Standardized Bycatch Reporting Methodology
Sea Day Analysis and Prioritization
2010

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Executive Summary

This report is an analysis of the expected coverage by at-sea observers for Northeast fisheries for the April 2010 to March 2011 period using the Standardized Bycatch Reporting Methodology (SBRM). The sea days needed to achieve the precision-based performance goals (30% CV) were updated using July 2008 to June 2009 data. The Council and public have an opportunity to consider and provide input into decisions regarding prioritization of at-sea observer coverage allocations, if the expected resources necessary may not be available to achieve CV-based performance goals. A total of 14,147 sea days are needed to monitor 51 fleets. For the April 2010 to March 2011 period, current agency funding[1] is available for 10,965 sea days along with an estimated industry funded of 4,000 days for a total of 14,965 sea days. While the total available days exceeds those required by 818 days, constraints on funding result in desired coverage levels in some fleets. Funding constraints relate specifically to the Congressional language that specifies the target species groups and the source (public or industry) of the funds. The prioritized sea day allocation is provided, along with two alternative allocations, as specified by the SBRM Omnibus Amendment.

The analytical basis for allocation of future sea day coverage rests on a target level of precision (i.e., 30% CV) and an expectation that the pattern of fishing activity observed in the prior year will be similar to the next year. Fishing activity by fleets often changes in response to patterns of stock abundance, weather, and fishery regulations. The SBRM is designed to adapt to these changing circumstances. In particular, the changes associated with the application of Annual Catch Limits in most fisheries and the implementation of Sectors in the Northeast Multispecies Groundfish fisheries represent a fundamental challenge to the forecasting of sea day coverage.

In response to this challenge, the prioritized sea day coverage for 2010-2011 incorporates a number of changes:

- Seven new fleets were added in response to observed changes in 2008-2009 and/or potential changes in 2010.
- Turtle monitoring requirements in the industry-funded scallop fisheries are explicitly included in the analysis.
- Coverage in New England Groundfish fleets will be increased to an average of more than 30% in response to targeted government funds for implementation of sectors.
- Coverage rates in vessels participating in US-Canada, Special Access Programs and B-Days for groundfish will be the same coverage rates as those vessels in Sectors.
- Fishing patterns under sector management are likely to be much different. In order to respond to these changes in real time, the pre-trip notification system will become an important determinant of fishing activity and therefore observer sea-day allocation.
- The anticipated but unknown changes in fishing patterns, industry activity, changes in discard rates and variability in discard rates, reduced the utility of

[1] As of January 15, 2010

optimization methods for 2010-2011. Formal optimization methods, apart from the application of filtering and constraints, were not applied.

In addition to these changes, the report for 2010-2011 illustrates the implications of reduced funding on the anticipated CV for species groups. Failure to attain the 30% CV target for a given fleet does not necessarily mean that the predicted precision for ALL species will exceed 30%. Moreover, attainment of the 30% CV standard for a particular fleet implies that ALL of the species groups will be at or below 30%.

Using the 2010 prioritized sea days, the expected CV achieved for each species group was derived. Of the 47 species groups with a CV, 29 species groups (62%) maintained a CV less than or equal to the SBRM performance target of a 30% CV.

Background

As established by the Standard Bycatch Reporting Methodology (SBRM) omnibus amendments (NEFMC 2007; NMFS 2008), the Councils and public are provided an opportunity to consider and provide input into decisions regarding prioritization of at-sea observer coverage allocations if the expected resources necessary may not be available to achieve CV-based performance goals. In any year in which external operational constraints would prevent NMFS from fully implementing the required at-sea observer coverage levels, the Regional Administrator and Science and Research Director will consult with the Councils to determine the most appropriate prioritization for how the available resources should be allocated. If re-prioritization is undertaken, the re-prioritized sea day allocations will be summarized in a subsequent document.

This document describes 1) the 2010 SBRM sea day analysis to determine the number of sea days needed for each fleet[2], 2) the information associated with prioritization of sea days, and 3) the 2010 prioritized sea day allocation for a 12-month period from April 2010 to March 2011 based on funding information available through January 15, 2010.

A complete summary of the NEFOP data is available in the 2010 SBRM Annual Discard Report (NEFSC 2010), a companion 2010 SBRM document.

Methods

Data Sources

The data set used includes data from the Northeast Fisheries Observer Program (NEFOP), the Vessel Trip Report (VTR, including logbooks from the surfclam and ocean quahog fishery) database, the Northeast Fisheries Science Center (NEFSC) commercial landings database, and the NOAA Fisheries Marine Recreational Information Program (MRIP) recreational landings from July 2008 through June 2009.

[2] 'fleet' is synonymous with 'fishing mode'

The same broad stratification scheme used in previous SBRM was employed in the 2010 analysis, where trips were partitioned into fleets using six classification variables: calendar quarter, geographic region, gear type, mesh, access area, and trip category. Calendar quarter was based on landed date and used to capture seasonal variations in fishing activity and discard rates. Two broad geographical regions were defined: New England (NE) and Mid-Atlantic (MA) based on port of departure[3]; ports located from Maine to Rhode Island constituted the NE region and ports located in states from Connecticut southward constituted the MA region. Gear type was based on Northeast gear codes (*negear)*. Some gear codes were combined: sink, anchored and drift gillnets, and single and paired mid-water trawls, and trips for which gear was unknown were excluded. Mesh size groups were formed for otter trawl and gillnet gear types. For otter trawls, two mesh groups were formed: small (mesh less than 5.5 inches) and large (5.5 inch mesh and greater). For gillnets: three mesh groups were formed: small (mesh less than 5.5 inches); large (mesh between 5.5 and 7.99 inches) and extra large (mesh 8 inches and greater). Two access area categories were formed: access area (AA) and open (OPEN). Trips participating in the US/Canada access area, 'B-day' category and other quota monitoring programs could not be identified in the VTR database, and hence these trips were grouped by the other stratification variables and therefore not partitioned separately. The sea scallop fishery was divided into General (GEN) and Limited (LIM) category trips. All other fisheries were combined into a category called 'all'.

Similar to previous SBRM analyses, trips participating in the US-Canada access area, B-day category and some of the other quota-monitored programs could not be identified in the VTR data. These trips have been grouped by the other stratification variables and have not been partitioned separately. The NEFOP training trips have been included in the 2010 (and 2009) SBRM analyses, this is a departure from the 2007 SBRM analysis. Additional information regarding the data sources can be found in Wigley et al. (2007).

A list of the 15 SBRM species groups analyzed, and the species comprising each species group, is given in Table 1. A summary of the data used, in terms of number of trips and number of sea days, by fleet and data source, is given in Table 2 and 3, respectively. Due to the sampling protocol differences within the NEFOP, the data set used for fish is summarized separately from the data set used for protected species (sea turtles).

Seven new fleets were included in the 2010 SBRM analysis, these include: MA and NE floating trap, MA and NE beam trawl, NE Ruhle trawl, NE shrimp pot, and MA other dredge. By gear type, these fleets each had over 100 industry trips associated with them during July 2008 and June 2009.

Of the 51 fleets examined in the 2010 analysis, 28 fleets (29 fleet for fish) had little or no observer data (all quarterly cells were missing for a fleet, or sparse observer coverage existed across all quarters for a fleet). These fleets are primarily pot and trap fisheries targeted for particular species (e.g., lobster, crab, conch, shrimp, hagfish). No discard estimation was performed for these fleets, which were designated as fleets in need of pilot coverage (Tables 2 and 3). Pilot coverage is defined as a minimum level of

[3] Wigley et al. (2007) found that the majority (over 93%) of 2004 observed trips both originated and fished in the same region and exhibited the same general pattern as in the VTR data.

observer coverage to acquire bycatch information with which to calculate variance estimates that in turn can be used to further define the level of sampling needed (NMFS 2004). For each of the remaining fleets, estimates of discards and its associated variance were derived to determine the sample sizes needed for a 30% CV.

Sample Size Analysis

The 2010 sea day analysis used the discard estimation methods described in the SBRM analysis (Wigley et al. 2007). Total discards of each of the 15 SBRM species groups from July 2008 through June 2009 were estimated using a combined 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. The variances of the discards were also derived. In this document, the term coefficient of variation (CV) is defined as the ratio of the standard error of the total discards divided by the total discards. Appendix 1 presents the equations used in the analysis.

The 2010 SBRM sea day analysis was conducted to estimate the number of baseline trips and sea days needed to monitor the 15 species groups in each fleet. As described in the SBRM analysis (and given in Appendix 1), the number of trips and sea days needed to achieve a given precision level was based on the variance of the species group total discard estimates. Sample size (trips and sea days) associated with the SBRM precision standard for discard estimates (30% CV) were derived. The sample size analysis was performed using trips as the sampling unit, and then converting the number of trips to sea days by multiplying by the weighted mean trip length - where the weighting factor was the quarterly number of VTR trips.

When total discards could not be estimated due to little or no observer coverage (no data) or when total discards were zero (no variance), the sample size (number of trips) was determined using a pilot coverage level set to 2% of the quarterly VTR trips for a fleet, with a minimum of 3 trips per quarter (12 trips per year) and a maximum of 100 trips per quarter (400 trips per year). The 2% pilot coverage level is the same as used in previous SBRM analysis. The quarterly trips were then multiplied by the quarterly mean VTR trip length to derive quarterly sea days. The quarterly trips and quarterly sea days were then summed for annual number of trips and sea days. The pilot coverage may result in too much coverage in cases where little or no observer coverage may actually be needed.

The SBRM Omnibus Amendment calls for attainment of CVs of no more than 30% in each fleet/species combination. Thus, for each fleet, a CV of 30% or less is to be attained for each species within that fleet. Some fleet/species combinations contribute very little to the total mortality or discard of the species, but may require significant resources to characterize the precision of the estimate. For example, a high variance estimate for a rare event within a fleet would require high levels of sampling, even though the total discard in that fleet was unimportant with respect to either the total discard or total mortality on the resource.

As in previous SBRM analyses, importance filters were used to provide a standardized protocol to further refine the number of baseline sea days based on (a) the importance of the discarded species relative to the total amount of discards by a fleet, and (b) the total fishing mortality due to the discards. Three filters (*i.e.*, unlikely cell filter; fraction of discard filter; and fraction of total mortality due to discards filter[4]) are applied simultaneously. The unlikely cell filter eliminates sea days associated with fleets where species and gear combinations are considered a priori as unlikely or infeasible. The unlikely cell filter can act as an 'override' mechanism in situations where pilot coverage is evoked due to no variance (observer coverage indicates zero discards). A detailed description of the SBRM importance filters is given in Wigley et al. (2007).

Consistent with previous SBRM analysis, the baseline sea days were filtered using a 95% cut-point in the discard filter, and a 98% cut-point for the total mortality filter due to discards. In other words, estimates of target sea-day coverage for a given species or species group were derived for those fleets that constituted 95% of the discard mortality and 98 % of the total mortality. In the 2010 analysis, the unlikely cell filter was not updated for the seven new fleets with regard to the 14 fish species groups; 'likely' was assumed for the new fleets. It is anticipated that the unlikely filters will be re-evaluated during the SBRM 3-year evaluation, scheduled to take place in late 2011. The turtle unlikely filters for all fleets, however, were updated based upon a review of NEFOP data (H. Haas, pers. comm.). This review resulted in a change of the unlikely filters for 11 fleets. Four fleets changed from 'likely' to 'unlikely' (NE Longline, NE Handline, NE large-mesh Gillnet, and NE Lobster Pots and Traps) and 7 fleets changed from 'unlikely' to 'likely' (the four Scallop Dredge Access Area fleets, NE Scallop Dredge Open GEN, NE Scallop Dredge Open LIM, and MA Scallop Dredge Open LIM). For turtles, in addition to the unlikely filter changes, the total discard filter and total mortality due to discards filter were employed in the 2010 analysis.

To determine the number of sea days (referred to as the '2010 SBRM recommended sea days') and trips needed to achieve a 30% CV within a fleet, the maximum number of sea days for the 15 species groups (i.e. the maximum number of sea days in a row) is used. This ensures that all species groups will have a 30% CV or less. In the event that sea days for each species group within a fleet are filtered out, then the number of sea days for the fleet will be based on pilot coverage to maintain monitoring coverage for that fleet. If the fleet is designated as a pilot fleet, then pilot sea days are used.

Funding available for the April 2010 to March 2011 period

There are two funding source categories: agency-funded and industry-funded. Within the agency-funded category, there are four sub-categories.

- **Agency-funded**: The NEFSC anticipates having funds for 10,965 sea days. The funding sources for these sea days include: Atlantic Coast (646 days), New England Groundfish (4,614 NEFOP sea days and 5,105 At-Sea Monitoring

[4] Fraction of total mortality due to discards is defined as the ratio of discards of species group *j* in fleet *h* (D_{jh}) to the sum of commercial landings (L_{jh}), recreational landings (R_{jh}), and discards (D_{jh}) summed of h;

(ASM) days), and Marine Mammal Protection Act (MMPA; 600 days). Each funding source has funding constraints (days targeted for specific species and/or data category).

- 590 of the 600 MMPA days have been excluded from SBRM due to sampling protocols that are specific to protected species and are not applicable for fish. However, these days will provide observer coverage for sea turtles above that which is allocated within SBRM. The remaining 10 MMPA days have been assigned to MA fleets.
- 10,375 days are applicable for SBRM.

- **Industry-funded**: A work plan is under development for determining compensation rates to support observer coverage of the nine industry-funded scallop fleets. The nine industry-funded fleets are Rows 9, 10, 12, 26, 27, 28, 29, 32, and 33 (Tables 2 and 3).
  - Coverage of the nine fleets depends on industry activity among these fleets.
  - Based on last year, approximately 4,000 sea days were observed in these fleets and this value was used as an estimate for the number of funded sea days for 2010 prioritization.
  - Limited Access General Category (LAGC) open area fleets are not industry-funded fleets.

Prioritization

As specified in the SBRM Omnibus Amendment, when a shortfall occurs, a prioritized sea day allocation is made. This allocation uses a combination of statistical methods and ad-hoc methods to assign sea days while keeping within the funded constraints. It is important to state that changes in management regulations have resulted in the expanded use of the pre-trip notification system. This expansion of coverage by the pre-trip notification system, increased overall coverage rates in groundfish, potential changes in the discarding rates in Sector fleets, and unknown changes in activities by fleets, reduced the applicability of optimization methods for 2010. Instead projected sea-day coverages based on proportional allocation among fleets based upon VTR days during the July 2008 to June 2009 period were used to assign sea days for fleets that are associated with the Call-In regulations (industry-funded fleets and New England Groundfish fleets). These sea day assignments should be considered as provisional. Actual coverage will depend on industry activity among fleets within these two funding categories. A comparison between the prioritized sea day allocation and the 2010 SBRM recommended sea days is made by calculating the difference and percent difference between 2010 SBRM recommended sea days and prioritized sea day allocation, by fleet.

Using the prioritized sea day allocation, the expected achieved CV is derived for species groups in fleets with prioritized sea days where the species group has discard estimates and variances that were not filtered out (see Eqs. 10 and 11 in Appendix 1).

Two alternative allocations were also made: proportional and proportional with funding constraints. In the proportional allocation, the funded sea days were allocated using two

categories: agency-funded (10,375 days) and industry-funded (4,000 days) for the April 2010 to March 2011 period. Although the agency-funded category has specific constraints for fish/protected species/data category targets associated within this category, those restrictions were not considered in this allocation. Thus, funding earmarked to observe New England groundfish bycatch was assumed to be transferable to any fleet, regardless of region, for example. The funded sea days for each category were distributed according to the proportion (the same proportion as the corresponding category) of the 2010 SBRM recommended sea days within each category.

The proportional allocation with funding constraints is new for 2010 SBRM prioritization, and reflects the obligations of the funding sources. Within the agency-funded category, there are two funding subcategories for SBRM: Atlantic Coast, and New England Groundfish. New England Groundfish funds are the sum of sea days for NEFOP and for ASM. The industry-funded category remains as described above. The funded sea days for the industry-funded category and the two agency-funded subcategories were distributed according to the proportion (the same proportion as the corresponding category or subcategory) of the 2010 SBRM recommended sea days within each category or subcategory.

Results

At-sea Observer Coverage Levels Required to Attain SBRM Performance in Each Applicable Fishery

The number of sea days needed to achieve at 30% CV for each of the 15 species groups by fleet are given in Table 4. The 2010 SBRM recommended sea days for each fleet are given in Tables 4 and 5. There are 28 fleets (29 fleets for fish) with 2010 SBRM recommended sea days based on pilot coverage, 14 fleets (13 fleets for fish) with sea days based on the discard variances, and nine fleets with sea days based on pilot coverage to prevent no coverage (fleets where all species groups had zero sea days; Rows 2, 4, 15, 18, 25, 26, 27, 28, and 41; Table 4).

The total 2010 SBRM recommended sea days (14,147 days) for the 51 fleets (Tables 4 and 5) is less than the total anticipated funded sea days (10,375 agency-funded days + 4,000 industry-funded days = 14,375 days) for the April 2010 to March 2011 period. By funding category, 2010 SBRM recommended sea days associated with the agency-funded fleets (9,689 days) is less than the anticipated agency-funded sea days (10,375 days) while the 2010 SBRM recommended sea days associated with the industry-funded fleets (4,458 days) is more than the estimated industry-funded sea days (4,000 days). As described below, shortfalls by fleet occur when sea days are allocated according to funding constraints within the agency-funded category.

Coverage Levels Available If Available Resources Were Allocated Proportionately Across All Applicable Fisheries

A total of 14,375 sea days (10,375 agency-funded days and 4,000 industry-funded days) were proportionally allocated for the 12-month period from April 2010 through March 2011 for the two funding categories. These allocations reflect funding information available through January 15, 2010.

Elements in the Table 5 column labeled "*Available Coverage with shortfall applied proportionally*" were obtained by multiplying the column "*2010 SBRM Recommended Sea Days*" by 1.071 (10,375/9,689) for the fleets in the agency-funded category and by 0.897 (4,000/4,458) for the fleets in the industry-funded category. This achieves the same relative distribution of days as the SBRM recommended days for the two funding categories, although the CVs of estimates for each species in each fleet will not be affected equally. This allocation results in coverage above the 2010 SBRM recommended coverage for all fleets associated with agency-funding. However, for industry-funded fleets, all fleets have less coverage than the 2010 SBRM recommended coverage.

Coverage Levels Available If Available Resources Were Allocated Proportionally Across All Applicable Fisheries <u>with funding constraints applied</u>

A total of 14,375 sea days (10,375 agency-funded days and 4,000 estimated industry-funded days) were proportionally allocated for the 12-month period from April 2010 through March 2011 using two agency-funded sub-categories (New England and MA-Atlantic) and the industry-funded category. These allocations reflect funding information available through January 15, 2010 and represent some of the obligations of the funding sources. It does not make the distinction between NEFOP common pool and sector fleets and ASM funds for sectors fleets. Groundfish fishing activity by fleet is unknown for the May 1, 2010 and onward.

Elements in the Table 5 column labeled *"Available Coverage with shortfall applied proportionally within funding constraints"* were obtained by multiplying the column "*2010 Recommended Sea Days*" by 2.238 (9,719/4,342) for New England fleets, by 0.897 (656/5,347) for Mid-Atlantic fleets, and by 0.897 (4,000/4,458) for industry-funded fleets. This achieves the same relative distribution of days as the SBRM recommended days for the funding category and sub-categories, although the CVs of estimates for each species group in each fleet will not be affected equally. For agency-funded fleets, this allocation results in coverage below the 2010 SBRM recommended coverage for MA fleets and above the 2010 SBRM recommend coverage for the NE fleets. As above, for industry-funded fleets, all fleets have less coverage than the 2010 SBRM recommended coverage.

Coverage Levels That Incorporate the Recommended Prioritization; Justification for Prioritization

Elements in the Table 5 column labeled "*Prioritized April 2010 – March 2011 Coverage*" represents the 2010 prioritized sea days based on the criteria given below.

New England groundfish funding is primarily used to support two objectives in the New England region:

> 1) To insure that program-specific and negotiated TACs are not exceeded, relatively intense monitoring of SAP/B day, US-Canada sharing fisheries, and New England Groundfish fisheries (including common pool and Sector catch shares) are supported (9,234 days). These days cannot be allocated to specific fleets a priori, because coverage depends on real-time industry use of DAS categories or available annual catch entitlements (ACEs).
>
> 2) To monitor bycatch of groundfish in the Atlantic herring fishery, a dedicated program covers mid-water trawl and purse seine components of the fishery, with statistical performance standards for that specific objective (485 sea days).

Atlantic Coast funding supports the estimation of sea turtle bycatch in mixed trawl and purse seine fisheries (333 sea days), supporting biological opinions and planned rulemaking. As mentioned above, the optimization tool was not used to allocate coverage among fleets to estimate discards of summer flounder, scup, black sea bass and monkfish to support fish stock assessments. The 2009 and 2010 variances associated with these fleets were compared and found to be similar, thus the sea days were assigned by re-scaling the 2009 sea days to the 2010 sea days (323 sea days).

Discovery days are usually held in reserve to address emerging questions of scientific and management interest as the year progresses to minimize disruption to statistically designed on-going coverage, however, this year no sea day were assigned (0 sea days).

Using the 2010 prioritized sea days (Table 5 column labeled "*Prioritized April 2010 – March 2011 Coverage*"), the expected CV achieved for each species group is given in Table 6. As stated above, there are 23 fleets with sufficient data to support sample size analysis based on the variance of the discard estimates. The fleets designated as in need of pilot coverage can not be evaluated and the fleets with no prioritized sea days are not evaluated. It is important to note that some species groups have been filtered out through the importance filter process and thus do not have an achieved CV; these species groups have been denoted with an '*' in Table 6. Of the 47 species groups with an achieved CV, 29 species groups (62%) maintained a CV less than or equal to the SBRM performance target of a 30% CV (Table 6).

For fleets associated with the New England groundfish fisheries (NE large-mesh otter trawls and NE gillnets), more sea days than required by SBRM have been assigned through the prioritization process; therefore the expected achieved CVs are lower than the 30% CV for all species groups. The usefulness of Table 6 is demonstrated in rows where the prioritized sea days are less than the SBRM recommended coverage. For example, the MA large-mesh otter trawl fleet has 2,175 SBRM recommended sea days and 1,537 prioritized sea days, indicating that 71% of the 2010 SBRM recommended days have been allocated to this fleet (Table 5, row 6). The impact of not funding the remaining 638 days results in achieved CVs that are less than the SBRM performance target for 4 of

the 5 species groups (Table 6). The small-mesh groundfish species group (GFS) has an expected 37% CV. It would require the additional 638 sea days to lower the CV of this species group by 7%. This information is useful when evaluating the prioritized sea days when a shortfall in resources has occurred.

The expected achieved CV for species groups given the shortfall and surplus of sea days across fleets is for illustrative purposes due to the provisional nature of the 2010 prioritized sea days.

Note on Projected Costs

For the SBRM recommended sea days and the two proportional allocations:

- Agency-funded fleets used $1200/day
- Industry-funded fleets used $775/day

For the SBRM sea day prioritization:

- Agency-funded used $1200/day for NEFOP days and $720/day for ASM days
- Industry-funded fleets used $775/day

Thus the difference is not truly representative between 2010 SBRM costs and funded sea days.

Discussion

The analytical basis for allocation of future sea day coverage rests on a target level of precision (i.e., 30% CV) and an expectation that the pattern of fishing activity observed in the prior year will be similar to the next year. Fishing activity by fleets often changes in response to patterns of stock abundance, weather, and fishery regulations. The SBRM is designed to adapt to these changing circumstances. In particular, the changes associated with application of Annual Catch Limits in most fisheries and the implementation of Sectors in the Northeast Multispecies Groundfish fisheries represent a fundamental challenge to the forecasting of sea day coverage.

- Seven new fleets were added in response to observed changes in 2009. The Ruhle Trawl (*negear* code 054) was authorized as a new gear and appears in the Quarter 2 data (Tables 2 and 3). This gear type is required in the US/CAN resource sharing area and its use is expected in non-access areas to reduce discards of New England groundfish when catch shares are implemented on May 1, 2010. This fleet should be covered as part of the NE groundfish sector and common pool fleets where observer coverage will be applied via the pre-trip notification system. Due to the low number of VTR trips for the fleet in the July 2008 to June 2009 period, the number of prioritized sea days assigned is zero. Other new fleets could be fleets where effort is re-directed in 2010.

- Turtle monitoring requirements in the industry-funded scallop fisheries are explicitly included in the analysis. The previous analysis for anticipated coverage in 2009 did not include necessary coverage rates for turtle bycatch. For this analysis, the observed discard rates for turtles are used to generate coverage rates sufficient to achieve a 30% CV. The SBRM filters were used to estimate target coverage rates.

- Coverage in New England groundfish fleets will be increased to an average of more than 30% in response to targeted government funds for implementation of sectors. The SBRM does not address the coverage rates necessary for individual sectors. Many of the sectors are relative small (in terms of number of vessels and/or catch shares) and the expected number of trips, even with high percentage of observed days, may be small. While the aggregate coverage rates should be sufficient to achieve a 30% CV the level of precision within Sectors could be high. Seventeen sectors have been formed from the New England otter trawl, longline and gillnet fleets. The effects of increased stratification on the precision of discard rates are unknown. Actual fishing patterns will be governed primarily by economic decisions within each sector, so previous year's catch patterns may not be a sufficient basis for inferring activity in the 2010 fishing year.

- Coverage rates in vessels participating in US-Canada, Special Access Programs and B-Days for groundfish will be the same coverage rates as those vessels in Sectors. Unlike in previous years, there will be no separate program for monitoring.

- Fishing patterns under sector management are likely to be much different. In order to respond to these changes in real time, the pre-trip notification system will become an important determinant of realized coverage rates across sectors.

- The anticipated but unknown changes in fishing patterns, industry activity, changes in discard rates and variability of discard rates, reduced the utility of optimization methods for 2010-2011. Formal optimization methods, apart from the application of filtering and constraints, were not applied. However, the prioritized sea days were proportionally distributed among fleets using VTR sea days with funding constraints even though future behavior is unknown. Actual coverage will depend in fishing activity among the fleets. Higher or lower sample sizes are now required for some components depending on changes in variability within a fleet over time. As indicated in Table 5, the fleets that lacked observer coverage in July 2008 to June 2009 were allocated sea days at the "pilot" coverage level (2% of trips with a cap of 100 trips per calendar quarter) in the SBRM report.

Important Caveats for 2010 SBRM prioritization

- Funding constraints remain an issue in sea day allocation and shortfalls by fleet resulted. The Mid-Atlantic fleets and the small-mesh fleets remain under-funded due to funding constraints.

- Changes in management regulations will result in different fishing practices such that previous year's data can not be used to inform the prioritization of 2010 sea days. The sea day allocation should be considered approximate for the fleets associated with New England groundfish.

- The high level of observer coverage for fleets that catch New England groundfish should provide a better basis for allocation of observer coverage in future years. However, in view of the uncertainty in fishing patterns in 2010-2011, fleet coverage rates will rely more heavily on proportional allocations and systematic sampling of trips governed by the actual patterns of fishing activity.

- The pre-trip notification system will dynamically assign sea day coverage according to industry activity for common pool and sector fleets by gear type and access area.

- Industry funded coverage in the various scallop fleets is the subject of ongoing discussions between industry and government. Analyses herein have assumed a coverage rate comparable to the base period. Actual coverage will be based on the outcome of industry discussions.

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Table 1. List of the 15 SBRM species groups (in bold) with species group abbreviations in parentheses, and the species comprising these groups, corresponding to the 13 federally managed fishery management plans in the Northeast region.

ATLANTIC SALMON (SAL)
BLUEFISH (BLUE)
FLUKE - SCUP - BLACK SEA BASS (FSB)
Black Sea Bass
Fluke
Scup
HERRING, ATLANTIC (HERR)
LARGE MESH GROUNDFISH (GFL)
American Plaice
Atlantic Cod
Atlantic Halibut
Atlantic Wolffish[1]
Haddock
Ocean Pout
Pollock
Redfish
White Hake
Windowpane Flounder
Winter Flounder
Witch Flounder
Yellowtail Flounder
MONKFISH (MONK)
RED CRAB (RCRAB)
SEA SCALLOP (SCAL)
SKATE COMPLEX (SKATE)
Barndoor Skate
Clearnose Skate
Little Skate
Rosette Skate
Smooth Skate
Thorny Skate
Winter Skate
SMALL MESH GROUNDFISH (GFS)
Offshore Hake
Red Hake
Silver Hake
SPINY DOGFISH (DOG)
SQUID - BUTTERFISH - MACKEREL (SBM)
Atlantic Mackerel
Butterfish
Illex Squid
Loligo Squid
SURFCLAM - OCEAN QUAHOG (SCOQ)
Surfclam
Ocean Quahog
TILEFISH (TILE)

TURTLES (TURS)
Green Turtle
Hawksbill Turtle
Kemp's Ridley Turtle
Leatherback Turtle
Loggerhead Turtle
Olive Ridley Turtle
Slider (Pond) Turtle
Snapper Turtle
Terrapin Turtle
Turtles, unk.
Turtles, unk hard-shell

[1] Atlantic wolffish is a species that will be added to the Northeast Multispecies FMP when Amendment 16 is implemented on May 1, 2010

Table 2. Number of Northeast Fisheries Observer Program (NEFOP) and Vessel Trip Report (VTR) **trips**, by fleet and calendar quarter (Q) for the July 2008 to June 2009 time period.

		Access	Trip			NEFOP Fish set					NEFOP Protected Species set					VTR set					
Row	Gear Type	Area	Cat.	Region	Mesh	Q3	Q4	Q1	Q2	TOTAL	Q3	Q4	Q1	Q2	TOTAL	Q3	Q4	Q1	Q2	TOTAL	Pilot
1	Longline	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	26	22	54	37	139	P
2	Longline	OPEN	all	NE	all	4	48	13	22	87	4	48	13	23	88	158	200	299	215	872	
3	Hand Line	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	1,431	683	155	913	3,182	P
4	Hand Line	OPEN	all	NE	all	2	.	4	6	12	3	.	4	7	14	1,306	240	431	450	2,427	
5	Otter Trawl	OPEN	all	MA	sm	26	38	51	35	150	26	38	51	35	150	1,175	1,075	688	893	3,831	
6	Otter Trawl	OPEN	all	MA	lg	39	21	16	44	120	40	22	16	44	122	2,049	844	1,280	1,971	6,144	
7	Otter Trawl	OPEN	all	NE	sm	19	16	12	77	124	19	16	13	81	129	1,176	689	494	900	3,259	
8	Otter Trawl	OPEN	all	NE	lg	171	232	255	156	814	171	232	256	156	815	2,946	2,582	2,730	2,050	10,308	
9	Scallop Trawl	AA	GEN	MA	all	.	.	1	1	2	.	.	1	1	2	.	.	63	21	84	P
10	Scallop Trawl	AA	LIM	MA	all	.	.	.	.	.	.	.	.	.	.	1	.	.	4	5	P
11	Scallop Trawl	OPEN	GEN	MA	all	17	1	1	.	19	17	1	1	.	19	380	68	97	345	890	P
12	Scallop Trawl	OPEN	LIM	MA	all	.	.	.	.	.	.	.	.	.	.	16	6	7	7	36	P
13+	Otter Trawl, Ruhle	OPEN	all	NE	all	.	.	.	.	.	.	.	.	.	.	.	.	.	6	6	P
14	Shrimp Trawl	OPEN	all	MA	all	.	.	.	1	1	.	.	.	1	1	506	233	27	178	944	P
15	Shrimp Trawl	OPEN	all	NE	all	.	3	7	.	10	.	3	7	.	10	17	116	1,281	39	1,453	
16+	Floating Trap	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	1	18	.	2	21	P
17+	Floating Trap	OPEN	all	NE	all	.	.	.	.	.	.	.	.	.	.	83	2	.	53	138	P
18	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	6	.	3	4	13	55	86	28	49	218	599	470	258	341	1,668	
19	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	1	.	.	3	4	11	31	14	22	78	200	400	209	255	1,064	P*
20	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	2	19	11	15	47	4	38	32	52	126	140	689	462	1,128	2,419	
21	Sink, Anchor, Drift Gillnet	OPEN	all	NE	sm	.	.	.	2	2	.	.	.	2	2	37	6	2	10	55	P
22	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	77	33	108	20	238	101	89	164	24	378	3,222	2,329	1,752	1,543	8,846	
23	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	54	19	20	14	107	59	39	37	20	155	1,109	836	348	891	3,184	
24	Purse Seine	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	164	32	.	15	211	P
25	Purse Seine	OPEN	all	NE	all	13	2	.	11	26	15	2	.	16	33	245	9	.	46	300	
26	Scallop Dredge	AA	GEN	MA	all		2	52	62	116	.	2	52	62	116	22	16	440	375	853	
27	Scallop Dredge	AA	GEN	NE	all	56	.	.	.	56	56	.	.	.	56	102	.	.	3	105	
28	Scallop Dredge	AA	LIM	MA	all	30	24	20	25	99	30	24	21	26	101	91	78	114	109	392	
29	Scallop Dredge	AA	LIM	NE	all	40	23	22	47	132	40	23	22	47	132	77	33	45	59	214	
30	Scallop Dredge	OPEN	GEN	MA	all	7	5	5	14	31	7	5	5	14	31	1,729	510	1,236	2,702	6,177	
31	Scallop Dredge	OPEN	GEN	NE	all	6	3	1	3	13	6	3	1	3	13	644	265	305	743	1,957	
32	Scallop Dredge	OPEN	LIM	MA	all	16	6	13	30	65	16	6	13	30	65	288	152	238	376	1,054	
33	Scallop Dredge	OPEN	LIM	NE	all	23	14	5	27	69	23	14	5	27	69	395	187	177	323	1,082	
34	Mid-water Paired & Single Trawl	OPEN	all	MA	all	.	.	2	.	2	.	.	2	.	2	3	.	61	6	70	P
35	Mid-water Paired & Single Trawl	OPEN	all	NE	all	4	20	22	18	64	4	26	28	20	78	22	112	144	35	313	
36	Pots and Traps, Fish	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	346	432	77	328	1,183	P
37	Pots and Traps, Fish	OPEN	all	NE	all	3	.	.	.	3	3	.	.	.	3	326	81	.	101	508	P
38	Pots and Traps, Conch	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	83	320	53	130	586	P
39	Pots and Traps, Conch	OPEN	all	NE	all	.	.	.	.	.	.	.	.	.	.	322	153	.	177	652	P
40	Pots and Traps, Hagfish	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	7	4	2	5	18	P
41	Pots and Traps, Hagfish	OPEN	all	NE	all	4	3	2	3	12	4	3	2	3	12	64	9	15	41	129	
42+	Pots and Traps, Shrimp	OPEN	all	NE	all	.	.	.	.	.	.	.	.	.	.	.	2	114	6	122	P
43	Pots and Traps, Lobster	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	1,238	546	269	644	2,697	P
44	Pots and Traps, Lobster	OPEN	all	NE	all	1	.	.	.	1	1	.	.	.	1	13,085	7,973	2,031	4,143	27,232	P
45	Pots and Traps, Crab	OPEN	all	MA	all	1	.	.	.	1	1	.	.	.	1	8	22	16	.	46	P
46	Pots and Traps, Crab	OPEN	all	NE	all	1	.	.	.	1	1	.	.	.	1	34	46	6	36	122	P
47+	Beam Trawl	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	78	44	28	80	230	P
48+	Beam Trawl	OPEN	all	NE	all	.	.	.	.	.	.	.	.	.	.	75	10	19	14	118	P
49+	Dredge, Other	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	3	78	172	8	261	P
50	Ocean Quahog/Surf Clam Dredge	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	872	737	191	212	2,012	P
51	Ocean Quahog/Surf Clam Dredge	OPEN	all	NE	all	.	.	.	.	.	.	.	.	.	.	468	394	25	30	917	P
					Total	**626**	**534**	**647**	**651**	**2,458**	**720**	**753**	**789**	**778**	**3,040**	**37,477**	**23,820**	**16,426**	**23,060**	**100,783**	

P= pilot coverage; P*= pilot coverage for fish only; + = new fleet in 2010; see text for fleet abbreviations.

Table 3. Number of Northeast Fisheries Observer Program (NEFOP) and Vessel Trip Report (VTR) **sea days**, by fleet and calendar quarter (Q) for the July 2008 to June 2009 time period.

		Access	Trip			NEFOP Fish set					NEFOP Protected Species set					VTR set					
Row	Gear Type	Area	Cat.	Region	Mesh	Q3	Q4	Q1	Q2	TOTAL	Q3	Q4	Q1	Q2	TOTAL	Q3	Q4	Q1	Q2	TOTAL	Pilot
1	Longline	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	228	228	376	384	1,216	P
2	Longline	OPEN	all	NE	all	7	98	15	59	179	7	98	15	62	182	179	357	340	374	1,250	
3	Hand Line	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	1,656	739	165	933	3,493	P
4	Hand Line	OPEN	all	NE	all	6	.	4	17	27	6	.	4	21	31	1,358	257	439	460	2,514	
5	Otter Trawl	OPEN	all	MA	sm	52	136	218	82	488	52	136	218	82	488	2,093	2,690	2,758	1,453	8,994	
6	Otter Trawl	OPEN	all	MA	lg	61	47	80	64	252	62	51	80	64	257	3,342	1,883	3,831	2,959	12,015	
7	Otter Trawl	OPEN	all	NE	sm	45	40	30	157	272	45	40	31	164	280	2,331	2,005	1,850	1,745	7,931	
8	Otter Trawl	OPEN	all	NE	lg	1,027	1,151	1,007	961	4,146	1,027	1,151	1,008	961	4,147	6,715	6,378	7,182	5,721	25,996	
9	Scallop Trawl	AA	GEN	MA	all	.	.	2	3	5	.	.	2	3	5	.	.	128	40	168	P
10	Scallop Trawl	AA	LIM	MA	all	.	.	.	.	.	.	.	.	.	.	8	.	.	23	31	P
11	Scallop Trawl	OPEN	GEN	MA	all	34	3	1	.	38	34	3	1	.	38	763	150	204	629	1,746	P
12	Scallop Trawl	OPEN	LIM	MA	all	.	.	.	.	.	.	.	.	.	.	83	55	40	55	233	P
13+	Otter Trawl, Ruhle	OPEN	all	NE	all	.	.	.	.	.	.	.	.	.	.	.	.	.	6	6	P
14	Shrimp Trawl	OPEN	all	MA	all	.	.	.	5	5	.	.	.	5	5	2,337	1,428	110	462	4,337	P
15	Shrimp Trawl	OPEN	all	NE	all	.	3	7	.	10	.	3	7	.	10	22	116	1,289	48	1,475	
16+	Floating Trap	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	2	36	.	2	40	P
17+	Floating Trap	OPEN	all	NE	all	.	.	.	.	.	.	.	.	.	.	83	2	.	53	138	P
18	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	6	.	3	4	13	56	89	28	51	224	621	491	263	356	1,731	
19	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	1	.	.	3	4	11	31	15	22	79	211	406	270	292	1,179	P*
20	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	2	23	15	17	57	4	45	41	56	146	167	984	696	1,493	3,340	
21	Sink, Anchor, Drift Gillnet	OPEN	all	NE	sm	.	.	.	2	2	.	.	.	2	2	38	6	2	10	56	P
22	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	82	58	147	41	328	119	121	207	45	492	3,710	2,669	2,024	1,940	10,343	
23	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	61	28	35	36	160	66	53	69	50	238	1,353	1,014	693	1,522	4,582	
24	Purse Seine	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	205	34	.	15	254	P
25	Purse Seine	OPEN	all	NE	all	31	6	.	33	70	36	6	.	52	94	585	30	.	121	736	
26	Scallop Dredge	AA	GEN	MA	all	.	6	126	135	267	.	6	126	135	267	46	39	770	683	1,538	
27	Scallop Dredge	AA	GEN	NE	all	125	.	.	.	125	125	.	.	.	125	202	.	.	6	208	
28	Scallop Dredge	AA	LIM	MA	all	261	187	171	220	839	261	187	181	233	862	669	583	841	948	3,041	
29	Scallop Dredge	AA	LIM	NE	all	301	260	253	453	1,267	301	260	253	453	1,267	468	312	447	538	1,765	
30	Scallop Dredge	OPEN	GEN	MA	all	8	11	5	17	41	8	11	5	17	41	2,686	865	1,844	3,859	9,254	
31	Scallop Dredge	OPEN	GEN	NE	all	11	6	3	3	23	11	6	3	3	23	1,260	363	367	1,228	3,218	
32	Scallop Dredge	OPEN	LIM	MA	all	128	58	102	300	588	128	58	102	300	588	2,516	1,236	1,941	3,628	9,321	
33	Scallop Dredge	OPEN	LIM	NE	all	258	145	63	351	817	258	145	63	351	817	3,867	2,002	1,789	3,531	11,189	
34	Mid-water Paired & Single Trawl	OPEN	all	MA	all	.	.	7	.	7	.	.	7	.	7	8	.	257	26	291	P
35	Mid-water Paired & Single Trawl	OPEN	all	NE	all	18	77	95	69	259	18	89	114	75	296	49	426	650	145	1,270	
36	Pots and Traps, Fish	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	353	447	80	341	1,221	P
37	Pots and Traps, Fish	OPEN	all	NE	all	3	.	.	.	3	3	.	.	.	3	330	81	.	108	519	P
38	Pots and Traps, Conch	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	83	320	54	131	588	P
39	Pots and Traps, Conch	OPEN	all	NE	all	.	.	.	.	.	.	.	.	.	.	322	153	.	178	653	P
40	Pots and Traps, Hagfish	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	62	45	26	47	180	P
41	Pots and Traps, Hagfish	OPEN	all	NE	all	23	12	5	10	50	23	12	5	10	50	310	48	69	153	580	
42+	Pots and Traps, Shrimp	OPEN	all	NE	all	.	.	.	.	.	.	.	.	.	.	.	2	114	6	122	P
43	Pots and Traps, Lobster	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	1,454	723	387	841	3,405	P
44	Pots and Traps, Lobster	OPEN	all	NE	all	1	.	.	.	1	1	.	.	.	1	15,456	9,948	3,516	5,691	34,611	P
45	Pots and Traps, Crab	OPEN	all	MA	all	7	.	.	.	7	7	.	.	.	7	64	61	24	.	149	P
46	Pots and Traps, Crab	OPEN	all	NE	all	10	.	.	.	10	10	.	.	.	10	105	198	46	70	419	P
47+	Beam Trawl	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	172	123	101	144	540	P
48+	Beam Trawl	OPEN	all	NE	all	.	.	.	.	.	.	.	.	.	.	100	16	19	29	164	P
49+	Dredge, Other	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	12	85	173	10	280	P
50	Ocean Quahog/Surf Clam Dredge	OPEN	all	MA	all	.	.	.	.	.	.	.	.	.	.	1,321	1,177	387	471	3,355	P
51	Ocean Quahog/Surf Clam Dredge	OPEN	all	NE	all	.	.	.	.	.	.	.	.	.	.	479	352	44	74	949	P
					Total	**2,569**	**2,355**	**2,394**	**3,042**	**10,360**	**2,679**	**2,601**	**2,585**	**3,217**	**11,082**	**60,484**	**41,562**	**36,606**	**43,982**	**182,634**	

P= pilot coverage; P*= pilot coverage for fish only; + = new fleet in 2010; see text for fleet abbreviations.

Table 4. The number of sea days needed to achieve a 30%CV based on the variance of the total composite discard for each the 15 SBRM species groups, the number of pilot sea days, and 2010 SBRM recommended sea days (the maximum number of sea days needed for each fleet) based on July 2008 though June 2009 data. Red font indicates basis for fleet sea days; species group abbreviation are given in Table 1.

Row	GearType	Access Area	Trip Cat.	Region	Mesh	BLUE	HERR	SAL	RCRAB	SCAL	SBM	MONK	GFL	GFS	SKATE	DOG	FSB	SCOQ	TILE	TURS	Pilot days	2010 SBRM Recommended Sea Days	Pilot
1	Longline	OPEN	all	MA	all	0	0	0	0	0	0	109	109	0	109	109	0	0	109	109	**109**	109	P
2	Longline	OPEN	all	NE	all	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**25**	25	
3	Hand Line	OPEN	all	MA	all	0	0	0	0	0	0	0	70	0	0	0	0	0	0	70	**70**	70	P
4	Hand Line	OPEN	all	NE	all	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**50**	50	
5	Otter Trawl	OPEN	all	MA	sm	0	0	0	0	0	723	0	0	533	692	691	1,359	0	0	**1,415**	180	1,415	
6	Otter Trawl	OPEN	all	MA	lg	0	0	0	0	0	0	0	163	**2,175**	158	237	265	0	0	0	240	2,175	
7	Otter Trawl	OPEN	all	NE	sm	0	0	0	0	0	0	0	0	1,257	0	2,038	**2,192**	0	0	1,683	159	2,192	
8	Otter Trawl	OPEN	all	NE	lg	0	0	0	0	0	0	438	64	**668**	61	238	370	0	0	0	520	668	
9	Scallop Trawl	AA	GEN	MA	all	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	**12**	12	P
10	Scallop Trawl	AA	LIM	MA	all	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	**41**	41	P
11	Scallop Trawl	OPEN	GEN	MA	all	41	0	0	0	41	41	41	41	41	41	41	41	0	0	41	**41**	41	P
12	Scallop Trawl	OPEN	LIM	MA	all	84	0	0	0	84	84	84	84	84	84	84	84	0	0	84	**84**	84	P
13+	Otter Trawl, Ruhle	OPEN	all	NE	all	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	**3**	3	P
14	Shrimp Trawl	OPEN	all	MA	all	0	97	0	0	0	97	97	97	97	97	0	97	0	0	97	**97**	97	P
15	Shrimp Trawl	OPEN	all	NE	all	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**36**	36	
16+	Floating Trap	OPEN	all	MA	all	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	**15**	15	P
17+	Floating Trap	OPEN	all	NE	all	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	**9**	9	P
18	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**35**	35	
19	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	24	24	0	0	0	24	24	24	0	24	24	24	0	0	**478**	24	478	P*
20	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	0	0	0	0	0	0	46	0	0	0	43	0	0	0	**423**	67	423	
21	Sink, Anchor, Drift Gillnet	OPEN	all	NE	sm	12	12	0	0	0	12	12	12	12	12	12	12	0	0	12	**12**	12	P
22	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	0	0	0	0	0	0	0	60	0	0	**159**	0	0	0	0	207	159	
23	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	0	0	0	0	0	0	**140**	0	0	72	86	0	0	0	0	92	140	
24	Purse Seine	OPEN	all	MA	all	10	10	0	0	0	10	0	10	10	10	10	10	0	0	10	**10**	10	P
25	Purse Seine	OPEN	all	NE	all	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**30**	30	
26	Scallop Dredge	AA	GEN	MA	all	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**43**	43	
27	Scallop Dredge	AA	GEN	NE	all	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**12**	12	
28	Scallop Dredge	AA	LIM	MA	all	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**93**	93	
29	Scallop Dredge	AA	LIM	NE	all	0	0	0	0	0	0	**255**	0	0	0	0	0	0	0	0	104	255	
30	Scallop Dredge	OPEN	GEN	MA	all	0	0	0	0	0	0	0	0	0	**49**	0	0	0	0	0	185	49	
31	Scallop Dredge	OPEN	GEN	NE	all	0	0	0	0	0	0	0	0	0	**23**	0	0	0	0	0	64	23	
32	Scallop Dredge	OPEN	LIM	MA	all	0	0	0	0	0	0	166	0	0	132	186	494	0	0	**3,443**	186	3,443	
33	Scallop Dredge	OPEN	LIM	NE	all	0	0	0	0	431	0	242	116	322	126	**475**	263	0	0	0	224	475	
34	Mid-water Paired & Single Trawl	OPEN	all	MA	all	34	34	0	0	0	34	34	34	34	0	34	0	0	0	34	**34**	34	P
35	Mid-water Paired & Single Trawl	OPEN	all	NE	all	0	0	0	0	0	0	0	0	**379**	0	182	0	0	0	0	44	379	
36	Pots and Traps, Fish	OPEN	all	MA	all	0	26	0	26	0	0	0	26	26	26	0	26	0	26	26	**26**	26	P
37	Pots and Traps, Fish	OPEN	all	NE	all	0	13	0	13	0	0	0	13	13	13	0	13	0	13	13	**13**	13	P
38	Pots and Traps, Conch	OPEN	all	MA	all	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	**16**	16	P
39	Pots and Traps, Conch	OPEN	all	NE	all	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	**13**	13	P
40	Pots and Traps, Hagfish	OPEN	all	MA	all	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	**128**	128	P
41	Pots and Traps, Hagfish	OPEN	all	NE	all	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**56**	56	
42+	Pots and Traps, Shrimp	OPEN	all	NE	all	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	**9**	9	P
43	Pots and Traps, Lobster	OPEN	all	MA	all	0	0	0	68	0	0	0	68	0	0	0	0	0	0	68	**68**	68	P
44	Pots and Traps, Lobster	OPEN	all	NE	all	0	0	0	427	0	0	0	427	0	0	0	0	0	0	0	**427**	427	P
45	Pots and Traps, Crab	OPEN	all	MA	all	0	0	0	37	0	0	0	0	0	0	0	0	0	0	37	**37**	37	P
46	Pots and Traps, Crab	OPEN	all	NE	all	0	0	0	51	0	0	0	0	0	0	0	0	0	0	51	**51**	51	P
47+	Beam Trawl	OPEN	all	MA	all	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	**31**	31	P
48+	Beam Trawl	OPEN	all	NE	all	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	**18**	18	P
49+	Dredge, Other	OPEN	all	MA	all	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	**23**	23	P
50	Ocean Quahog/Surf Clam Dredge	OPEN	all	MA	all	0	0	0	0	67	0	67	0	0	0	0	0	67	0	67	**67**	67	P
51	Ocean Quahog/Surf Clam Dredge	OPEN	all	NE	all	0	0	0	0	29	0	29	0	0	0	0	0	29	0	29	**29**	29	P
						523	**534**	**318**	**940**	**970**	**1,343**	**2,102**	**1,736**	**5,969**	**2,047**	**4,967**	**5,568**	**414**	**466**	**8,508**	**4,169**	**14,147**	

P= pilot coverage; P*= pilot coverage for fish only; + = new fleet in 2010; see text for fleet abbreviations.

Table 5. Standardized Bycatch Reporting Methodology 2010 prioritization information for April 2010 to March 2011, based on July 2008 to June 2009 data.

Row	GearType	Access Area	Trip Cat.	Region	Mesh	2010 SBRM Recommended Sea Days	Available Coverage with shortfall applied proportionally	Available Coverage with shortfall applied proportionally within funding contraints	Prioritized April 2010 - March 2011 Coverage	April 2010 - March 2011 Difference from Preferred Alternative	April 2010 - March 2011 Percentage of Preferred Alternative	Justification	Basis for SBRM Coverage
1	Longline	OPEN	all	MA	all	109	117	13	104	-5	95%	Fish stock assessment support [1]	P
2	Longline	OPEN	all	NE	all	25	27	56	201	176	806%	Fish stock assessment support [1]	
3	Hand Line	OPEN	all	MA	all	70	75	9	0	-70	0%		P
4	Hand Line	OPEN	all	NE	all	50	54	113	50	0	99%	Fish stock assessment support	
5	Otter Trawl	OPEN	all	MA	sm	1415	1515	174	116	-1299	8%	Fish stock assessment and turtle bycatch support	
6	Otter Trawl	OPEN	all	MA	lg	2175	2329	267	1537	-638	71%	Fish stock assessment and turtle bycatch support [1]	
7	Otter Trawl	OPEN	all	NE	sm	2192	2347	4906	733	-1459	33%	Fish stock assessment support	
8	Otter Trawl	OPEN	all	NE	lg	668	715	1495	4190	3522	627%	Fish stock assessment support [1]	
9	Scallop Trawl	AA	GEN	MA	all	12	11	11	24	12	204%	Industry funded, coverage is dependent on industry activity	P
10	Scallop Trawl	AA	LIM	MA	all	41	37	37	5	-36	11%	Industry funded, coverage is dependent on industry activity	P
11	Scallop Trawl	OPEN	GEN	MA	all	41	44	5	41	0	100%	Fish stock assessment support	P
12	Scallop Trawl	OPEN	LIM	MA	all	84	75	75	34	-50	40%	Industry funded, coverage is dependent on industry activity	P
13+	Otter Trawl, Ruhle	OPEN	all	NE	all	3	3	7	0	-3	15%	Coverage is expected for fish stock assessment support and US/CAN monitoring [1]	P
14	Shrimp Trawl	OPEN	all	MA	all	97	104	12	0	-97	0%		P
15	Shrimp Trawl	OPEN	all	NE	all	36	39	81	16	-20	44%	Fish stock assessment support	
16+	Floating Trap	OPEN	all	MA	all	15	16	2	0	-15	0%		P
17+	Floating Trap	OPEN	all	NE	all	9	10	20	0	-9	0%		P
18	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	35	37	4	0	-35	0%	(355 days for protected species bycatch not included in SBRM)	
19	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	478	512	59	100	-378	21%	Fish stock assessment support [1] (56 days for protected species bycatch not included in SBRM)	P*
20	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	423	453	52	302	-121	71%	Fish stock assessment support [1] (62 days for protected species bycatch not included in SBRM)	
21	Sink, Anchor, Drift Gillnet	OPEN	all	NE	sm	12	13	27	12	0	102%	Fish stock assessment support (2 days for protected species bycatch not included in SBRM)	P
22	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	159	170	356	1667	1508	1049%	Fish stock assessment support [1] (69 days for protected species bycatch not included in SBRM)	
23	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	140	150	313	739	599	528%	Fish stock assessment support [1] (46 days for protected species bycatch not included in SBRM)	
24	Purse Seine	OPEN	all	MA	all	10	11	1	20	10	200%	Fish stock assessment and turtle bycatch support	P
25	Purse Seine	OPEN	all	NE	all	30	32	67	30	0	100%	Fish stock assessment support	
26	Scallop Dredge	AA	GEN	MA	all	43	39	39	224	181	521%	Industry funded, coverage is dependent on industry activity	
27	Scallop Dredge	AA	GEN	NE	all	12	11	11	30	18	252%	Industry funded, coverage is dependent on industry activity	
28	Scallop Dredge	AA	LIM	MA	all	93	83	83	442	349	476%	Industry funded, coverage is dependent on industry activity	
29	Scallop Dredge	AA	LIM	NE	all	255	229	229	257	2	101%	Industry funded, coverage is dependent on industry activity	
30	Scallop Dredge	OPEN	GEN	MA	all	49	52	6	49	0	100%	Fish stock assessment support	
31	Scallop Dredge	OPEN	GEN	NE	all	23	25	51	23	0	100%	Fish stock assessment support	
32	Scallop Dredge	OPEN	LIM	MA	all	3443	3089	3089	1356	-2087	39%	Industry funded, coverage is dependent on industry activity	
33	Scallop Dredge	OPEN	LIM	NE	all	475	426	426	1628	1153	343%	Industry funded, coverage is dependent on industry activity	
34	Mid-water Paired & Single Trawl	OPEN	all	MA	all	34	36	4	66	32	194%	Fish stock assessment support	P
35	Mid-water Paired & Single Trawl	OPEN	all	NE	all	379	406	848	379	0	100%	Fish stock assessment support	
36	Pots and Traps, Fish	OPEN	all	MA	all	26	28	3	0	-26	0%		P
37	Pots and Traps, Fish	OPEN	all	NE	all	13	14	29	0	-13	0%		P
38	Pots and Traps, Conch	OPEN	all	MA	all	16	17	2	0	-16	0%		P
39	Pots and Traps, Conch	OPEN	all	NE	all	13	14	29	0	-13	0%		P
40	Pots and Traps, Hagfish	OPEN	all	MA	all	128	137	16	0	-128	0%		P
41	Pots and Traps, Hagfish	OPEN	all	NE	all	56	60	125	0	-56	0%		
42+	Pots and Traps, Shrimp	OPEN	all	NE	all	9	10	20	0	-9	0%		P
43	Pots and Traps, Lobster	OPEN	all	MA	all	68	73	8	0	-68	0%		P
44	Pots and Traps, Lobster	OPEN	all	NE	all	427	457	956	0	-427	0%		P
45	Pots and Traps, Crab	OPEN	all	MA	all	37	40	5	0	-37	0%		P
46	Pots and Traps, Crab	OPEN	all	NE	all	51	55	114	0	-51	0%		P
47+	Beam Trawl	OPEN	all	MA	all	31	33	4	0	-31	0%		P
48+	Beam Trawl	OPEN	all	NE	all	18	19	40	0	-18	0%		P
49+	Dredge, Other	OPEN	all	MA	all	23	25	3	0	-23	0%		P
50	Ocean Quahog/Surf Clam Dredge	OPEN	all	MA	all	67	72	8	0	-67	0%		P
51	Ocean Quahog/Surf Clam Dredge	OPEN	all	NE	all	29	31	65	0	-29	0%		P
	SAP/B day/US-CAN (covered as part of NE groundfish)												
	Discovery Days											Notes:	
Total Days						14,147	14,375	14,375	14,375			1: Sector monitoring coverage is dependent on industry activity	
Projected Costs						$15,082,110	$15,550,000	$15,550,000	11,539,038				

P= pilot coverage; P*= pilot coverage for fish only; + = new fleet in 2010; see text for fleet abbreviations.

Table 6. The expected coefficient of variation (CV) achieved for the proposed prioritized sea days, by species group and fleet based on July 2008 to June 2009 data. Red font indicates CVs less than or equal to 30% ; '*' denotes species groups that have been filtered out through the importance filter process.

Row	GearType	Access Area	Trip Cat.	Region	Mesh	2010 SBRM Prioritized Sea Days	BLUE	HERR	SAL	RCRAB	SCAL	SBM	MONK	GFL	GFS	SKATE	DOG	FSB	SCOQ	TILE	TURS	Pilot
1	Longline	OPEN	all	MA	all	104																P
2	Longline	OPEN	all	NE	all	201	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
3	Hand Line	OPEN	all	MA	all	0																P
4	Hand Line	OPEN	all	NE	all	191	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
5	Otter Trawl	OPEN	all	MA	sm	116	*	*	*	*	*	0.780	*	*	0.662	0.751	0.772	1.183	*	*	1.139	
6	Otter Trawl	OPEN	all	MA	lg	1,537	*	*	*	*	*	*	*	**0.092**	0.370	**0.090**	**0.112**	**0.119**	*	*	*	
7	Otter Trawl	OPEN	all	NE	sm	603	*	*	*	*	*	*	*	*	0.445	*	0.587	0.614	*	*	0.518	
8	Otter Trawl	OPEN	all	NE	lg	4,190	*	*	*	*	*	*	**0.089**	**0.034**	**0.113**	**0.033**	**0.067**	**0.083**	*	*	*	
9	Scallop Trawl	AA	GEN	MA	all	24																P
10	Scallop Trawl	AA	LIM	MA	all	5																P
11	Scallop Trawl	OPEN	GEN	MA	all	0																P
12	Scallop Trawl	OPEN	LIM	MA	all	34																P
13+	Otter Trawl, Ruhle	OPEN	all	NE	all	0																P
14	Shrimp Trawl	OPEN	all	MA	all	0																P
15	Shrimp Trawl	OPEN	all	NE	all	16	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
16+	Floating Trap	OPEN	all	MA	all	0																P
17+	Floating Trap	OPEN	all	NE	all	0																P
18	Sink, Anchor, Drift Gillnet	OPEN	all	MA	sm	0																
19	Sink, Anchor, Drift Gillnet	OPEN	all	MA	lg	100															0.859	P*
20	Sink, Anchor, Drift Gillnet	OPEN	all	MA	xlg	302	*	*	*	*	*	*	**0.112**	*	*	*	**0.108**	*	*	*	0.361	
21	Sink, Anchor, Drift Gillnet	OPEN	all	NE	sm	4																P
22	Sink, Anchor, Drift Gillnet	OPEN	all	NE	lg	1,667	*	*	*	*	*	*	*	**0.054**	*	*	**0.088**	*	*	*	*	
23	Sink, Anchor, Drift Gillnet	OPEN	all	NE	xlg	739	*	*	*	*	*	*	**0.122**	*	*	**0.089**	**0.095**	*	*	*	*	
24	Purse Seine	OPEN	all	MA	all	54																P
25	Purse Seine	OPEN	all	NE	all	71	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
26	Scallop Dredge	AA	GEN	MA	all	224	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
27	Scallop Dredge	AA	GEN	NE	all	30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
28	Scallop Dredge	AA	LIM	MA	all	442	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
29	Scallop Dredge	AA	LIM	NE	all	257	*	*	*	*	*	*	**0.298**	*	*	*	*	*	*	*	*	
30	Scallop Dredge	OPEN	GEN	MA	all	6	*	*	*	*	*	*	*	*	*	0.861	*	*	*	*	*	
31	Scallop Dredge	OPEN	GEN	NE	all	29	*	*	*	*	*	*	*	*	*	**0.269**	*	*	*	*	*	
32	Scallop Dredge	OPEN	LIM	MA	all	1,356	*	*	*	*	*	*	**0.097**	*	*	**0.088**	**0.103**	**0.175**	*	*	0.522	
33	Scallop Dredge	OPEN	LIM	NE	all	1,628	*	*	*	*	**0.145**	*	**0.108**	**0.074**	**0.125**	**0.077**	**0.156**	**0.113**	*	*	*	
34	Mid-water Paired & Single Trawl	OPEN	all	MA	all	433																P
35	Mid-water Paired & Single Trawl	OPEN	all	NE	all	12	*	*	*	*	*	*	*	*	1.956	*	1.238	*	*	*	*	
36	Pots and Traps, Fish	OPEN	all	MA	all	0																P
37	Pots and Traps, Fish	OPEN	all	NE	all	0																P
38	Pots and Traps, Conch	OPEN	all	MA	all	0																P
39	Pots and Traps, Conch	OPEN	all	NE	all	0																P
40	Pots and Traps, Hagfish	OPEN	all	MA	all	0																P
41	Pots and Traps, Hagfish	OPEN	all	NE	all	0																
42+	Pots and Traps, Shrimp	OPEN	all	NE	all	0																P
43	Pots and Traps, Lobster	OPEN	all	MA	all	0																P
44	Pots and Traps, Lobster	OPEN	all	NE	all	0																P
45	Pots and Traps, Crab	OPEN	all	MA	all	0																P
46	Pots and Traps, Crab	OPEN	all	NE	all	0																P
47+	Beam Trawl	OPEN	all	MA	all	0																P
48+	Beam Trawl	OPEN	all	NE	all	0																P
49+	Dredge, Other	OPEN	all	MA	all	0																P
50	Ocean Quahog/Surf Clam Dredge	OPEN	all	MA	all	0																P
51	Ocean Quahog/Surf Clam Dredge	OPEN	all	NE	all	0																P
						14,375																

P= pilot coverage; P*= pilot coverage for fish only; + = new fleet in 2010; see text for fleet abbreviations.

Appendix 1. Equations used in discard estimation and sample size analysis

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

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

where

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

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*; 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:

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

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_{jiqh} is discards of species *j* from trip *i* in quarter *q* and stratum *h*; k_{iqh} is kept pounds of all species on trip *i* in quarter *q* and stratum *h*; N_{qh} is the number of VTR trips in quarter *q* and stratum *h*; n_{qh} is the number of observed trips in quarter *q* and stratum *h*.

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

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

The number of sea days and trips needed to achieve a 30% CV are derived based on the variance of the total discards using the combined ratio method and the d/k discard ratio (Eq 3).

From Eq 3, let

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

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

where δ_{qh} is the fraction of the trips in quarter *q* in stratum *h*; $r_{c,jh}$ is the combined annual ratio of species *j* in stratum *h*; d_{jiqh} is discards of species *j* from trip *i* in stratum *h* in quarter *q*; k_{iqh} is kept pounds of all species on trip *i* in stratum *h* in quarter *q*; and n_{qh} is the number of observed trips in stratum *h* in quarter *q*. The $r_{c,jh}$ in Eq. 5 is defined in Eq. 2 where the summation is over quarters within a given strata defined by gear, region, access area, trip type and so forth.

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

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

where $0.09 = 0.30^2$, the square of the 30%CV, the given target precision level.

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

(8) $$\hat{SD}_{30\,jh} = \hat{TD}_{30\,jh} * \overline{DA_h}$$

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

When total discards could not be estimated due to little or no observer coverage (no data) or when total discards are zero (no variance), sample size was determined by pilot cover, where 2% of the quarterly VTR trips for a fleet were multiplied by the quarterly mean VTR trip length.

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

where $\hat{T}_{hq}$ is 2% of the VTR trips in stratum *h* and quarter *q*, and 3 <= $\hat{T}_{hq}$ <= 100 trips; $\overline{DA}_{hq}$ is the average trip length of VTR trips in stratum *h* and quarter *q*. The quarterly trips and sea days were then summed for annual number of trips and sea days.

The achieved precision resulting from the number of funded sea days can be derived by converting funded sea days into funded trips. The number of funded trips, $\hat{TF}_h$ for stratum *h* is defined as:

(10) $\hat{TF}_h = \hat{SF}_h / \overline{DA_h}$

where $\hat{SF}_h$ is the number of funded sea days in stratum *h* and $\overline{DA}_h$ is the weighted average trip length of VTR trips in stratum *h* (weighted by the number of VTR trips in each quarter).

The achieved coefficient of variation (CV) of $\hat{D}_j$ is based on the variance of the composite annual total discards for species group *j* in stratum *h* and the number of funded trips in stratum *h* and re-writing Eq 7.

From Eq 7, let

(11) $$CV(\hat{D}_{jh}) = \sqrt{\frac{\sum_{q=1}^{4}\left(\frac{K_{qh}^2}{\bar{k}_{qh}^2}\hat{S}_{jqh}^2\frac{1}{\delta_{qh}}\right) - \hat{TF}_h\left[\frac{\sum_{q=1}^{4}\left(\frac{K_{qh}^2}{\bar{k}_{qh}^2}\hat{S}_{jqh}^2\right)}{N_h}\right]}{\hat{TF}_h * \hat{D}_{jh}^{\,2}}}$$