,j}$  is the combined ratio of species  $j$ ;  $d_{jih}$  is discards of species  $j$  from trip  $i$  in quarter  $q$  and stratum  $h$ ;  $k_{iqh}$  is kept pounds of all species on trip  $i$  in quarter  $q$  and stratum  $h$ ;  $N_{qh}$  is the number of VTR trips in quarter  $q$  and stratum  $h$ ; and  $n_{qh}$  is the number of observed trips in quarter  $q$  and stratum  $h$ .

Coefficient of variation (CV) of  $\hat{D}_j$  is defined as:

$$(4) \quad CV(\hat{D}_j) = \frac{\sqrt{V(\hat{D}_j)}}{\hat{D}_j}$$

For each species and fleet, the landings from the VTR and clam logbook are presented to provide perspective for the discard estimates.

## Method Validation

Validation of the approach used to estimate total discards was performed by using the same approach to estimate the landings of each of the species in 2010, and comparing these estimates to the landings included in the VTR and Dealer databases.

To estimate landings using the NEFOP data, the same estimation method as described above was used; however, the species-specific poundage discarded ( $d_j$ ) was replaced with species-specific kept pounds ( $k_j$ ).

Total landed pounds for species  $j$  is defined as:

$$(5) \quad \hat{L}_j = \sum_{h=1}^Q K_h r_{c,j}$$

where

$$(6) \quad r_{c,j} = \frac{\sum_{h=1}^Q N_h \sum_{i=1}^{n_h} \frac{k_{jih}}{n_h}}{\sum_{h=1}^Q N_h \sum_{i=1}^{n_h} \frac{k_{ih}}{n_h}}$$

where  $\hat{L}_j$  is total kept pounds of species  $j$ ;  $K_h$  is VTR total kept pounds in stratum  $h$ ;  $r_{c,j}$  is the combined ratio of species  $j$ ;  $k_{jih}$  is the total kept pounds of species  $j$  from trip  $i$  in stratum  $h$ ;  $k_{ih}$  is kept pounds of all species on 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  $h$ . In Eq. 6 the summation over strata  $h = 1$  to  $Q$  is over calendar quarters and the other strata values are held constant. Equation 7 (below) requires a more explicit definition of the stratum designation since the summation over quarter relies on an annual average ratio defined in Eq. 6.

The variance of  $\hat{L}_j$  for species  $j$  is defined as:

$$(7) \quad V(\hat{L}_j) = \sum_{q=1}^4 K_{qh}^2 \left( \frac{N_{qh} - n_{qh}}{n_{qh} N_{qh}} \right) \frac{1}{\left( \frac{\sum_{i=1}^{n_h} k_{iqh}}{n_{qh}} \right)^2} \left[ \frac{\sum_{i=1}^{n_{qh}} \left( k_{jih}^2 + (r_{c,j})^2 k_{iqh}^2 - 2r_{c,j} k_{jih} k_{iqh} \right)}{n_{qh} - 1} \right]$$

where  $\hat{L}_j$  is total discarded pounds for species  $j$ ;  $K_{qh}$  is VTR total kept pounds in quarter  $q$  and stratum  $h$ ;  $r_{c,j}$  is the combined ratio of species  $j$ ;  $k_{jih}$  is the kept pounds of species  $j$  from trip  $i$  in quarter  $q$  and stratum  $h$ ;  $k_{iqh}$  is kept pounds of all species on trip  $i$  in quarter  $q$  and stratum  $h$ ;  $N_{qh}$  is the number of VTR trips in quarter  $q$  and stratum  $h$ ; and  $n_{qh}$  is the number of observed trips in quarter  $q$  and stratum  $h$ .

The coefficient of variation of  $\hat{L}_j$  was defined as:

$$(8) \quad CV(\hat{L}_j) = \frac{\sqrt{V(\hat{L}_j)}}{\hat{L}_j}$$

For each species, 95% confidence intervals were calculated for the point estimate of total landings.

## RESULTS

The list of the 34 federally managed fish and invertebrate species analyzed for the 2013 Update to the NBR is given in Table 1. One species (Atlantic wolffish) was added to the analysis since the First Edition of the NBR (Wigley et al. 2008, NMFS 2011).

There were 63 fleets identified during the January-December 2010 time period (Table 2). There were three new fleets added to the analysis since the First Edition of the NBR (Wigley et

al. 2008, NMFS 2011): NE large mesh Ruhl trawl (Row 16), NE large mesh haddock separator trawl (Row 17), and NE hagfish pots and traps (Row 45). Seventeen fleets present in the NBR First Edition are no longer present: NE HOOK longline, MA harpoon, MA B large mesh otter trawl, NE B small mesh otter trawl, NE B large mesh otter trawl, MA USCAN small mesh otter trawl, MA USCAN large mesh otter trawl, NE USCAN small mesh otter trawl, NE USCAN large mesh otter trawl, NE LIM AA scallop trawl, NE GEN OPEN scallop trawl, NE LIM OPEN scallop trawl, MA Danish seine, NE pots and traps, MA diving gear, MA Scottish seine, and NE Scottish seine.

## Discard Estimation

Of the 63 fleets examined, 34 fleets had little or no observer data: 4 fleets had sparse observer data across all quarters, while 30 fleets were missing observer data in all quarterly cells. The fleets with no observer coverage were primarily pot and trap fisheries targeting particular species (e.g., lobster, crab, conch, shrimp, and hagfish). No discard estimation was performed for these 34 fleets (Table 2). For the 29 remaining fleets, estimates of discards and their associated CV were derived. Of the 29 fleets, there were 13 fleets (Rows 12, 14, 19, 22, 23, 24, 29, 30, 31, 33, 35, 41, and 45) where the simple imputation was applied (Table 2).

A total of 4,370 NEFOP trips was observed during January and December 2010. When these trips were stratified, some trips were partitioned between strata resulting in 5,008 trips (Table 2). There appears to be minor misreporting of gear type associated with trips in the NE large mesh Ruhl trawl fleet (Row 16; Table 2). The percentage of observed trips varied by fleet and calendar quarter. On an annual basis, the percentage of observed trips by fleet ranged between 0.03% (MA handline fleet, Row 3) to 63.82% (NE large mesh haddock separator trawl fleet, Row 17; Table 2). Over all fleets, the percentage of observed trips was 4.66%.

The 2010 VTR landings (all species combined, live weight, by fleet and quarter) used to expand the discard ratios are presented in Table 3. Total annual landings varied by fleet, with a range from 0.2 mt in the MA mussel dredge fleet (Row 58) to 181,450 mt in the MA ocean quahog/surflclam dredge; total landings over all 63 fleets was 658,765 mt.

Total 2010 estimated discards (live, metric tons, assuming 100% discard mortality), with associated CVs and combined d/k ratios, by species and fleet, are presented in Table 4. Because discards were not estimated for all fisheries (due to data limitations), the values in Table 4 underestimate the actual *total* discards by species in 2010.

Based on this analysis, approximately 64,557 mt (live weight) of discards of the 34 species occurred in the 29 fleets considered during the January to December 2010 period. The majority (78%) of the discards were comprised of three species groups: skates (49%), Atlantic sea scallops (19%), and spiny dogfish (10%); the remaining species each represented less than 4% of the total discards (Table 4). No discards occurred for Atlantic salmon. Almost half (45%) of the discards came from two fleets: NE large mesh otter trawl (Row 11; 25%), and MA LIM OPEN scallop trawl (Row 36; 20%); the remaining fleets each represented less than 10% of the total discards (Table 4). Two fleets had zero discards estimated for all 34 species under consideration: NE fish pots and traps (Row 41), and hagfish pots and traps (Row 45).

The combined d/k ratio<sup>6</sup> varied among the 34 species and 29 fleets (Table 4). Among species, skates generally had the highest combined d/k ratios, followed by Atlantic sea scallop

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<sup>6</sup> The “combined d/k ratio” used in this analysis to estimate discards should not be confused with the NBR “bycatch ratio,” which is defined as the ratio of bycatch to total catch where total catch equals landings plus bycatch (NMFS 2011).

and spiny dogfish. Fleets with the highest combined d/k ratios included the MA GEN OPEN scallop trawl (Row 14) and MA Shrimp Trawl (Row 18).

The CV of the discard estimate also varied by species and fleet (Table 4). Of a total of 986 cells (where a cell is a species-fleet combination), over half (53%) had a value for CV; 463 cells had a null CV due to a zero discard estimate. Among the 523 cells with a CV value, 33% had a CV < 0.30, 35% had a CV between 0.31 and 0.60, 27% had a CV between 0.61 and 1.10, and 5% had CV >1.11, with a maximum CV value of 3.46 (windowpane in MA extra-large mesh gillnet [Row 24]). Ocean quahog, Atlantic surfclam, and offshore hake typically had the highest CV on discard estimates, while monkfish and skates had the lowest. The fleets with the highest CV values overall were the NE purse seine (Row 29) and NE GEN OPEN scallop dredge (Row 35), while the NE large mesh otter trawl (Row 11), NE large mesh haddock separator trawl (Row 17) and NE large mesh Ruhle trawl (Row 16) had the lowest overall CV values.

## Method Validation

For most species, the VTR and Dealer databases provide similar values for the 2010 landings (Table 5, Figure 1). VTR landings exceeded Dealer landings in only five of the 33 species listed in Table 5: Atlantic herring, ocean pout, ocean quahog, offshore hake, and red hake. Four species (Atlantic halibut, bluefish, white hake, and windowpane flounder) had VTR landings below Dealer landings by more than 30%. However when potentially mixed species (i.e., longfinned and shortfinned squids, and offshore, red and white hakes) were combined, the resulting VTR landings were closer to the dealer data.

The results of the validation exercise (Table 5, Figure 1) show that the estimated landings derived using the NEFOP dataset do not differ significantly from the VTR values for ten species: the 95% confidence intervals of the estimated landings encompass the VTR landings for Acadian redfish, Atlantic herring, Atlantic mackerel, Atlantic wolffish, bluefish, haddock, offshore hake, silver hake, summer flounder, and winter flounder. Several species had 95% confidence intervals of the estimated landings relatively close to the VTR landings: American plaice, Atlantic cod, Atlantic halibut, Atlantic sea scallop, monkfish, ocean pout, pollock, shortfinned squid, skates, spiny dogfish, windowpane flounder, witch flounder, and yellowtail flounder. The ten remaining species (Atlantic surfclam, black sea bass, butterfish, deep sea red crab, longfinned squid, ocean quahog, red hake, scup, tilefish, and white hake) had 95% confidence intervals of the estimated landings that differed substantially from VTR landings.

There was no observer coverage for the 2010 fisheries for five species (Atlantic surfclam, deep sea red crab, ocean quahog, and tilefish) so the estimated landings of these species do not approximate the VTR landings. For the three hake species (red, white and offshore hake) and the two squid species (longfinned and shortfinned), reporting of “mixed” species results in landings at the individual species level that do not compare as favorably as at the combined (i.e., “mixed hakes” or “mixed squid”) level (Table 5 and Figure 1).

At the group level corresponding to fishery management plans, estimated landings did not differ significantly from the VTR for the Groundfish-small mesh, and Squid-Butterfish-Mackerel groups; these values were close for the Groundfish-large mesh group. The Fluke-Scup-Black Sea Bass and Atlantic surfclam-ocean quahog groups had more significant differences between estimated landings and VTR landings.

## DISCUSSION

The analysis presented in this document used a broad stratification and a combined ratio method to estimate the 2010 discards of 34 federally managed finfish and invertebrate species in commercial fisheries of the Northeast region of the United States. Species-specific stock assessment discard estimation may differ from this report due to differences in stratification and data used (VTR landings versus Dealer landings). It is expected, however, that estimates would be in the same order of magnitude. The discard estimates presented here are not definitive estimates, but are indicative of where discarding occurred among commercial fleets.

This analysis used VTR data. Dealer (*CFDETSyyyy*) data do not contain mesh or area fished information until the trip-based allocation is performed. The trip-based allocation of Dealer (*CFDETT/SyyyyAA*) data is conducted annually and was not available when this analysis was initiated. Given that the VTR landings estimates are usually less (VTR reports the good faith hauls) than the dealer records for a given fleet, the corresponding estimates of discards will also be underestimated. The magnitude of the underestimation will vary by fleet and year.

New fleets were added to reflect VTR activity in the time period examined. The Ruhle trawl (*negear* code 054) and haddock separator trawl (*negear* code 057) were used by vessels fishing in the NE region. These gear types are required in the US/Canada resource sharing area and their use is expected in both access and non-access areas to reduce discards of New England groundfish under sector management. Outreach and education via permit holder letters to industry members should emphasize the proper use of these two gear codes since underreporting does occur (i.e., VTR trips < NEFOP trips; Row 16; Table 2).

The NEFOP, VTR, and VMS databases do not contain the requisite information to directly match trips (i.e., one to one match) across databases, and hence ad-hoc methods were developed to accomplish this. Some misclassification of trips to various fleets is therefore inevitable and may also occur due to the limited auditing of the VTR data resulting in overlapping trip dates, incorrect gear codes, and/or incorrect area fished. In addition, misclassification of trips into access area categories was possible for trips using scallop gear (*negear* 052 and 132), due to limitations associated with the use of the VMS activity code.

Qualitative comparisons of the 2010 discard estimates (using both the annual totals and the totals for specific gear) with other recent discard estimates available for the same species indicated a similarity in order of magnitude. That is, the 2010 estimates approximate those derived from: (a) the 2009, 2010, and 2011 Standardized Bycatch Reporting Methodology analysis (Wigley et al. 2011a); (b) the 2012 discard estimation analysis (Wigley et al. 2012); (c) the 2012 Northeast groundfish stock assessment updates (NEFSC 2012); and (d) various Stock Assessment Workshop analyses.

Discard estimates in Table 4 assumed 100% discard mortality, i.e., we did not account for potential survival of organisms returned to the water. When comparing discard estimates from this study with those from stock assessments, it is usefully to note that survival ratios are applied in stock assessments for spiny dogfish, summer flounder, southern New England and Gulf of Maine stocks of winter flounder, southern New England yellowtail flounder, and Atlantic sea scallop. In addition, survival ratios are currently under consideration for the Georges Bank and Gulf of Maine Atlantic cod stocks.

The annual imputation approach may not be appropriate for all fleets and species and, in some cases, quarterly d/k ratios were based on very small sample sizes. This contributed to the lower precision (higher CVs) associated with several of the discard estimates (Table 4).

The validation analysis indicated that the VTR and Dealer estimates are generally comparable and the discard estimation method is appropriate. Where they exist, differences in VTR and Dealer landings reflect the different nature of the data, where VTR data report the good-faith hail weights whereas Dealer data provide actual landings weight. Some of the cases where the dealer landings exceeded the VTR landings (such as Atlantic halibut, black sea bass, bluefish, scup, and windowpane flounder) are likely discrepancies resulting from the inability to partition out the mandatory reporting landings (reflective of the VTR) from the state landings. The difference for monkfish likely reflects misreporting of monkfish product forms (i.e., tails vs. whole fish) in the VTR database.

Estimated landings using NEFOP data were similar to VTR landings in most species, although several species had significantly different estimates. Five species (Atlantic surfclam, deep sea red crab, ocean quahog, and tilefish) have targeted fisheries that were not observed, and it is therefore not surprising that the estimated landings of these species do not approximate the VTR landings. Other factors related to the onset of sector-based management for New England groundfish<sup>7</sup> in May 2010 may also be contributing to these differences. For example, changes in regulations that enacted a “no possession” status for Atlantic wolffish, ocean pout, windowpane flounder, and winter flounder (Southern New England and Mid-Atlantic stocks only) likely result in inflated discard estimates and landing estimates (from the validation analysis).

In summary, a very broad stratification was used to encompass all species in the Northeast regional analysis. Discard estimates provided in this report will differ from discard estimates developed separately in stock assessments because of differences in estimation methods and in spatial/temporal/fleet stratification schemes.

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<sup>7</sup> For more information on Amendment 16 to the Northeast Multispecies Fishery Management Plan, see <http://www.nero.noaa.gov/nero/hotnews/mulamend16pr/>

## REFERENCES CITED

- Cochran, WL. 1963. Sampling Techniques. J. Wiley and Sons. New York.
- National Marine Fisheries Service (NMFS). 2011. U.S. National Bycatch Report [W. A. Karp, L. L. Defosse, S. G. Brooke, Editors]. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-117E, 508 p. Available on-line at: <http://spo.nmfs.noaa.gov/tm/117E.pdf>
- Northeast Fisheries Observer Program (NEFOP). 2010. Fisheries Observer Program Manual 2010. Northeast Fisheries Science Center, Woods Hole, MA 02543. 442 p. Available on-line at: [http://www.nefsc.noaa.gov/fsb/manuals/2010/NEFOPM\\_010110\\_Bookmarks\\_Compressed.pdf](http://www.nefsc.noaa.gov/fsb/manuals/2010/NEFOPM_010110_Bookmarks_Compressed.pdf)
- Northeast Fisheries Observer Program (NEFOP). 2011. At-Sea Monitoring Program Manual. Northeast Fisheries Science Center, Woods Hole, MA 02543. 502 p. Available on-line at: [http://www.nefsc.noaa.gov/fsb/manuals/2011/ASM\\_program\\_manual\\_0611.pdf](http://www.nefsc.noaa.gov/fsb/manuals/2011/ASM_program_manual_0611.pdf)
- Northeast Fisheries Science Center (NEFSC). 2012. Assessment or Data Updates of 13 Northeast Groundfish Stocks through 2010. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 12-06; 789 p. Available on-line at: <http://nefsc.noaa.gov/publications/crd/crd1206/>
- Wigley SE, Blaylock J, Rago PJ, Shield G. 2012. 2012 Discard estimation, precision, and sample size analyses for 14 federally managed species groups in the northeast region. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 12-17; 146 p. Available on-line at: <http://www.nefsc.noaa.gov/publications/crd/crd1217/>
- Wigley SE, Blaylock J, Rago PJ, Tang J, Haas HL, and Shield G. 2011a. Standardized Bycatch Reporting Methodology 3-year review report 2011 - Part 1. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 11-09; 285 p. Available on-line at: <http://www.nefsc.noaa.gov/publications/crd/crd1109/>
- Wigley SE, Palmer MC, Blaylock J, and Rago PJ. 2008. A brief description of the discard estimation for the National Bycatch Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 08-02; 35 p. Available on-line at: <http://www.nefsc.noaa.gov/publications/crd/crd0802/>
- Wigley SE, Palmer MC, and Legault CM. 2011b. A comparison of discard rates derived from at-sea monitoring and observer trips. Working Paper # 11 in the Appendix of: Northeast Fisheries Science Center (NEFSC). 2011. 52nd Northeast Regional Stock Assessment Workshop (52nd SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 11-17; 962 p. Available on-line at: <http://www.nefsc.noaa.gov/publications/crd/crd1117/>
- Wigley SE, Rago PJ, Sosebee KA, and Palka DL. 2007. The analytic component to the Standardized Bycatch Reporting Methodology Omnibus Amendment: sampling design and estimation of precision and accuracy (2nd edition). US Dept Commer, Northeast Fish Sci Cent Ref Doc. 07-09; 156 p. Available on-line at: <http://www.nefsc.noaa.gov/publications/crd/crd0709/index.htm>



**Table 1. List of the Northeast fish and invertebrate species (abbreviations in parentheses), with their scientific names, examined in the 2013 Update to the National Bycatch Report.**

Acadian Redfish (RED)	<i>Sebastes fasciatus</i>
American Plaice (AMP)	<i>Hippoglossoides platessoides</i>
Atlantic Cod (COD)	<i>Gadus morhua</i>
Atlantic Halibut (HAL)	<i>Hippoglossus hippoglossus</i>
Atlantic Herring (HERR)	<i>Clupea harengus</i>
Atlantic Mackerel (MACK)	<i>Scomber scombrus</i>
Atlantic Salmon (SAL)	<i>Salmo salar</i>
Atlantic Sea Scallop (SCAL)	<i>Placopecten magellanicus</i>
Atlantic Surfclam (CLAM)	<i>Spisula solidissima</i>
Atlantic Wolffish <sup>8</sup> (WOLF)	<i>Anarhichas lupus</i>
Black Sea Bass (BSB)	<i>Centropristis striata</i>
Bluefish (BLUE)	<i>Pomatomus saltatrix</i>
Butterfish (BUT)	<i>Peprilus triacanthus</i>
Deep Sea Red Crab (RCRAB)	<i>Chaceon quinque-dens</i>
Haddock (HADD)	<i>Melanogrammus aeglefinus</i>
Longfinned Squid (LOL)	<i>Loligo pealeii</i>
Monkfish (MONK)	<i>Lophius americanus</i>
Ocean Pout (OP)	<i>Zoarces americanus</i>
Ocean Quahog (QUAH)	<i>Artica islandica</i>
Offshore Hake (OHAK)	<i>Merluccius albidus</i>
Pollock (POL)	<i>Pollachius virens</i>
Red Hake (RHAK)	<i>Urophycis chuss</i>
Scup (SCUP)	<i>Stenotomus chrysops</i>
Shortfinned Squid (ILL)	<i>Illex illecebrosus</i>
Silver Hake (SHAK)	<i>Merluccius bilinearis</i>
Skate Complex <sup>9</sup> (SKATE)	
Spiny Dogfish (DOG)	<i>Squalus acanthias</i>
Summer Flounder (FLUK)	<i>Paralichthys dentatus</i>
Tilefish (TILE)	<i>Lopholatilus chamaeleonticeps</i>
White Hake (WHAK)	<i>Urophycis tenuis</i>
Windowpane Flounder (WIND)	<i>Scophthalmus aquosus</i>
Winter Flounder (WINT)	<i>Pseudopleuronectes americanus</i>
Witch Flounder (WIT)	<i>Glyptocephalus cynoglossus</i>
Yellowtail Flounder (YT)	<i>Limanda ferruginea</i>

<sup>8</sup> Atlantic wolffish was added to the Northeast Multispecies FMP when Amendment 16 was implemented on May 1, 2010. Atlantic wolffish was not examined in the first edition of the National Bycatch Report (NMFS 2011).

<sup>9</sup> Skate Complex is comprised of seven species (barndoor skate [*Dipturus leavis*], clearnose skate [*Raja eglanteria*], little skate [*Leucoraja erinacea*], rosette skate [*Leucoraja garmani*], smooth skate [*Malacoraja senta*], thorny skate [*Amblyraja radiata*], and winter skate [*Leucoraja ocellata*]); individual species are not summarized separately.

**Table 2. Number of Northeast Fisheries Observer Program (NEFOP) and Vessel Trip Report (VTR) trips, by fleet and calendar quarter (Q) for calendar year 2010.**

Row	Gear Type	Access Area	Trip Category	Area Fished	Mesh Group	Gear Code(s)	NEFOP set					VTR set					VTR < NEFOP	Comments / Imputation
							Q1	Q2	Q3	Q4	TOTAL	Q1	Q2	Q3	Q4	TOTAL		
1	Longline	OPEN	all	MA	all	010, 060	.	.	.	.	.	21	34	40	18	<b>113</b>		no discard estimation
2	Longline	OPEN	all	NE	all	010, 060	24	40	83	29	<b>176</b>	253	257	439	100	<b>1,049</b>		
3	Hand Line	OPEN	all	MA	all	020, 021	.	.	.	1	<b>1</b>	139	1,052	1,877	765	<b>3,833</b>		no discard estimation
4	Hand Line	OPEN	all	NE	all	020, 021	3	5	46	10	<b>64</b>	512	460	1,772	262	<b>3,006</b>		
5	Harpoon	OPEN	all	NE	all	030	.	.	.	.	.	.	24	18	.	<b>42</b>		no discard estimation
6	Longline, Pelagic	OPEN	all	MA	all	040	.	.	.	.	.	8	4	17	12	<b>41</b>		no discard estimation
7	Longline, Pelagic	OPEN	all	NE	all	040	.	.	.	.	.	.	2	28	1	<b>31</b>		no discard estimation
8	Otter Trawl	OPEN	all	MA	sm	050	80	121	86	73	<b>360</b>	624	1,369	1,195	917	<b>4,105</b>		
9	Otter Trawl	OPEN	all	MA	lg	050	57	80	89	48	<b>274</b>	1,010	1,709	1,936	1,318	<b>5,973</b>		
10	Otter Trawl	OPEN	all	NE	sm	050	23	88	71	63	<b>245</b>	355	1,149	1,141	679	<b>3,324</b>		
11	Otter Trawl	OPEN	all	NE	lg	050	123	240	329	316	<b>1,008</b>	3,144	2,012	2,085	1,583	<b>8,824</b>		
12	Scallop Trawl	AA	GEN	MA	all	052, 053	.	1	6	1	<b>8</b>	10	267	104	21	<b>402</b>		impute q1, q2, q4
13	Scallop Trawl	AA	LIM	MA	all	052, 053	.	2	.	.	<b>2</b>	2	6	2	3	<b>13</b>		no discard estimation
14	Scallop Trawl	OPEN	GEN	MA	all	052, 053	.	6	10	3	<b>19</b>	11	61	39	9	<b>120</b>		impute q1
15	Scallop Trawl	OPEN	LIM	MA	all	052, 053	1	.	.	1	<b>2</b>	11	2	7	4	<b>24</b>		no discard estimation
16	Otter Trawl, Ruhle	OPEN	all	NE	lg	054	3	18	7	.	<b>28</b>	.	9	4	.	<b>13</b>	X	
17	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	057	11	29	31	26	<b>97</b>	.	14	61	77	<b>152</b>		
18	Shrimp Trawl	OPEN	all	MA	all	058	.	1	1	.	<b>2</b>	12	62	282	127	<b>483</b>		no discard estimation
19	Shrimp Trawl	OPEN	all	NE	all	058	11	.	.	4	<b>15</b>	2,284	196	157	588	<b>3,225</b>		impute q2, and q3
20	Floating Trap	OPEN	all	MA	all	080	.	.	.	.	.	.	28	25	.	<b>53</b>		no discard estimation
21	Floating Trap	OPEN	all	NE	all	080	.	.	.	.	.	.	89	40	.	<b>129</b>		no discard estimation
22	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	100, 110	.	4	4	4	<b>12</b>	441	328	614	359	<b>1,742</b>		impute q1
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	100, 110	1	21	3	26	<b>51</b>	174	460	480	644	<b>1,758</b>		impute q1
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	100, 110	6	35	.	50	<b>91</b>	421	998	121	619	<b>2,159</b>		impute q3
25	Sink, Anchor, Drift Gillnet	OPEN	all	NE	sm	100, 110	.	.	.	.	.	4	23	15	2	<b>44</b>		no discard estimation
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	100, 110	29	199	655	384	<b>1,267</b>	2,457	1,042	2,554	1,075	<b>7,128</b>		
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	100, 110	6	187	372	206	<b>771</b>	444	1,384	1,101	705	<b>3,634</b>		
28	Purse Seine	OPEN	all	MA	all	120, 121	.	.	.	.	.	.	47	179	5	<b>231</b>		no discard estimation
29	Purse Seine	OPEN	all	NE	all	120, 121	.	3	13	1	<b>17</b>	.	34	148	41	<b>223</b>		impute q4
30	Scallop Dredge	AA	GEN	MA	all	132	5	4	6	.	<b>15</b>	403	888	892	595	<b>2,778</b>		impute q4
31	Scallop Dredge	AA	GEN	NE	all	132	.	.	18	7	<b>25</b>	251	538	538	322	<b>1,649</b>		impute q1 and q2
32	Scallop Dredge	AA	LIM	MA	all	132	19	29	26	19	<b>93</b>	329	451	268	201	<b>1,249</b>		
33	Scallop Dredge	AA	LIM	NE	all	132	.	.	28	1	<b>29</b>	11	11	346	18	<b>386</b>		impute q1, q2, and q4
34	Scallop Dredge	OPEN	GEN	MA	all	132	7	20	12	6	<b>45</b>	176	74	83	80	<b>413</b>		
35	Scallop Dredge	OPEN	GEN	NE	all	132	1	9	6	3	<b>19</b>	505	181	124	209	<b>1,019</b>		impute q1
36	Scallop Dredge	OPEN	LIM	MA	all	132	12	32	23	18	<b>85</b>	175	537	293	202	<b>1,207</b>		
37	Scallop Dredge	OPEN	LIM	NE	all	132	3	4	13	8	<b>28</b>	33	40	148	102	<b>323</b>		

See supporting text for abbreviations.

**Table 2, continued. Number of Northeast Fisheries Observer Program (NEFOP) and Vessel Trip Report (VTR) trips, by fleet and calendar quarter (Q) for calendar year 2010.**

Row	Gear Type	Access Area	Trip Category	Area Fished	Mesh Group	Gear Code(s)	NEFOP set					VTR set					VTR < NEFOP	Comments / Imputation
							Q1	Q2	Q3	Q4	TOTAL	Q1	Q2	Q3	Q4	TOTAL		
38	Mid-water Paired & Single Trawl	OPEN	all	MA	all	170, 370	13	2	.	2	17	90	7	.	2	99		
39	Mid-water Paired & Single Trawl	OPEN	all	NE	all	170, 370	3	25	66	41	135	13	41	96	121	271		
40	Pots and Traps, Fish	OPEN	all	MA	all	181	.	.	.	.	.	24	452	372	344	1,192		no discard estimation
41	Pots and Traps, Fish	OPEN	all	NE	all	181	.	4	.	.	4	.	191	401	69	661		impute q3, q4
42	Pots and Traps, Conch	OPEN	all	MA	all	183	.	.	.	.	.	29	364	195	567	1,155		no discard estimation
43	Pots and Traps, Conch	OPEN	all	NE	all	183	.	.	.	.	.	.	258	351	223	832		no discard estimation
44	Pots and Traps, Hagfish	OPEN	all	MA	all	186	.	.	.	.	.	1	1	1	.	3		no discard estimation
45	Pots and Traps, Hagfish	OPEN	all	NE	all	186	2	1	.	.	3	14	27	42	6	89		impute q2, q3, q4
46	Pots and Traps, Shrimp	OPEN	all	NE	all	190	.	.	.	.	.	274	1	3	.	278		no discard estimation
47	Pots and Traps, Lobster	OPEN	all	MA	all	200	.	.	.	.	.	234	673	1,183	528	2,618		no discard estimation
48	Pots and Traps, Lobster	OPEN	all	NE	all	200	.	.	.	.	.	2,372	6,484	14,274	9,393	32,523		no discard estimation
49	Rakes, Other	OPEN	all	MA	all	250	.	.	.	.	.	.	21	40	26	87		no discard estimation
50	Rakes, Other	OPEN	all	NE	all	250	.	.	.	.	.	.	16	14	11	41		no discard estimation
51	Pots and Traps, Crab	OPEN	all	MA	all	300	.	.	.	.	.	11	94	14	37	156		no discard estimation
52	Pots and Traps, Crab	OPEN	all	NE	all	300	.	.	.	.	.	18	74	114	58	264		no discard estimation
53	Diving Gear	OPEN	all	NE	all	330	.	.	.	.	.	.	20	35	.	55		no discard estimation
54	Beam Trawl	OPEN	all	MA	all	350	.	.	.	.	.	27	18	31	27	103		no discard estimation
55	Beam Trawl	OPEN	all	NE	all	350	.	.	.	.	.	40	22	87	1	150		no discard estimation
56	Dredge, Other	OPEN	all	MA	all	381	.	.	.	.	.	330	30	2	96	458		no discard estimation
57	Dredge, Other	OPEN	all	NE	all	381	.	.	.	.	.	8	1	1	1	11		no discard estimation
58	Dredge, Mussel	OPEN	all	MA	all	385	.	.	.	.	.	.	.	.	25	25		no discard estimation
59	Dredge, Mussel	OPEN	all	NE	all	385	.	.	.	.	.	1	4	17	.	22		no discard estimation
60	Dredge, Urchin	OPEN	all	MA	all	387	.	.	.	.	.	.	.	.	5	5		no discard estimation
61	Dredge, Urchin	OPEN	all	NE	all	387	.	.	.	.	.	16	.	.	19	35		no discard estimation
62	Ocean Quahog/Surflclam Dredge	OPEN	all	MA	all	386, 400	.	.	.	.	.	723	893	871	748	3235		no discard estimation
63	Ocean Quahog/Surflclam Dredge	OPEN	all	NE	all	386, 400	.	.	.	.	.	421	650	650	428	2149		no discard estimation
<b>Total</b>							<b>443</b>	<b>1,210</b>	<b>2,004</b>	<b>1,351</b>	<b>5,008</b>	<b>18,866</b>	<b>26,184</b>	<b>37,967</b>	<b>24,398</b>	<b>107,415</b>		

See supporting text for abbreviations.

**Table 3. Vessel Trip Report landings (live, mt), by fleet and calendar quarter (Q) in 2010.**

Row	Gear Type	Access Area	Trip Category	Area Fished	Mesh Group	Gear Code(s)	Q1	Q2	Q3	Q4	TOTAL
1	Longline	OPEN	all	MA	all	010, 060	118.3	98.6	114.7	57.4	389.0
2	Longline	OPEN	all	NE	all	010, 060	176.2	404.8	643.1	203.1	1,427.1
3	Hand Line	OPEN	all	MA	all	020, 021	24.4	63.3	150.0	72.0	309.8
4	Hand Line	OPEN	all	NE	all	020, 021	99.3	26.0	248.6	42.5	416.3
5	Harpoon	OPEN	all	NE	all	030	.	2.3	1.9	.	4.2
6	Longline, Pelagic	OPEN	all	MA	all	040	22.7	13.0	29.0	32.0	96.7
7	Longline, Pelagic	OPEN	all	NE	all	040	.	2.7	49.8	1.1	53.5
8	Otter Trawl	OPEN	all	MA	sm	050	6,684.5	6,959.0	11,722.3	4,180.2	29,545.9
9	Otter Trawl	OPEN	all	MA	lg	050	3,061.5	1,691.6	1,583.1	2,302.5	8,638.8
10	Otter Trawl	OPEN	all	NE	sm	050	3,421.9	3,152.7	3,771.6	3,004.5	13,350.7
11	Otter Trawl	OPEN	all	NE	lg	050	8,396.2	9,663.1	5,409.2	6,232.9	29,701.4
12	Scallop Trawl	AA	GEN	MA	all	052, 053	10.9	393.2	159.3	30.1	593.5
13	Scallop Trawl	AA	LIM	MA	all	052, 053	56.9	44.7	50.4	34.3	186.4
14	Scallop Trawl	OPEN	GEN	MA	all	052, 053	11.1	59.7	19.1	9.6	99.5
15	Scallop Trawl	OPEN	LIM	MA	all	052, 053	46.4	23.6	281.0	126.2	477.1
16	Otter Trawl, Ruhle	OPEN	all	NE	lg	054	.	63.7	50.8	.	114.5
17	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	057	.	233.2	675.2	753.6	1,662.0
18	Shrimp Trawl	OPEN	all	MA	all	058	45.2	90.9	612.7	304.7	1,053.6
19	Shrimp Trawl	OPEN	all	NE	all	058	3,101.2	253.1	301.7	723.2	4,379.3
21	Floating Trap	OPEN	all	NE	all	080	.	101.8	10.0	.	111.8
22	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	100, 110	963.4	239.9	252.9	277.3	1,733.4
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	100, 110	429.9	501.1	316.6	633.9	1,881.5
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	100, 110	452.1	1,611.8	111.2	637.7	2,812.8
25	Sink, Anchor, Drift Gillnet	OPEN	all	NE	sm	100, 110	1.1	9.9	5.1	1.0	17.2
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	100, 110	1,159.4	986.3	2,790.3	1,154.1	6,090.1
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	100, 110	1,242.6	3,988.3	2,532.4	551.0	8,314.2
28	Purse Seine	OPEN	all	MA	all	120, 121	.	1,730.1	13,681.1	394.6	15,805.8
29	Purse Seine	OPEN	all	NE	all	120, 121	.	498.0	5,634.0	2,398.4	8,530.4
30	Scallop Dredge	AA	GEN	MA	all	132	726.9	1,478.1	1,378.6	885.1	4,468.7
31	Scallop Dredge	AA	GEN	NE	all	132	331.3	690.4	838.0	459.7	2,319.3
32	Scallop Dredge	AA	LIM	MA	all	132	16,583.5	22,599.7	11,319.7	7,975.4	58,478.4
33	Scallop Dredge	AA	LIM	NE	all	132	448.7	313.7	20,635.5	514.2	21,912.1
34	Scallop Dredge	OPEN	GEN	MA	all	132	442.9	216.0	282.2	167.3	1,108.3
35	Scallop Dredge	OPEN	GEN	NE	all	132	206.7	137.6	296.6	247.5	888.3
36	Scallop Dredge	OPEN	LIM	MA	all	132	10,397.3	52,177.5	19,146.2	11,124.1	92,845.1
37	Scallop Dredge	OPEN	LIM	NE	all	132	2,291.2	3,201.1	13,212.1	7,980.9	26,685.4
38	Mid-water Paired & Single Trawl	OPEN	all	MA	all	170, 370	16,248.4	886.4	.	556.3	17,691.1
39	Mid-water Paired & Single Trawl	OPEN	all	NE	all	170, 370	1,713.1	5,799.9	13,427.9	22,875.1	43,816.1
40	Pots and Traps, Fish	OPEN	all	MA	all	181	5.2	93.1	71.7	90.3	260.3
41	Pots and Traps, Fish	OPEN	all	NE	all	181	.	33.2	45.7	9.7	88.6
42	Pots and Traps, Conch	OPEN	all	MA	all	183	15.6	264.9	126.9	384.0	791.4
43	Pots and Traps, Conch	OPEN	all	NE	all	183	.	81.2	105.5	110.6	297.3
44	Pots and Traps, Hagfish	OPEN	all	MA	all	186	49.9	0.8	1.3	.	52.0
45	Pots and Traps, Hagfish	OPEN	all	NE	all	186	124.9	235.0	158.0	56.1	574.0
46	Pots and Traps, Shrimp	OPEN	all	NE	all	190	209.6	0.1	0.4	.	210.0
47	Pots and Traps, Lobster	OPEN	all	MA	all	200	203.1	231.4	342.5	234.1	1,011.2
48	Pots and Traps, Lobster	OPEN	all	NE	all	200	2,236.0	2,177.1	3,868.5	3,827.5	12,109.1
51	Pots and Traps, Crab	OPEN	all	MA	all	300	236.6	372.5	187.0	131.0	927.1
52	Pots and Traps, Crab	OPEN	all	NE	all	300	226.3	123.5	120.4	232.6	702.8
53	Diving Gear	OPEN	all	NE	all	330	.	0.6	1.2	.	1.8
54	Beam Trawl	OPEN	all	MA	all	350	27.3	8.2	15.7	82.3	133.5
55	Beam Trawl	OPEN	all	NE	all	350	33.1	8.7	16.9	0.1	58.8
56	Dredge, Other	OPEN	all	MA	all	381	221.2	36.9	87.1	148.6	493.8
57	Dredge, Other	OPEN	all	NE	all	381	29.9	0.8	1.5	0.5	32.6
61	Dredge, Urchin	OPEN	all	NE	all	387	4.5	.	.	4.6	9.2
62	Ocean Quahog/Surf Clam Dredge	OPEN	all	MA	all	386, 400	42,371.6	53,809.7	41,741.0	43,222.5	181,144.9
63	Ocean Quahog/Surf Clam Dredge	OPEN	all	NE	all	386, 400	14,465.7	11,494.3	15,728.3	9,782.8	51,471.1
	6 Confidential Fleets						7.3	187.8	175.6	15.3	386.0
						<b>Total</b>	<b>139,382.9</b>	<b>189,566.6</b>	<b>194,538.9</b>	<b>135,276.3</b>	<b>658,764.8</b>

**Table 4. Total discards (live, mt) with associated coefficient of variation (CV) and combined discard-to-kept (d/k) ratio, by fleet and species in 2010. Species are listed in the order of appearance in Table 1.**

Row	Gear Type	Access Area	Trip Category	Region	Mesh Group	RED			AMP			COD			HAL		
						discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio
2	Longline	OPEN	all	NE	all	0.03	0.425	0.000018	0.01	0.479	0.000010	28.33	0.190	0.019848	1.04	0.383	0.000727
4	Hand Line	OPEN	all	NE	all	0.03	0.738	0.000082	0.00		0.000000	12.39	1.566	0.029756	0.00		0.000000
8	Otter Trawl	OPEN	all	MA	sm	1.09	0.548	0.000037	0.00	1.326	0.000000	0.18	0.412	0.000006	0.00		0.000000
9	Otter Trawl	OPEN	all	MA	lg	0.00		0.000000	0.05	1.099	0.000006	0.19	0.509	0.000022	0.00		0.000000
10	Otter Trawl	OPEN	all	NE	sm	1.33	0.646	0.000100	71.62	0.368	0.005365	7.09	0.343	0.000531	0.09	0.573	0.000007
11	Otter Trawl	OPEN	all	NE	lg	165.29	0.160	0.005565	256.19	0.080	0.008625	475.87	0.126	0.016022	18.94	0.100	0.000638
12	Scallop Trawl	AA	GEN	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
14	Scallop Trawl	OPEN	GEN	MA	all	0.00		0.000000	0.00		0.000000	0.00	1.575	0.000012	0.00		0.000000
16	Otter Trawl, Ruhle	OPEN	all	NE	lg	0.05	0.145	0.000449	0.11	0.184	0.000954	0.52	0.094	0.004521	0.02	0.376	0.000158
17	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	5.12	0.263	0.003081	3.87	0.151	0.002326	11.66	0.122	0.007017	0.69	0.214	0.000415
19	Shrimp Trawl	OPEN	all	NE	all	7.62	0.282	0.001741	35.94	0.332	0.008208	0.46	0.799	0.000106	0.01	0.671	0.000002
22	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	0.00		0.000000	0.00		0.000000	0.06	0.713	0.000022	0.00		0.000000
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	2.97	0.261	0.000488	2.35	0.127	0.000386	145.82	0.224	0.023945	1.23	0.168	0.000202
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	0.09	0.725	0.000011	0.28	0.302	0.000033	14.85	0.261	0.001786	1.95	0.239	0.000234
29	Purse Seine	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
30	Scallop Dredge	AA	GEN	MA	all	0.00		0.000000	0.03	1.057	0.000007	0.00		0.000000	0.00		0.000000
31	Scallop Dredge	AA	GEN	NE	all	0.00		0.000000	0.03	0.682	0.000013	0.00		0.000000	0.00		0.000000
32	Scallop Dredge	AA	LIM	MA	all	0.00	0.994	0.000000	0.12	0.708	0.000002	0.00		0.000000	0.00		0.000000
33	Scallop Dredge	AA	LIM	NE	all	0.00		0.000000	0.00		0.000000	0.72	0.387	0.000033	0.00		0.000000
34	Scallop Dredge	OPEN	GEN	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
35	Scallop Dredge	OPEN	GEN	NE	all	0.00		0.000000	0.11	1.278	0.000119	0.00	0.597	0.000005	0.00		0.000000
36	Scallop Dredge	OPEN	LIM	MA	all	0.00		0.000000	0.06	0.981	0.000001	0.63	0.449	0.000007	0.00		0.000000
37	Scallop Dredge	OPEN	LIM	NE	all	0.00		0.000000	0.41	0.835	0.000015	1.71	0.343	0.000064	0.08	0.895	0.000003
38	Mid-water Paired & Single Trawl	OPEN	all	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
39	Mid-water Paired & Single Trawl	OPEN	all	NE	all	0.24	0.696	0.000005	0.00	0.535	0.000000	0.88	0.377	0.000020	0.00		0.000000
41	Pots and Traps, Fish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
45	Pots and Traps, Hagfish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
TOTAL						183.88	0.145		371.18	0.095		701.36	0.102		24.05	0.084	

**Table 4, continued. Total discards (live, mt) with associated coefficient of variation (CV) and combined discard-to-kept (d/k) ratio, by fleet and species in 2010. Species are listed in the order of appearance in Table 1.**

Row	Gear Type	Access Area	Trip Category	Region	Mesh Group	HERR			MACK			SAL			SCAL		
						discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio
2	Longline	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	1.19	0.396	0.000831
4	Hand Line	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
8	Otter Trawl	OPEN	all	MA	sm	40.79	0.569	0.001381	9.15	0.455	0.000310	0.00		0.000000	149.12	0.473	0.005047
9	Otter Trawl	OPEN	all	MA	lg	0.14	0.807	0.000016	1.01	0.794	0.000117	0.00		0.000000	70.24	0.537	0.008131
10	Otter Trawl	OPEN	all	NE	sm	115.61	0.335	0.008659	88.96	0.507	0.006664	0.00		0.000000	2.37	0.592	0.000178
11	Otter Trawl	OPEN	all	NE	lg	5.17	0.307	0.000174	1.45	0.359	0.000049	0.00		0.000000	17.02	0.345	0.000573
12	Scallop Trawl	AA	GEN	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	12.33	0.597	0.020769
14	Scallop Trawl	OPEN	GEN	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	14.27	0.290	0.143403
16	Otter Trawl, Ruhle	OPEN	all	NE	lg	0.06	0.164	0.000527	0.08	0.194	0.000674	0.00		0.000000	0.00	0.186	0.000020
17	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	0.39	0.259	0.000236	0.13	0.167	0.000077	0.00		0.000000	1.63	0.348	0.000983
19	Shrimp Trawl	OPEN	all	NE	all	29.57	0.798	0.006753	0.54	0.956	0.000122	0.00		0.000000	0.03	1.248	0.000006
22	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	0.00		0.000000	0.00	0.714	0.000001	0.00		0.000000	0.03	1.936	0.000009
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	1.14	0.445	0.000187	1.30	0.180	0.000213	0.00		0.000000	0.65	0.928	0.000106
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	0.06	0.331	0.000008	1.24	0.786	0.000149	0.00		0.000000	0.59	0.667	0.000071
29	Purse Seine	OPEN	all	NE	all	10.48	0.940	0.001229	0.00		0.000000	0.00		0.000000	0.00		0.000000
30	Scallop Dredge	AA	GEN	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	155.83	0.447	0.034872
31	Scallop Dredge	AA	GEN	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	901.18	0.215	0.388551
32	Scallop Dredge	AA	LIM	MA	all	0.00		0.000000	0.02	0.848	0.000000	0.00		0.000000	2,245.33	0.217	0.038396
33	Scallop Dredge	AA	LIM	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	2,599.38	0.239	0.118628
34	Scallop Dredge	OPEN	GEN	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	100.85	0.585	0.090990
35	Scallop Dredge	OPEN	GEN	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	119.87	0.309	0.134956
36	Scallop Dredge	OPEN	LIM	MA	all	0.02	0.749	0.000000	0.01	0.964	0.000000	0.00		0.000000	3,313.24	0.326	0.035686
37	Scallop Dredge	OPEN	LIM	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	2,919.89	0.297	0.109419
38	Mid-water Paired & Single Trawl	OPEN	all	MA	all	15.10	0.801	0.000853	1.73	0.569	0.000098	0.00		0.000000	0.00		0.000000
39	Mid-water Paired & Single Trawl	OPEN	all	NE	all	9.29	0.441	0.000212	0.44	0.474	0.000010	0.00		0.000000	0.00		0.000000
41	Pots and Traps, Fish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
45	Pots and Traps, Hagfish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
					TOTAL	227.82	0.235		106.06	0.428		0.00			12,625.04	0.128	

**Table 4, continued. Total discards (live, mt) with associated coefficient of variation (CV) and combined discard-to-kept (d/k) ratio, by fleet and species in 2010. Species are listed in the order of appearance in Table 1.**

Row	Gear Type	Access Area	Trip Category	Region	Mesh Group	CLAM			WOLF			BSB			BLUE		
						discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio
2	Longline	OPEN	all	NE	all	0.00		0.000000	2.73	0.332	0.001916	0.00		0.000000	0.03	0.867	0.000020
4	Hand Line	OPEN	all	NE	all	0.00		0.000000	0.11	0.855	0.000274	0.00		0.000000	2.19	0.400	0.005270
8	Otter Trawl	OPEN	all	MA	sm	0.37	0.962	0.000013	0.00		0.000000	52.25	0.287	0.001769	9.54	0.590	0.000323
9	Otter Trawl	OPEN	all	MA	lg	3.41	0.315	0.000394	0.00		0.000000	28.76	0.503	0.003329	1.68	0.518	0.000194
10	Otter Trawl	OPEN	all	NE	sm	0.07	1.057	0.000005	0.17	1.408	0.000013	30.46	0.463	0.002282	5.69	0.339	0.000426
11	Otter Trawl	OPEN	all	NE	lg	1.14	0.946	0.000039	10.68	0.139	0.000359	1.76	0.377	0.000059	9.95	1.043	0.000335
12	Scallop Trawl	AA	GEN	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
14	Scallop Trawl	OPEN	GEN	MA	all	0.00		0.000000	0.00		0.000000	0.06	0.673	0.000613	0.00		0.000000
16	Otter Trawl, Ruhle	OPEN	all	NE	lg	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
17	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	0.01	0.118	0.000008	0.25	0.168	0.000148	0.00	0.727	0.000002	1.54	0.838	0.000929
19	Shrimp Trawl	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
22	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	0.00		0.000000	0.00		0.000000	0.00		0.000000	13.71	0.979	0.007908
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	0.00		0.000000	0.00		0.000000	0.00		0.000000	40.46	0.940	0.021506
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	0.00		0.000000	0.00		0.000000	0.00		0.000000	5.14	0.365	0.001827
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	0.00	1.157	0.000000	2.54	0.183	0.000417	0.00	0.607	0.000001	1.68	0.190	0.000275
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	0.01	1.134	0.000001	0.69	0.289	0.000083	0.00	0.848	0.000000	6.19	0.187	0.000744
29	Purse Seine	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
30	Scallop Dredge	AA	GEN	MA	all	0.00		0.000000	0.00		0.000000	0.11	1.986	0.000023	0.00		0.000000
31	Scallop Dredge	AA	GEN	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
32	Scallop Dredge	AA	LIM	MA	all	0.86	0.576	0.000015	0.00		0.000000	5.14	0.291	0.000088	0.02	1.016	0.000000
33	Scallop Dredge	AA	LIM	NE	all	0.49	0.799	0.000022	0.00		0.000000	0.00		0.000000	0.00		0.000000
34	Scallop Dredge	OPEN	GEN	MA	all	0.03	0.953	0.000026	0.00		0.000000	0.04	0.861	0.000034	0.00		0.000000
35	Scallop Dredge	OPEN	GEN	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
36	Scallop Dredge	OPEN	LIM	MA	all	2.49	1.059	0.000027	0.00		0.000000	6.17	0.213	0.000067	0.28	0.800	0.000003
37	Scallop Dredge	OPEN	LIM	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
38	Mid-water Paired & Single Trawl	OPEN	all	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
39	Mid-water Paired & Single Trawl	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00	0.540	0.000000	0.11	0.363	0.000003
41	Pots and Traps, Fish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
45	Pots and Traps, Hagfish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
TOTAL						8.88	0.352		17.17	0.107		124.76	0.203		98.21	0.429	

**Table 4, continued. Total discards (live, mt) with associated coefficient of variation (CV) and combined discard-to-kept (d/k) ratio, by fleet and species in 2010. Species are listed in the order of appearance in Table 1.**

Row	Gear Type	Access Area	Trip Category	Region	Mesh Group	BUT			RCRAB			HADD			LOL		
						discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio
2	Longline	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	11.77	0.174	0.008251	0.00		0.000000
4	Hand Line	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
8	Otter Trawl	OPEN	all	MA	sm	374.51	0.275	0.012676	0.94	0.647	0.000032	6.80	0.597	0.000230	35.66	0.494	0.001207
9	Otter Trawl	OPEN	all	MA	lg	1.86	0.193	0.000215	20.38	0.742	0.002359	0.00		0.000000	2.10	0.459	0.000243
10	Otter Trawl	OPEN	all	NE	sm	417.05	0.265	0.031238	13.13	0.972	0.000983	40.39	0.685	0.003026	42.93	0.361	0.003216
11	Otter Trawl	OPEN	all	NE	lg	3.79	0.449	0.000128	186.08	0.412	0.006265	32.88	0.138	0.001107	2.80	0.387	0.000094
12	Scallop Trawl	AA	GEN	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.01	1.013	0.000015
14	Scallop Trawl	OPEN	GEN	MA	all	0.12	0.345	0.001215	0.00		0.000000	0.00		0.000000	0.00	0.505	0.000044
16	Otter Trawl, Ruhle	OPEN	all	NE	lg	0.00	0.186	0.000041	0.00		0.000000	1.01	0.097	0.008857	0.08	0.208	0.000717
17	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	0.05	0.370	0.000029	0.04	0.200	0.000024	6.13	0.111	0.003689	0.11	0.184	0.000066
19	Shrimp Trawl	OPEN	all	NE	all	1.33	0.704	0.000303	0.00		0.000000	0.61	0.464	0.000139	0.08	0.501	0.000017
22	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	0.09	0.437	0.000051	0.00		0.000000	0.00		0.000000	0.00		0.000000
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	0.01	0.722	0.000003	0.00		0.000000	0.00		0.000000	0.00		0.000000
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	0.02	0.790	0.000004	0.11	0.317	0.000017	1.85	0.160	0.000303	0.00	0.832	0.000000
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	0.00	0.643	0.000000	0.04	0.379	0.000005	0.61	0.252	0.000073	0.00		0.000000
29	Purse Seine	OPEN	all	NE	all	0.00	1.049	0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
30	Scallop Dredge	AA	GEN	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
31	Scallop Dredge	AA	GEN	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
32	Scallop Dredge	AA	LIM	MA	all	0.37	0.804	0.000006	0.00		0.000000	0.00		0.000000	0.78	0.220	0.000013
33	Scallop Dredge	AA	LIM	NE	all	0.00	0.959	0.000000	0.00		0.000000	1.85	0.923	0.000084	0.00	0.959	0.000000
34	Scallop Dredge	OPEN	GEN	MA	all	0.00		0.000000	0.01	0.680	0.000006	0.00		0.000000	0.01	0.733	0.000013
35	Scallop Dredge	OPEN	GEN	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
36	Scallop Dredge	OPEN	LIM	MA	all	0.04	0.451	0.000000	0.00		0.000000	0.00	1.050	0.000000	1.96	0.291	0.000021
37	Scallop Dredge	OPEN	LIM	NE	all	0.02	1.053	0.000001	0.00		0.000000	0.05	0.758	0.000002	0.01	1.118	0.000000
38	Mid-water Paired & Single Trawl	OPEN	all	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
39	Mid-water Paired & Single Trawl	OPEN	all	NE	all	0.03	0.438	0.000001	0.00		0.000000	3.29	0.494	0.000075	0.00	0.749	0.000000
41	Pots and Traps, Fish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
45	Pots and Traps, Hagfish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
TOTAL						799.29	0.189		220.71	0.359		107.25	0.266		86.54	0.272	



**Table 4, continued. Total discards (live, mt) with associated coefficient of variation (CV) and combined discard-to-kept (d/k) ratio, by fleet and species in 2010. Species are listed in the order of appearance in Table 1.**

Row	Gear Type	Access Area	Trip Category	Region	Mesh Group	MONK			OP			QUAH			OHAK		
						discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio
2	Longline	OPEN	all	NE	all	0.01	0.620	0.000009	3.29	0.222	0.002308	0.00		0.000000	0.00	0.865	0.000002
4	Hand Line	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
8	Otter Trawl	OPEN	all	MA	sm	30.28	0.299	0.001025	6.08	0.368	0.000206	0.01	0.770	0.000000	3.24	0.557	0.000110
9	Otter Trawl	OPEN	all	MA	lg	53.13	0.253	0.006150	4.10	1.130	0.000474	0.20	0.946	0.000023	0.03	0.778	0.000003
10	Otter Trawl	OPEN	all	NE	sm	76.87	0.483	0.005758	28.35	0.276	0.002123	0.02	1.404	0.000002	0.52	0.528	0.000039
11	Otter Trawl	OPEN	all	NE	lg	387.26	0.091	0.013038	44.58	0.137	0.001501	0.02	1.008	0.000001	2.24	0.285	0.000075
12	Scallop Trawl	AA	GEN	MA	all	1.25	0.223	0.002105	0.00		0.000000	0.00		0.000000	0.00		0.000000
14	Scallop Trawl	OPEN	GEN	MA	all	1.14	0.450	0.011499	0.17	0.787	0.001699	0.05	0.510	0.000517	0.00		0.000000
16	Otter Trawl, Ruhle	OPEN	all	NE	lg	0.03	0.168	0.000262	0.07	0.186	0.000623	0.00		0.000000	0.01	0.212	0.000092
17	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	1.32	0.164	0.000795	1.92	0.361	0.001157	0.01	0.591	0.000004	0.00		0.000000
19	Shrimp Trawl	OPEN	all	NE	all	0.08	1.042	0.000018	0.00		0.000000	0.00		0.000000	0.00		0.000000
22	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	0.23	0.821	0.000123	0.00		0.000000	0.00		0.000000	0.00		0.000000
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	66.21	0.290	0.023539	0.00		0.000000	0.00		0.000000	0.00		0.000000
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	3.63	0.128	0.000596	0.12	0.352	0.000020	0.00		0.000000	0.15	1.059	0.000025
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	70.08	0.101	0.008429	0.05	0.556	0.000006	0.00		0.000000	0.00		0.000000
29	Purse Seine	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
30	Scallop Dredge	AA	GEN	MA	all	27.86	0.317	0.006234	0.00		0.000000	0.00		0.000000	0.00		0.000000
31	Scallop Dredge	AA	GEN	NE	all	8.75	0.252	0.003772	0.13	0.406	0.000055	0.00		0.000000	0.00		0.000000
32	Scallop Dredge	AA	LIM	MA	all	670.51	0.135	0.011466	0.00	1.016	0.000000	1.19	0.494	0.000020	0.07	0.919	0.000001
33	Scallop Dredge	AA	LIM	NE	all	137.09	0.204	0.006256	1.28	0.221	0.000059	0.34	0.877	0.000015	0.07	0.861	0.000003
34	Scallop Dredge	OPEN	GEN	MA	all	0.82	0.395	0.000743	0.00		0.000000	0.01	1.055	0.000007	0.00		0.000000
35	Scallop Dredge	OPEN	GEN	NE	all	2.07	0.612	0.002332	0.03	0.601	0.000033	0.00		0.000000	0.00		0.000000
36	Scallop Dredge	OPEN	LIM	MA	all	797.56	0.122	0.008590	2.00	0.515	0.000022	2.72	0.936	0.000029	0.03	1.044	0.000000
37	Scallop Dredge	OPEN	LIM	NE	all	110.33	0.355	0.004134	0.45	0.480	0.000017	0.00		0.000000	0.19	0.939	0.000007
38	Mid-water Paired & Single Trawl	OPEN	all	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
39	Mid-water Paired & Single Trawl	OPEN	all	NE	all	0.05	0.347	0.000001	0.00		0.000000	0.00		0.000000	0.10	0.669	0.000002
41	Pots and Traps, Fish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
45	Pots and Traps, Hagfish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
TOTAL						2,446.56	0.062		92.63	0.122		4.57	0.578		6.64	0.294	

**Table 4, continued. Total discards (live, mt) with associated coefficient of variation (CV) and combined discard-to-kept (d/k) ratio, by fleet and species in 2010. Species are listed in the order of appearance in Table 1.**

Row	Gear Type	Access Area	Trip Category	Region	Mesh Group	POL			RHAK			SCUP			ILL		
						discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio
2	Longline	OPEN	all	NE	all	0.06	0.575	0.000040	5.83	0.183	0.004088	0.00		0.000000	0.00		0.000000
4	Hand Line	OPEN	all	NE	all	1.40	1.306	0.003359	0.00		0.000000	0.00		0.000000	0.00		0.000000
8	Otter Trawl	OPEN	all	MA	sm	0.00		0.000000	136.36	0.386	0.004615	307.83	0.291	0.010419	368.37	0.357	0.012468
9	Otter Trawl	OPEN	all	MA	lg	0.00		0.000000	1.75	0.507	0.000203	118.03	0.385	0.013662	0.30	0.898	0.000035
10	Otter Trawl	OPEN	all	NE	sm	0.22	0.445	0.000016	1,049.07	0.255	0.078578	518.17	0.386	0.038812	117.32	0.514	0.008788
11	Otter Trawl	OPEN	all	NE	lg	22.70	0.145	0.000764	60.02	0.277	0.002021	8.11	0.731	0.000273	11.70	0.174	0.000394
12	Scallop Trawl	AA	GEN	MA	all	0.00		0.000000	0.00	0.437	0.000002	0.00	0.437	0.000002	0.01	1.205	0.000025
14	Scallop Trawl	OPEN	GEN	MA	all	0.00		0.000000	0.18	0.306	0.001774	0.03	0.654	0.000262	0.00	0.494	0.000006
16	Otter Trawl, Ruhle	OPEN	all	NE	lg	0.00	0.852	0.000035	0.09	0.122	0.000825	0.00		0.000000	0.32	0.159	0.002803
17	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	1.46	0.232	0.000876	2.14	0.227	0.001289	0.00		0.000000	0.56	0.178	0.000339
19	Shrimp Trawl	OPEN	all	NE	all	2.39	0.887	0.000546	7.02	0.423	0.001603	0.05	0.471	0.000012	0.00		0.000000
22	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	0.00		0.000000	0.00	0.718	0.000000	0.01	0.718	0.000005	0.00		0.000000
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	44.03	0.109	0.007231	0.77	0.167	0.000127	0.00	0.889	0.000000	0.00	0.768	0.000000
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	3.13	0.217	0.000377	0.06	0.362	0.000008	0.00		0.000000	0.00		0.000000
29	Purse Seine	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
30	Scallop Dredge	AA	GEN	MA	all	0.00		0.000000	0.05	1.986	0.000012	0.01	1.007	0.000001	0.00		0.000000
31	Scallop Dredge	AA	GEN	NE	all	0.00		0.000000	0.07	0.446	0.000030	0.00		0.000000	0.00		0.000000
32	Scallop Dredge	AA	LIM	MA	all	0.00		0.000000	6.18	0.353	0.000106	0.19	0.410	0.000003	0.16	0.305	0.000003
33	Scallop Dredge	AA	LIM	NE	all	0.00		0.000000	25.50	0.435	0.001164	0.18	0.956	0.000008	0.01	0.959	0.000000
34	Scallop Dredge	OPEN	GEN	MA	all	0.00		0.000000	0.04	0.953	0.000032	0.00		0.000000	0.00		0.000000
35	Scallop Dredge	OPEN	GEN	NE	all	0.00		0.000000	0.48	1.491	0.000542	0.00		0.000000	0.12	1.641	0.000132
36	Scallop Dredge	OPEN	LIM	MA	all	0.00		0.000000	12.61	0.519	0.000136	0.23	0.369	0.000003	1.16	0.650	0.000012
37	Scallop Dredge	OPEN	LIM	NE	all	0.00		0.000000	10.78	0.548	0.000404	0.00		0.000000	0.02	1.000	0.000001
38	Mid-water Paired & Single Trawl	OPEN	all	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
39	Mid-water Paired & Single Trawl	OPEN	all	NE	all	0.85	0.362	0.000019	0.01	0.535	0.000000	0.00	0.540	0.000000	0.08	0.320	0.000002
41	Pots and Traps, Fish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
45	Pots and Traps, Hagfish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
TOTAL						76.24	0.085		1,319.03	0.207		952.84	0.235		500.13	0.290	

**Table 4, continued. Total discards (live, mt) with associated coefficient of variation (CV) and combined discard-to-kept (d/k) ratio, by fleet and species in 2010. Species are listed in the order of appearance in Table 1.**

Row	Gear Type	Access Area	Trip Category	Region	Mesh Group	SHAK			SKATE			DOG			FLUK		
						discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio
2	Longline	OPEN	all	NE	all	0.01	0.594	0.000010	281.53	0.160	0.197279	178.65	0.535	0.125189	0.00		0.000000
4	Hand Line	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	22.69	0.280	0.054499	0.00		0.000000
8	Otter Trawl	OPEN	all	MA	sm	349.61	0.321	0.011833	1,131.57	0.266	0.038299	921.10	0.249	0.031175	110.29	0.305	0.003733
9	Otter Trawl	OPEN	all	MA	lg	11.02	0.292	0.001275	2,678.44	0.119	0.310047	889.40	0.244	0.102954	177.49	0.206	0.020545
10	Otter Trawl	OPEN	all	NE	sm	1,158.15	0.240	0.086749	1,468.71	0.223	0.110010	941.90	0.249	0.070551	142.06	0.313	0.010641
11	Otter Trawl	OPEN	all	NE	lg	76.68	0.155	0.002582	11,902.71	0.075	0.400746	1,521.87	0.079	0.051239	347.45	0.146	0.011698
12	Scallop Trawl	AA	GEN	MA	all	0.04	1.015	0.000071	6.63	0.423	0.011170	2.55	0.437	0.004304	0.49	0.421	0.000824
14	Scallop Trawl	OPEN	GEN	MA	all	1.28	0.514	0.012867	100.42	0.193	1.008879	5.90	0.613	0.059232	1.45	0.406	0.014590
16	Otter Trawl, Ruhle	OPEN	all	NE	lg	0.23	0.107	0.002017	34.91	0.087	0.304985	2.25	0.161	0.019617	0.01	0.181	0.000098
17	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	1.47	0.199	0.000886	770.84	0.155	0.463793	79.75	0.214	0.047986	5.91	0.382	0.003559
19	Shrimp Trawl	OPEN	all	NE	all	300.50	0.275	0.068618	0.43	0.822	0.000099	1.70	0.713	0.000388	0.00		0.000000
22	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	0.00		0.000000	0.43	0.637	0.000251	21.90	0.378	0.012637	0.30	0.962	0.000172
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	0.00		0.000000	6.07	0.405	0.003225	48.66	0.629	0.025862	0.23	1.009	0.000123
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	0.00		0.000000	379.24	0.281	0.134824	32.41	0.246	0.011521	3.60	0.213	0.001278
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	7.90	0.225	0.001298	80.36	0.122	0.013196	1,393.29	0.099	0.228781	0.80	0.483	0.000131
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	0.21	0.305	0.000025	776.81	0.129	0.093432	100.05	0.136	0.012034	15.90	0.210	0.001912
29	Purse Seine	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	1.29	1.054	0.000152	0.00		0.000000
30	Scallop Dredge	AA	GEN	MA	all	0.19	0.582	0.000044	186.85	0.542	0.041814	6.92	0.834	0.001548	30.36	0.609	0.006794
31	Scallop Dredge	AA	GEN	NE	all	0.20	0.517	0.000088	53.21	0.126	0.022944	0.14	0.748	0.000061	0.64	0.426	0.000275
32	Scallop Dredge	AA	LIM	MA	all	5.70	0.297	0.000098	2,707.95	0.110	0.046307	87.71	0.172	0.001500	331.51	0.127	0.005669
33	Scallop Dredge	AA	LIM	NE	all	3.16	0.282	0.000144	418.28	0.205	0.019089	10.06	0.226	0.000459	13.34	0.216	0.000609
34	Scallop Dredge	OPEN	GEN	MA	all	0.03	0.909	0.000027	66.87	0.392	0.060330	0.11	0.606	0.000095	6.75	0.552	0.006093
35	Scallop Dredge	OPEN	GEN	NE	all	0.01	0.488	0.000017	54.96	0.594	0.061877	0.05	1.491	0.000060	0.07	1.574	0.000083
36	Scallop Dredge	OPEN	LIM	MA	all	13.51	0.233	0.000145	7,508.72	0.133	0.080874	63.93	0.205	0.000689	436.56	0.152	0.004702
37	Scallop Dredge	OPEN	LIM	NE	all	2.27	0.498	0.000085	807.16	0.271	0.030247	30.50	0.328	0.001143	20.96	0.307	0.000785
38	Mid-water Paired & Single Trawl	OPEN	all	MA	all	0.00		0.000000	0.00		0.000000	108.49	0.303	0.006132	0.00		0.000000
39	Mid-water Paired & Single Trawl	OPEN	all	NE	all	0.26	0.497	0.000006	0.25	0.276	0.000006	94.76	0.298	0.002163	0.00		0.000000
41	Pots and Traps, Fish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
45	Pots and Traps, Hagfish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
TOTAL						1,932.45	0.161		31,423.37	0.048		6,568.02	0.068		1,646.17	0.071	

**Table 4, continued. Total discards (live, mt) with associated coefficient of variation (CV) and combined discard-to-kept (d/k) ratio, by fleet and species in 2010. Species are listed in the order of appearance in Table 1.**

Row	Gear Type	Access Area	Trip Category	Region	Mesh Group	TILE			WHAK			WIND			WINT		
						discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio	discards	CV	combined d/k ratio
2	Longline	OPEN	all	NE	all	0.00		0.000000	1.37	0.290	0.000958	0.02	0.802	0.000015	0.09	0.389	0.000061
4	Hand Line	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
8	Otter Trawl	OPEN	all	MA	sm	0.79	0.360	0.000027	0.10	0.562	0.000003	43.56	0.326	0.001474	31.58	0.269	0.001069
9	Otter Trawl	OPEN	all	MA	lg	0.00		0.000000	1.01	0.912	0.000117	133.95	0.142	0.015505	60.80	0.190	0.007038
10	Otter Trawl	OPEN	all	NE	sm	4.07	0.620	0.000305	11.17	0.848	0.000836	13.67	0.301	0.001024	217.25	0.263	0.016272
11	Otter Trawl	OPEN	all	NE	lg	0.24	0.386	0.000008	26.50	0.148	0.000892	223.00	0.137	0.007508	60.92	0.150	0.002051
12	Scallop Trawl	AA	GEN	MA	all	0.00		0.000000	0.00		0.000000	0.23	0.414	0.000394	0.00		0.000000
14	Scallop Trawl	OPEN	GEN	MA	all	0.00		0.000000	0.06	1.511	0.000653	1.13	0.814	0.011393	1.18	0.419	0.011820
16	Otter Trawl, Ruhle	OPEN	all	NE	lg	0.00		0.000000	0.01	0.104	0.000052	0.80	0.190	0.006985	0.27	0.198	0.002335
17	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	0.01	0.877	0.000004	0.58	0.199	0.000346	5.56	0.139	0.003348	2.83	0.511	0.001701
19	Shrimp Trawl	OPEN	all	NE	all	0.00		0.000000	4.74	0.342	0.001083	3.14	0.568	0.000716	7.13	0.409	0.001627
22	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	0.00		0.000000	0.00		0.000000	0.04	1.146	0.000022	0.00		0.000000
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	0.00		0.000000	0.00		0.000000	0.38	0.534	0.000201	0.04	1.166	0.000019
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	0.00		0.000000	0.00		0.000000	0.02	3.455	0.000008	0.00		0.000000
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	0.00		0.000000	22.54	0.249	0.003702	0.45	0.287	0.000074	3.87	0.161	0.000636
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	0.50	0.611	0.000060	0.72	0.290	0.000087	0.05	0.371	0.000006	0.91	0.618	0.000109
29	Purse Seine	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
30	Scallop Dredge	AA	GEN	MA	all	0.00		0.000000	0.23	0.825	0.000052	0.08	0.530	0.000017	0.81	0.954	0.000181
31	Scallop Dredge	AA	GEN	NE	all	0.00		0.000000	0.00		0.000000	1.70	0.498	0.000734	2.46	0.397	0.001060
32	Scallop Dredge	AA	LIM	MA	all	0.00		0.000000	0.51	0.424	0.000009	37.79	0.481	0.000646	0.34	0.783	0.000006
33	Scallop Dredge	AA	LIM	NE	all	0.00		0.000000	0.19	0.503	0.000009	12.47	0.252	0.000569	24.53	0.232	0.001120
34	Scallop Dredge	OPEN	GEN	MA	all	0.00		0.000000	0.00		0.000000	1.83	0.444	0.001653	0.13	0.724	0.000113
35	Scallop Dredge	OPEN	GEN	NE	all	0.00		0.000000	0.00		0.000000	2.71	0.995	0.003055	1.60	0.841	0.001800
36	Scallop Dredge	OPEN	LIM	MA	all	0.00		0.000000	7.31	0.651	0.000079	129.00	0.285	0.001389	16.07	0.454	0.000173
37	Scallop Dredge	OPEN	LIM	NE	all	0.00		0.000000	1.96	0.916	0.000073	21.02	0.571	0.000788	78.15	0.177	0.002929
38	Mid-water Paired & Single Trawl	OPEN	all	MA	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
39	Mid-water Paired & Single Trawl	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00	0.540	0.000000	0.01	0.540	0.000000
41	Pots and Traps, Fish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
45	Pots and Traps, Hagfish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000	0.00		0.000000	0.00		0.000000
TOTAL						5.60	0.457		79.01	0.163		632.61	0.092		510.96	0.121	

Table 4, continued. Total discards (live, mt) with associated coefficient of variation (CV) and combined discard-to-kept (d/k) ratio, by fleet and species in 2010. Species are listed in the order of appearance in Table 1.

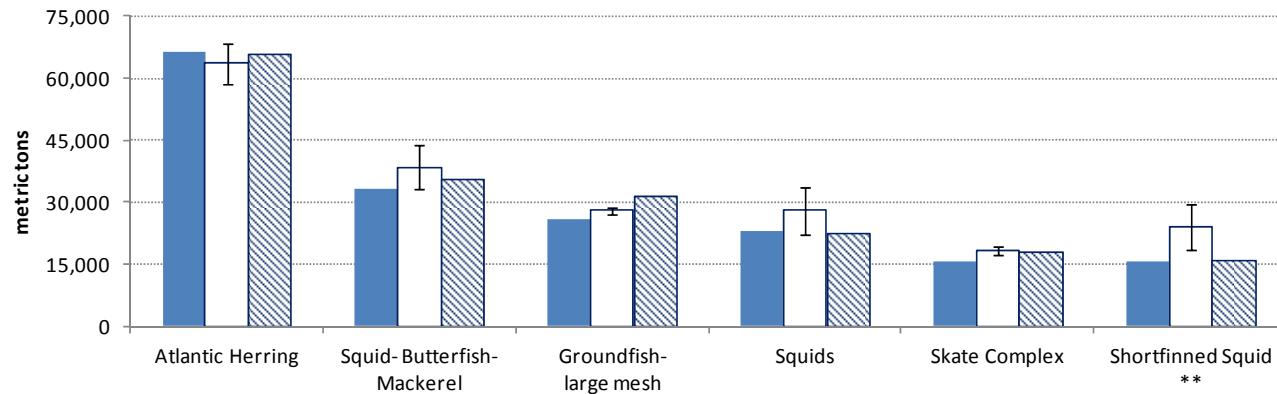
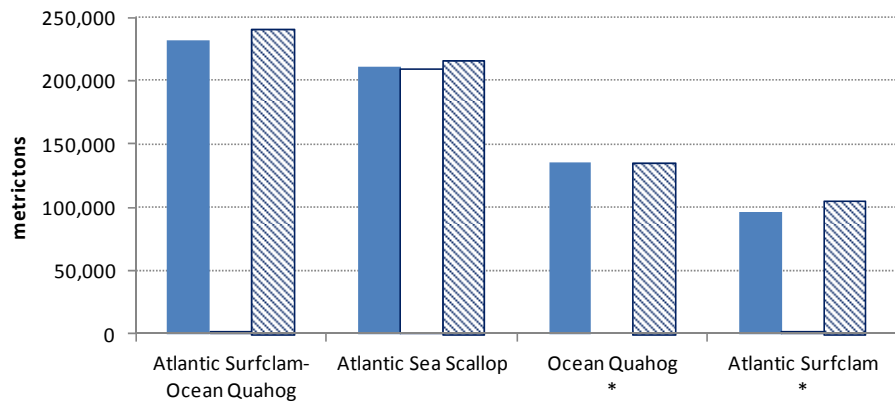
Row	Gear Type	Access Area	Trip Category	Region	Mesh Group	WIT			YT		
						discards	CV	combined d/k ratio	discards	CV	combined d/k ratio
2	Longline	OPEN	all	NE	all	0.00		0.000000	0.04	0.522	0.000025
4	Hand Line	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000
8	Otter Trawl	OPEN	all	MA	sm	8.57	0.306	0.000290	2.71	0.565	0.000092
9	Otter Trawl	OPEN	all	MA	lg	6.68	0.570	0.000774	0.56	0.875	0.000065
10	Otter Trawl	OPEN	all	NE	sm	30.15	0.625	0.002258	66.85	0.260	0.005007
11	Otter Trawl	OPEN	all	NE	lg	98.57	0.083	0.003319	244.29	0.222	0.008225
12	Scallop Trawl	AA	GEN	MA	all	0.00		0.000000	0.00		0.000000
14	Scallop Trawl	OPEN	GEN	MA	all	0.04	1.017	0.000389	2.86	0.302	0.028743
16	Otter Trawl, Ruhle	OPEN	all	NE	lg	0.01	0.721	0.000108	0.94	0.182	0.008221
17	Otter Trawl, Haddock Separator	OPEN	all	NE	lg	0.62	0.201	0.000376	9.80	0.187	0.005898
19	Shrimp Trawl	OPEN	all	NE	all	3.45	0.417	0.000787	1.19	0.474	0.000273
22	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	0.00		0.000000	0.00		0.000000
23	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	0.00		0.000000	0.00		0.000000
24	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	0.00		0.000000	0.00		0.000000
26	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	0.37	0.156	0.000061	29.94	0.196	0.004916
27	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	0.05	0.305	0.000007	0.19	0.342	0.000023
29	Purse Seine	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000
30	Scallop Dredge	AA	GEN	MA	all	0.10	0.538	0.000023	0.00		0.000000
31	Scallop Dredge	AA	GEN	NE	all	0.03	1.003	0.000014	1.43	0.240	0.000615
32	Scallop Dredge	AA	LIM	MA	all	9.95	0.265	0.000170	0.10	0.516	0.000002
33	Scallop Dredge	AA	LIM	NE	all	0.20	0.818	0.000009	12.22	0.249	0.000558
34	Scallop Dredge	OPEN	GEN	MA	all	0.01	1.250	0.000009	0.27	0.445	0.000247
35	Scallop Dredge	OPEN	GEN	NE	all	0.01	1.491	0.000012	4.15	1.014	0.004671
36	Scallop Dredge	OPEN	LIM	MA	all	9.85	0.455	0.000106	89.74	0.270	0.000967
37	Scallop Dredge	OPEN	LIM	NE	all	0.21	0.543	0.000008	21.59	0.436	0.000809
38	Mid-water Paired & Single Trawl	OPEN	all	MA	all	0.00		0.000000	0.00		0.000000
39	Mid-water Paired & Single Trawl	OPEN	all	NE	all	0.00	0.384	0.000000	0.00		0.000000
41	Pots and Traps, Fish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000
45	Pots and Traps, Hagfish	OPEN	all	NE	all	0.00		0.000000	0.00		0.000000
TOTAL						168.90	0.129		488.88	0.129	

**Table 5. 2010 Vessel Trip Report landings (kept; live mt), dealer landings (live mt), and estimated landings (live, mt) based on Northeast Fisheries Observer Program data with associated coefficient of variation (CV) and 95% confidence interval for 33 species and 7 species groups. Species are listed in the order of appearance in Table 1; Atlantic salmon is not included due to zero landings.**

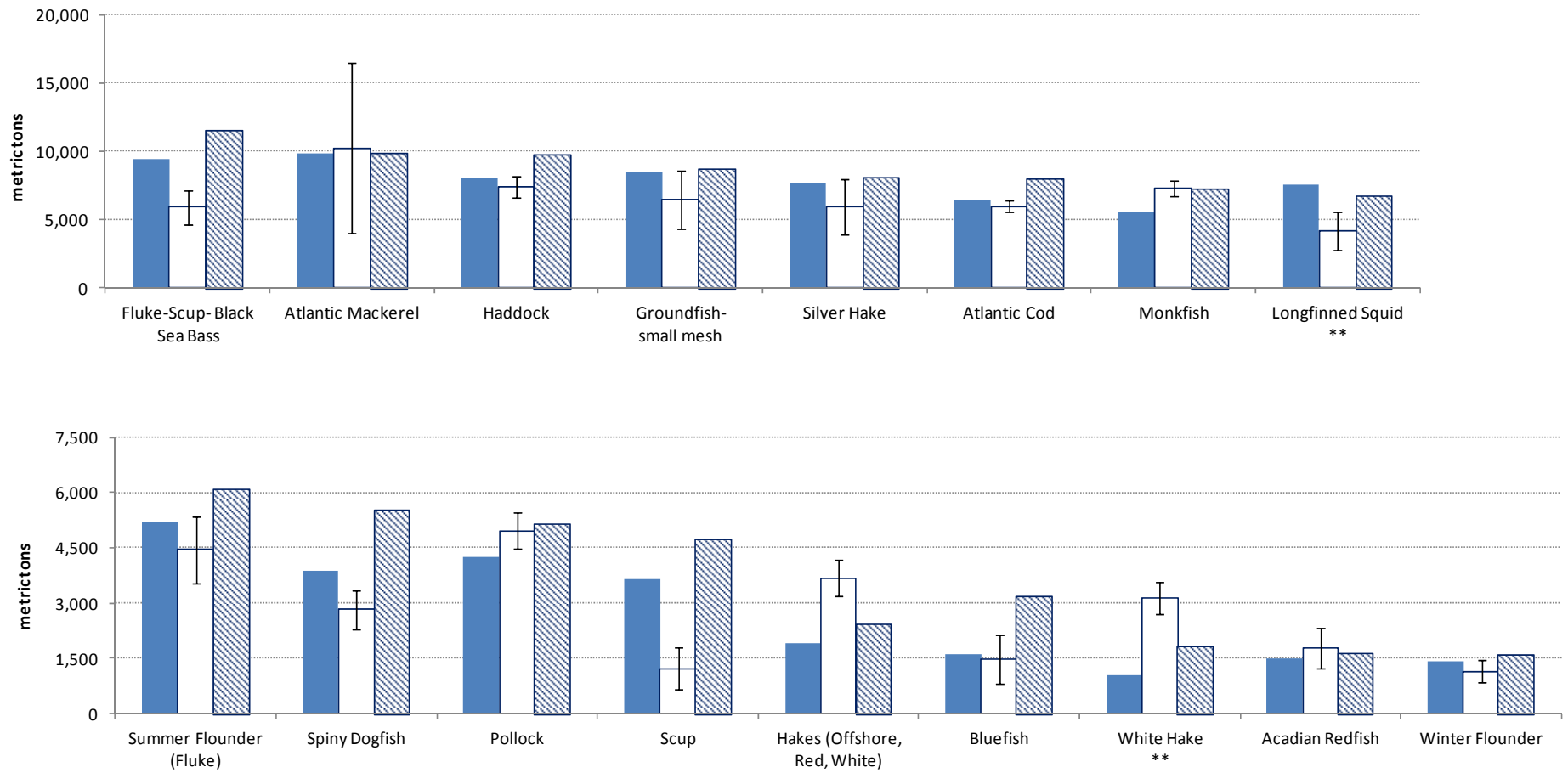
Species	VTR Landings	Dealer Landings	Estimated Landings	CV	CI-lower	CI-upper
Acadian Redfish	1,487	1,646	1,787	0.158	1,233	2,341
American Plaice	1,303	1,413	1,636	0.066	1,424	1,849
Atlantic Cod	6,458	8,041	5,991	0.034	5,597	6,385
Atlantic Halibut	7	25	10	0.105	8	12
Atlantic Herring	66,343	65,733	63,587	0.039	58,775	68,399
Atlantic Mackerel	9,795	9,877	10,244	0.312	3,975	16,512
Atlantic Sea Scallop	211,231	215,586	208,791	0.000	208,626	208,957
* Atlantic Surfclam	96,872	104,682	2	1.054	-2	5
Atlantic Wolffish	2	3	2	0.228	1	3
Black Sea Bass	570	786	230	0.284	102	358
Bluefish	1,596	3,164	1,471	0.226	819	2,124
Butterfish	492	576	225	0.181	145	304
* Deep Sea Red Crab	1,396	1,417	0	0.118	0	0
Haddock	8,045	9,811	7,422	0.054	6,630	8,213
** Longfinned Squid	7,590	6,749	4,169	0.171	2,771	5,568
Monkfish	5,550	7,270	7,317	0.038	6,775	7,859
Ocean Pout	1	0	0	0.490	0	1
* Ocean Quahog	134,982	134,986	0	0.000	0	0
** Offshore Hake	120	10	263	0.290	114	412
Pollock	4,244	5,158	4,971	0.050	4,481	5,461
** Red Hake	735	603	272	0.233	148	396
Scup	3,649	4,724	1,227	0.238	655	1,800
** Shortfinned Squid	15,463	15,825	23,924	0.119	18,349	29,499
Silver Hake	7,650	8,078	5,939	0.176	3,893	7,984
Skate Complex	15,456	17,861	18,320	0.032	17,178	19,463
Spiny Dogfish	3,885	5,509	2,827	0.095	2,298	3,355
Summer Flounder (Fluke)	5,195	6,072	4,444	0.105	3,532	5,356
* Tilefish	803	922	15	0.277	7	23
** White Hake	1,060	1,807	3,150	0.071	2,713	3,588
Windowpane Flounder	24	54	12	0.375	3	20
Winter Flounder	1,429	1,587	1,149	0.137	841	1,456
Witch Flounder	700	759	887	0.054	794	980
Yellowtail Flounder	1,271	1,319	940	0.090	775	1,105
Total of single species	615,405	642,052	381,223	0.014	370,980	391,466
Fluke-Scup-Black Sea Bass	9,415	11,583	5,902	0.107	4,665	7,139
Groundfish - large mesh	26,032	31,622	27,956	0.016	27,082	28,831
Groundfish - small mesh	8,505	8,692	6,473	0.168	4,337	8,610
Squid-Butterfish-Mackerel	33,341	35,615	38,567	0.073	33,057	44,077
Surfclam-Ocean Quahog	231,854	239,668	2	1.054	-2	5
Hakes (Offshore, Red, White)	1,915	2,421	3,685	0.066	3,206	4,164
Squids (Illex and Loligo)	23,054	22,574	28,093	0.10	22,346	33,841

\* These species have gear-specific, directed fisheries that were not observed in 2010.

\*\* Potential “mixed” species: squid unknown, and red, offshore and white hake mix.



**Figure 1. Vessel Trip Report landings (kept; live mt; shaded blue bar), estimated landings (live, mt; open bar) based on Northeast Fisheries Observer Program data with associated 95% confidence error bars, and Dealer landings (live, mt; hatched bar) in 2010, for 33 species and 7 species groups. Plots are ordered by scale. Species marked with a star (\*) have gear-specific, directed fisheries that were not observed in 2010. Species marked with a double star (\*\*) are potentially “mixed” species: squid unknown, and red, offshore, and white hake mix.**



**Figure 1, continued. Vessel Trip Report landings (kept; live mt; shaded bar), estimated landings (live, mt; open bar) based on Northeast Fisheries Observer Program data with associated 95% confidence error bars, and Dealer landings (live, mt; hatched bar) in 2010, for 33 species and 7 species groups. Plots are ordered by scale. Species marked with a star (\*) have gear-specific, directed fisheries that were not observed in 2010. Species marked with a double star (\*\*) are potentially "mixed" species: squid unknown, and red, offshore, and white hake mix.**



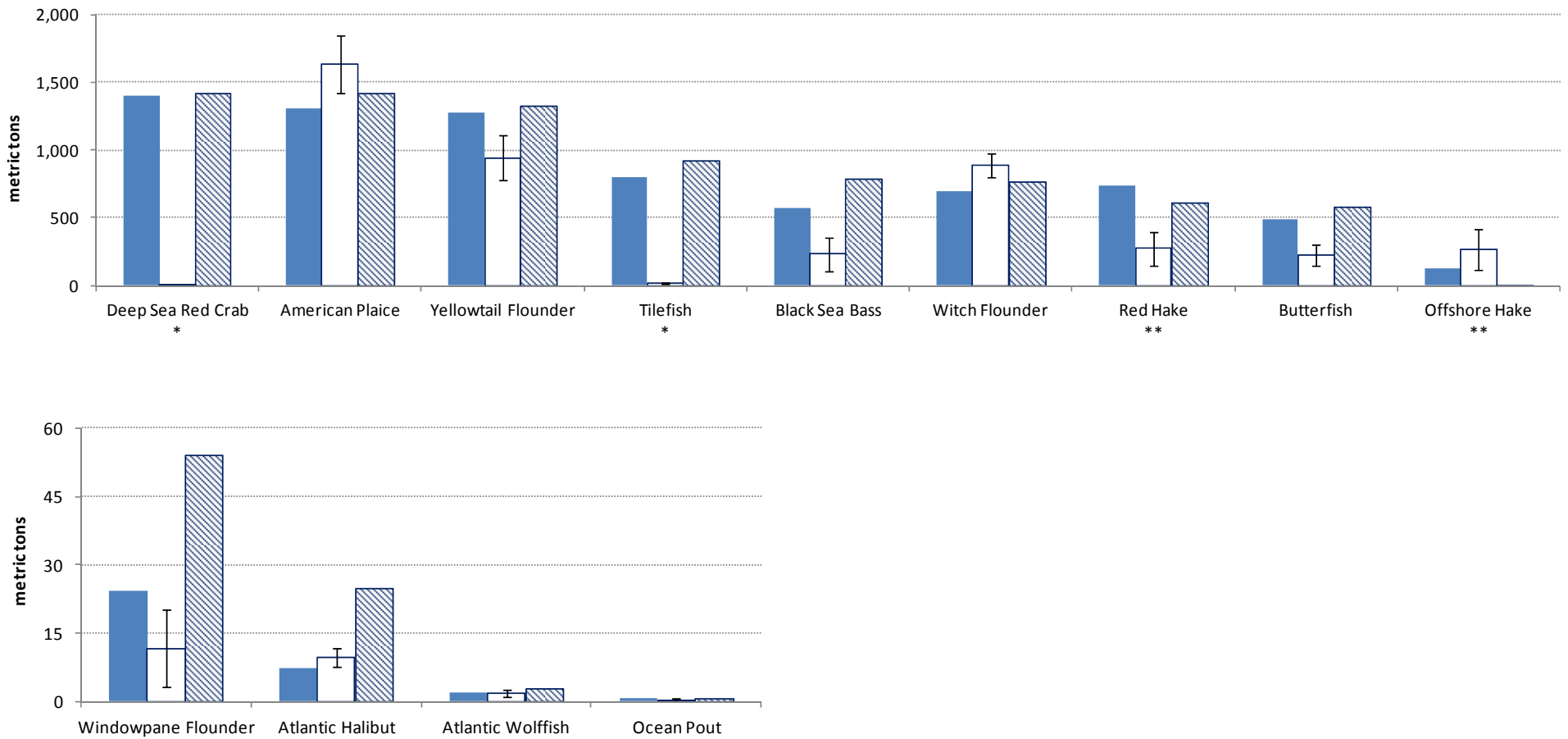


Figure 1, continued. Vessel Trip Report landings (kept; live mt; shaded bar), estimated landings (live, mt; open bar) based on Northeast Fisheries Observer Program data with associated 95% confidence error bars, and Dealer landings (live, mt; hatched bar) in 2010, for 33 species and 7 species groups. Plots are ordered by scale. Species marked with a star (\*) have gear-specific, directed fisheries that were not observed in 2010. Species marked with a double star (\*\*) are potentially “mixed” species: squid unknown, and red, offshore, and white hake mix.

# APPENDIX: OVERVIEW OF 2009-2012 VMS ANALYTICAL DATASETS

*Murali Mood and Michael Palmer, NEFSC Population Dynamics*

## Rationale

Beginning in 2009, the Vessel Monitoring System (VMS) data available at the Northeast Fisheries Science Center (NEFSC) came from the HQ-based VMS system. Previously, the dataset available for NEFSC staff contained basic information on VMS activity declaration and vessel name and hull identifier. The content of these data fields both in the historical dataset as well as in the current data set is uncertain and in cases, questionable. For this reason when the data pull for the 2009-present data was initially constructed, these fields were not included. This initiative reflects an attempt to construct a clean VMS analytical set that contains as accurate information as is available in the core data sources (VMS, Allocation Management System [AMS], permits, Vessel Trip Report [VTR], and Observer Database [OBDBS]). Currently these products are available from 2009 onward. Subsequent work will explore extending this time series back in time as supported by the underlying data sets.

## Table/view Summary

**T\_TRIP\_OBS\_VMS\_VTR\_yyyy (table):** Base table that contains the full matched set of VMS positions, AMS activity declarations, VTR trips and observer trips.

Matching procedures (Appendix Figure 1):

1. VTR data (from VESLOG series) matched using outer join on permit number or hull identifier and trip midpoint. The VESLOG trip midpoint is matched between the OBDBS sail and landing dates. *\*note VESLOG.TRIPID has been re-coded as DOCID.*
  - Outer join condition:  $((\text{obtrp.hullnum1} = \text{veslog.hullnum}) \text{ OR } (\text{obtrp.permit1} = \text{veslog.permit})) \text{ AND } (\text{veslog.datesail} + (\text{veslog.date1nd1} - \text{veslog.datesail}) / 2) \text{ BETWEEN } \text{obtrp.datesail} \text{ AND } \text{obtrp.dateland}$
2. The VTR/Observer data product was matched to AMS (TRP) data using an outer join on permit number **or** hull identifier and the trip midpoint. The VESLOG trip midpoint is matched between AMS sail and landing dates.
  - Outer join condition:  $\text{trp.permit\_nbr} = \text{veslog.permit} \text{ AND } (\text{veslog.date\_sail} + (\text{veslog.date\_land} - \text{veslog.date\_sail}) / 2) \text{ BETWEEN } \text{trp.date\_sail} \text{ AND } \text{trp.date\_land}$
  - Join to the observer data uses the permit number preferentially, if available, then hull identifier.
3. VMS positions were joined to activity declarations using permit number and trip sail/end dates (i.e., pull all VMS positions within the AMS trip/sail dates). **VMS positions were adjusted from GMT to local time prior to the join.**
  - i. Outer join condition:  $\text{T.permit} = \text{VMS.vessel\_permit} \text{ AND } \text{vms.pos\_sent\_date} \text{ BETWEEN } \text{T.date\_sail} \text{ AND } \text{T.date\_land}$ . Note: “T” here is data from step 2 (VTR/Observer join to AMS data).

- ii. Since the interest is only in AMS trips with VMS positional info, trips with AMS.TRIP\_SOURCE='VMS'.
- iii. A trip is included in a calendar year based on the date of landing.
- iv. Occasionally, the QA/QC team at RO invalidates some trips by making the activity codes as 'XXX-XXX-XXXXXX'. These trips are either short duration trips, which can be stitched with the actual trip preceding or succeeding this or just flyers. Most of these are scallop trips. These trips are excluded from the AMS data.

**V\_YYYY\_TRIP\_MATCH\_VMS (view):** This is the base analytical view. It contains all VMS positions that could be matched to an AMS trip. It also includes the VTR DOCID (from VESLOG) and OBDBS.LINK1 where a match exists. The match between AMS and VMS is an inner join, the match between AMS/VMS and VTR and OBDBS is a left join (includes only VTR and OBDBS trips than can be matched to the AMS/VMS set). See matching rules outlined above. Complete documentation of the fields contained in this view is presented in Appendix Table 1.

**V\_YYYY\_TRIP\_NOVMS (view):** These are AMS trips that have no corresponding VMS position information.

**V\_YYYY\_VMS\_NOTRIP (view):** These are VMS positions that have no matching AMS trip information.

## Duplicate Matches

Data quality reviews on the 2011 data revealed the presence of approximately 500 trips where multiple matches existed across databases. For example, single AMS trips would match to multiple VTR trips if an AMS trip had prolonged sail dates (e.g., tripid 557451 has date\_sail of 12/10/2010 and date\_land of 2/17/2011). This trip would match to many DOCID/LINK1 values. The matched trips have been excluded from the analytical data set and isolated into individual views depending on the type of duplication. There are three categories of duplication which are summarized below:

**MV\_YYYY\_DUPES\_DAS\_ID:** *AMS matches to multiple OBDBS, VTR.*

**MV\_YYYY\_DUPES\_DOCID:** *VTR matches to multiple OBDBS, AMS.*

**MV\_YYYY\_DUPES\_LINK1:** *OBDBS matches to multiple VTR, AMS.*

These duplicate matches should be periodically evaluated and forwarded to the appropriate contacts so that data issues can be addressed in the base data sets (AMS, VTR or OBDBS). By querying the primary key in these views back with the T\_TRIP\_OBS\_VMS\_VTR\_YYYY table, the matched trips from the corresponding database can be determined and investigated.

## Calculated Speed and Course

The base VMS data contains both speed and course information. Previous experience with VMS data has found these values to be occasionally unreliable when compared to speed and course estimates calculated from the previous VMS position. Most notably, the VMS data

contain course values of 0 in situations where there is no movement between subsequent positions and course cannot be defined.

An analysis was conducted to compare the speed and course data to the corresponding calculated values. Speeds were calculated based on the Haversine distance equation (Sinnott 1984) from the previous vessel position fields in the VMS data (PREV\_LAT\_GIS, PREV\_LON\_GIS, PREV\_POS\_SENT\_DATE). The Haversine distance equation utilizes an approximation of earth curvature that should be sufficient at the scales associated with VMS data.

Results of the speed and course comparison are shown in Appendix Figures 2 and 3, respectively. In general, the data and calculated values agree, but there are notable ‘runs’ in the data values compared to the calculate values. For example, the calculated speed values show much greater variability than the VMS data values at 0, 3, 6, 9, 12, 15, and 18 knots. **The regularity of the ‘run’ increments suggests that there is some rounding of the VMS data values and argues for use of the calculated values over the values reported in the base VMS data.**

The calculated speed and course values make use of the previous vessel position fields in the VMS data (PREV\_LAT\_GIS, PREV\_LON\_GIS, PREV\_POS\_SENT\_DATE). Since these data would be used as the basis of the calculated speed and course fields, a quick check was conducted to evaluate the accuracy of these data compared to calculated previous positional points, which were calculated using a lag procedure. Once the previous position was calculated, speed and course were calculated. These calculated speed and course values were then compared to the corresponding metrics calculated from the previous vessel position fields in the VMS data (PREV\_LAT\_GIS, PREV\_LON\_GIS, PREV\_POS\_SENT\_DATE). The results of this comparison show that there are no differences in the speed or course values calculated from either approach (Appendix Figures 4 and 5). **Because there are no differences, the calculated speed and course data contained in the analytical set will be based on the previous vessel position fields in the VMS data (PREV\_LAT\_GIS, PREV\_LON\_GIS, PREV\_POS\_SENT\_DATE).**

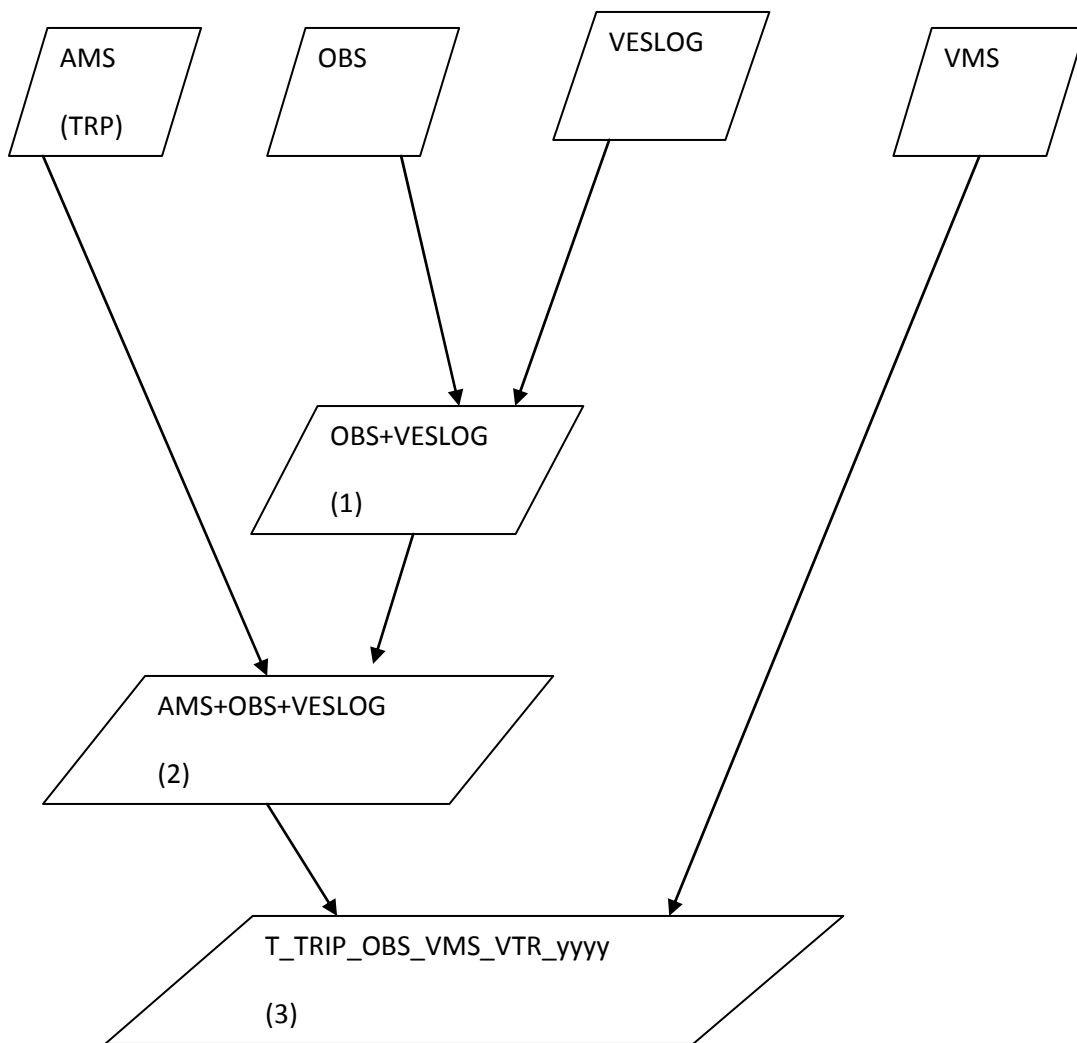
It should be noted that in the 2011 data used for development of the analytical data set 15 records were missing previous position and datetime info (i.e., null). For these records the calculated speed and course cannot be determined. This represents a very small percentage of the total VMS positions available (<0.1 %) and is thus not considered to be problematic.

## REFERENCE CITED

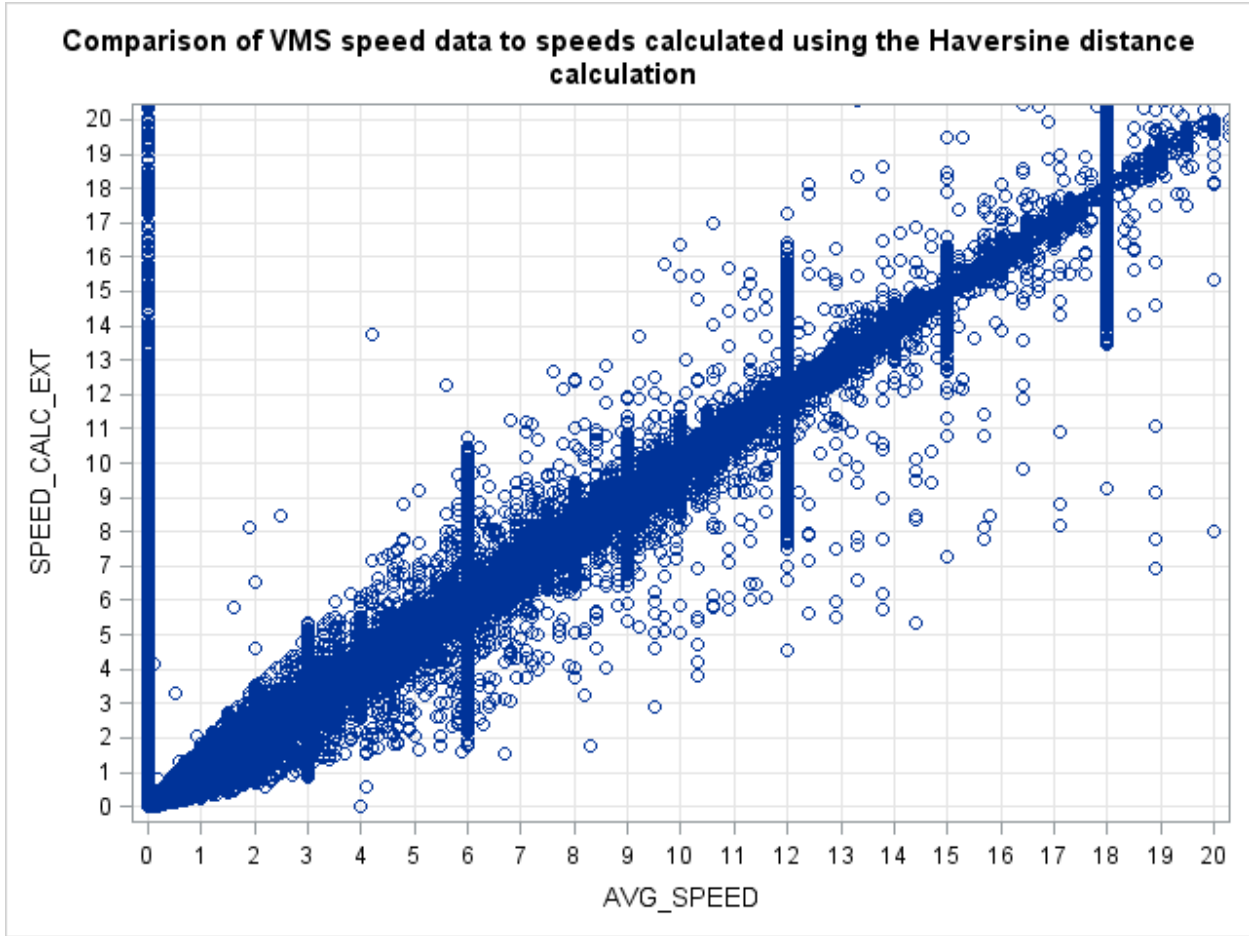
Sinnott, R.W., 1984. Virtues of the haversine. *Sky Telescope* 68, 159.

**Appendix Table 1. Description of the fields contained in the base analytical tables, V\_YYYY\_TRIP\_MATCH\_VMS.**

Field	Data Type	Description	Source
PERMIT	Number	Vessel's federal permit number	NOVA.VMS.VMSyyyy.VESSEL_PERMIT
VESSEL_HULL_ID	Varchar2 (10)	Official vessel registration number painted on the hull. US Coast Guard, state or tribal registration number. Unkown=blank/null.	Derived from the SOLE.PERMIT database based on the permit, date_sail and activity code from the trip table. This method has limitations such as not being able to get the FMP from a DOF trip declaration. In these cases the value is set to a null value.
TRIP_ID	Number (10)	This is the ID field in the VMS dataset. Since this field is not contained in the	NOVA.AMS.TRIP.DAS_ID
DAS_ID	Number (10)	This is the unique identifier of the SOLE.AMS.TRIP table.	NOVA.AMS.TRIP.TRIP_ID
ACTIVITY_CODE	Varchar2 (20)	The VMS activity code declared by the vessel.	NOVA.AMS.TRIP.ACTIVITY_CODE
DATE_SAIL	Date	The date (and time) the trip sailed by ams definition (typically the date the vessel crosses the VMS demarcation line).	NOVA.AMS.TRIP.DATE_SAIL
DATE_LAND	Date	The date (and time) the trip ended by ams definition (typically the date the vessel crosses the VMS demarcation line).	NOVA.AMS.TRIP.DATE_LAND
POS_SENT_DATE	Date	The date (and time) the positional information was sent from the VMS unit.	NOVA.VMS.VMSyyyy.POS_SENT_DATE
LAT_GIS	Varchar2 (11)	The vessels latitude at the time the position information was sent from the VMS unit (decmlinal degrees).	NOVA.VMS.VMSyyyy.LAT_GIS
LON_GIS	Varchar2 (11)	The vessels longitude at the time the position information was sent from the VMS unit (decmlinal degrees).	NOVA.VMS.VMSyyyy.LON_GIS
PREV_POS_SENT_DATE	Date	The previous date (and time) the vessel transmitted positional information from the VMS.	NOVA.VMS.VMSyyyy.PREV_POS_SENT_DATE
PREV_LAT_GIS	Varchar2 (11)	The vessels latitude at the previous position (decmlinal degrees).	NOVA.VMS.VMSyyyy.PREV_LAT_GIS
PREV_LON_GIS	Varchar2 (11)	The vessels longitude at the previous position (decmlinal degrees).	NOVA.VMS.VMSyyyy.PREV_LON_GIS
VMS_AVG_COURSE	Number (3)	<b>Vessel course (degrees). Use with caution!</b>	NOVA.VMS.VMSyyyy.AVG_COURSE
VMS_AVG_SPEED	Number (4,1)	<b>Vessel speed (knots). Use with caution!</b>	NOVA.VMS.VMSyyyy.AVG_SPEED
CALC_AVG_SPEED	Number	Calculated vessel speed (knots) from positional and previous positional information.	
CALC_AVG_COURSE	Number	Calculated vessel course (degrees) from positional and previous positional information.	
HULLNUM	Varchar2 (10)	Hull identifier from matched VTR or observer trips. When the trip can be matched to both VTR and observer data, the hull identifier is taken preferentially from the VTR data.	SOLE.VTR.VESLOGyyyyT.HULLNUM or NOVA.OBDBS.OBTRP.HULLNUM1
DOCID	Number	The primary key in the VTR VESLOGyyyyT table	SOLE.VTR.VESLOGyyyyT.TRIPID
LINK1	Varchar2 (15)	The primary key in the OBTRP table	NOVA.OBDBS.OBTRP.LINK1

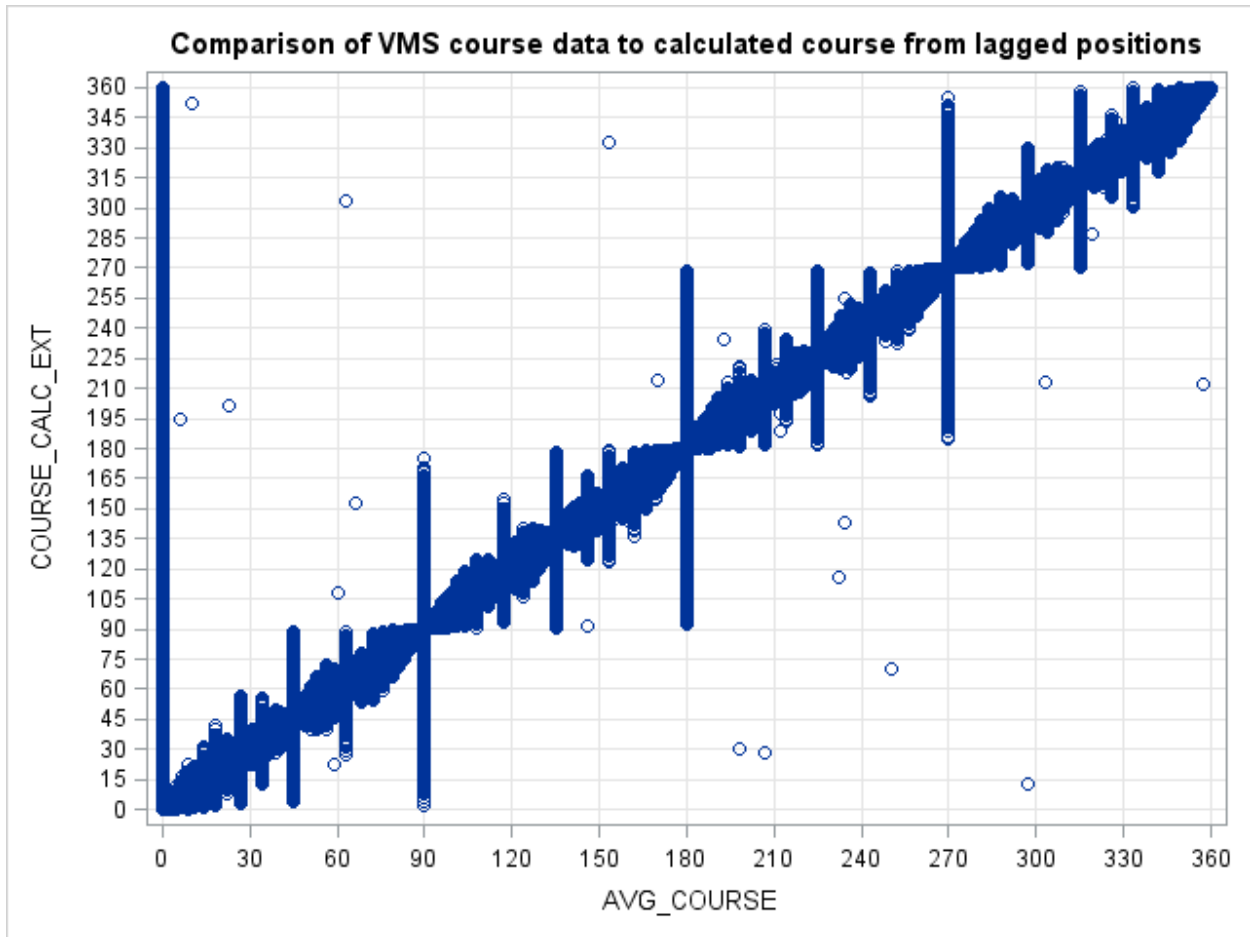


**Appendix Figure 1. Schematic diagram of the data set joins used to generate the final T\_TRIP\_OBS\_VMS\_VTR\_yyyy product.**

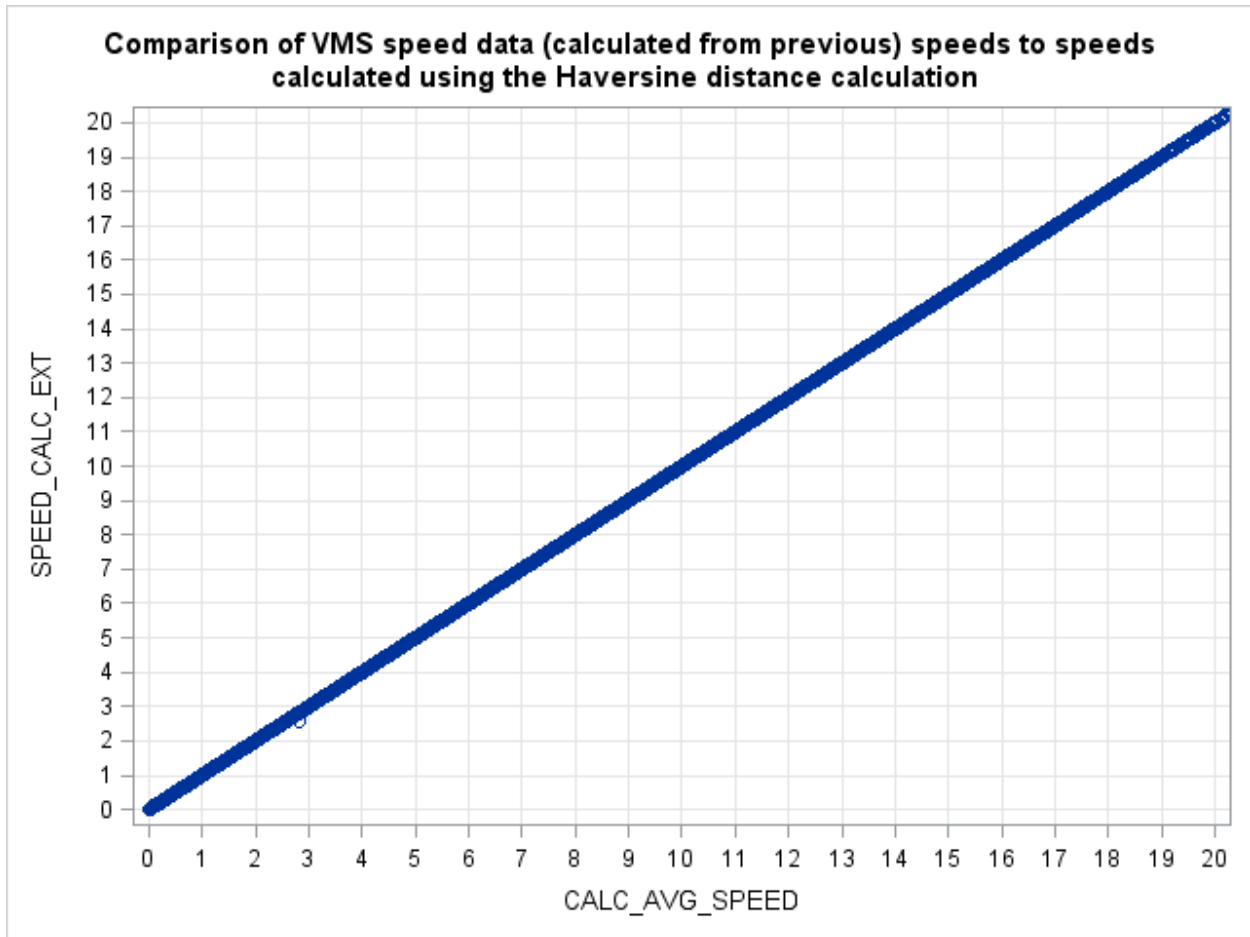


**Appendix Figure 2. Comparison of the calculated average speed (CALC\_AVG\_SPEED) in knots to the speed value contained in the VMS data (VMS\_AVG\_SPEED).**

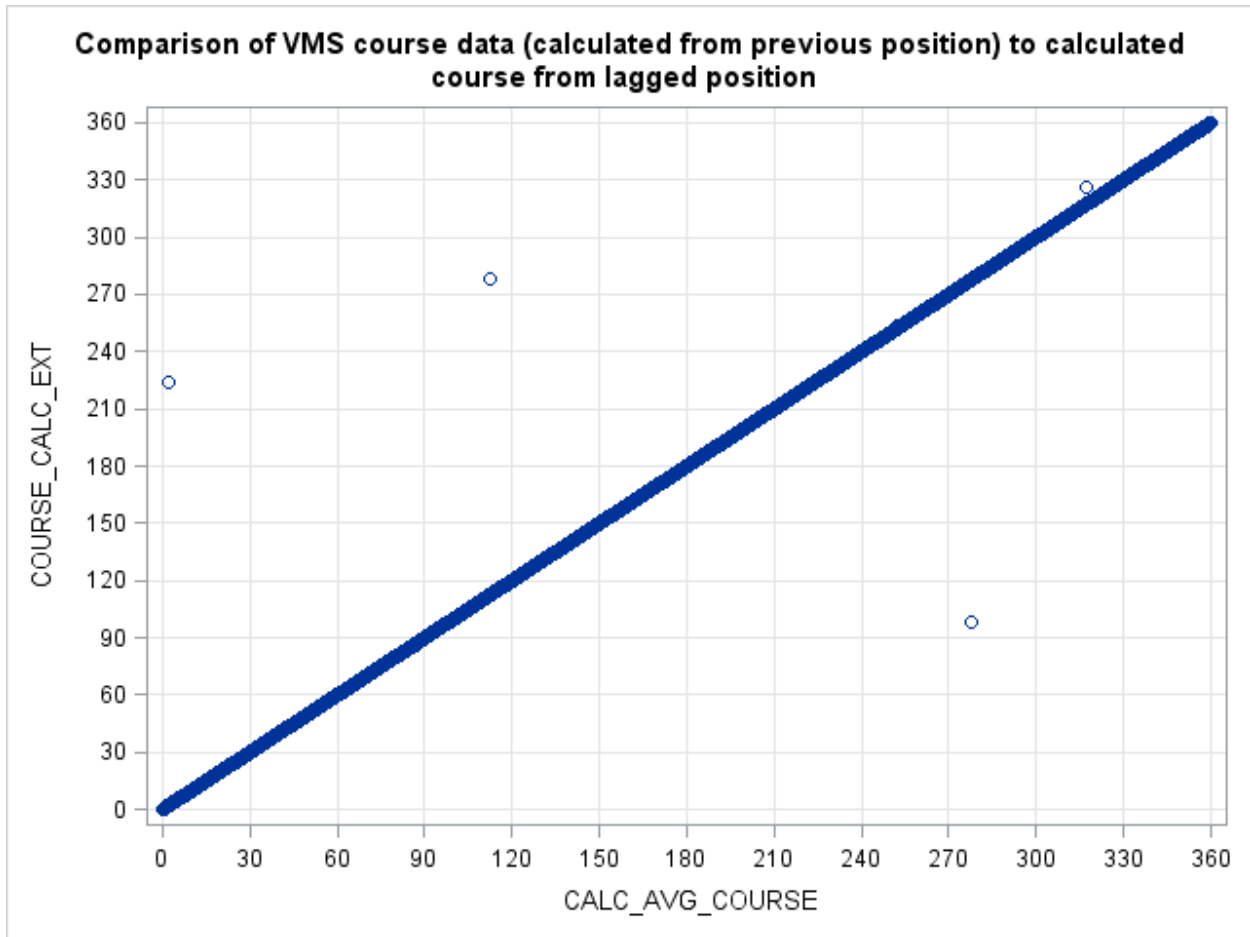




**Appendix Figure 3. Comparison of the calculated average course (CALC\_AVG\_COURSE) in degrees to the course value contained in the VMS data (VMS\_AVG\_COURSE).**



**Appendix Figure 4. Comparison of the average speed calculated from a determined previous position (SPEED\_CALC\_EXT) to the average speed calculated from the previous position reported in the VMS data (CALC\_AVG\_SPEED).**



**Appendix Figure 5. Comparison of the average course calculated from a determined previous position (COURSE\_CALC\_EXT) to the average course calculated from the previous position reported in the VMS data (CALC\_AVG\_COURSE).**

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