

## Discard Estimation for use in Weekly Sector Catch Reports

Discards and landings are the two components that comprise total catch, the quantity that will be reported weekly to NMFS by each sector. All weights associated with the estimation of total catch (including discards and landings) are in live weight (pounds). Dealer landed weights will be converted to live weight using NMFS-provided conversion factors. Until fishing year (FY) 2012, a sector may elect to develop an at-sea monitoring program that must be approved by NMFS, or use an assumed discard rate based either on the most recent assessment or sector-specific observer data. For fishing year 2012, a sector must develop an approved at-sea monitoring program. When a sector utilizes an at-sea monitoring program, discards will be determined by using one of two methods depending upon the at-sea monitoring coverage level: 1) 100% at-sea coverage or 2) some at-sea coverage (ranging from > 0% to <100% coverage) of applicable trips. An applicable trip is defined as a trip where catch (landings or discards) of groundfish are expected to occur, as described in Amendment 16.

### *Discard estimates based upon assumed discard rates:*

If a sector decides not to have an at-sea monitoring program in FY2010 and FY2011, then a discard estimation approach utilizing an assumed discard rate, expanded to total stock discards, will be used. All sectors not utilizing an approved at-sea monitoring program will use this discard estimation approach.

When the Council selects one of the assumed discard rate options in Amendment 16, a matrix (as specified by the selected option) of assumed discard rates will be provided by NMFS. The assumed discard rate will use a combined ratio method. This is the method used in the Standardized Bycatch Reporting Methodology (SBRM) analyses as well as that used to estimate discards for stock assessments. The method is based on a ratio estimate pooled over all calendar quarters for trips in a stratum (a stratum is defined by gear type and geographical area). The assumed discard rate for a stock is the weighted sum of discarded pounds of a stock divided by the weighted sum of kept pounds of all species from trips using the same gear type fishing in the same geographic area pooled over calendar quarter (Equation 1 in Appendix 1). The discard pounds of a stock from a trip are derived by multiplying the discard ratio by the total kept pounds of all species for the trip (Equation 2 in Appendix 1).

The trip kept pounds of all species will be determined by each sector using unaudited Dealer and unaudited VTR data, by gear type and stock area. The unaudited Dealer data contains the kept pounds and the unaudited VTR data contains the information on gear type and area. If a trip fished in multiple areas and/or fished with multiple gears, then the total kept pounds for each subtrip will be derived and then used. A subtrip is defined as each unique combination of statistical area, gear type and mesh size fished on a trip. Sectors will be required to apportion Dealer landings to statistical areas and gear types by using the proportions of species landings by area and gear type as reported in the VTR data. Illustrative examples will be provided in Appendix 2 and available at the workshop. As audited data become available, there is an expectation that sectors will update the discard estimates using audited data and provide updated catch reports.

*Discard estimates based upon 100% at-sea monitoring coverage:*

If a sector has an at-sea monitoring program with 100% coverage, then no discard estimation is required when all hauls are observed: the total trip discards for each stock will be the sum of the direct observations for each stock. For trips with unobserved hauls (hauls with no direct observation), stock discards for the trip will be estimated by a discard rate based on the trip's observed hauls. The stock discard rate will be the sum of the stock discard pounds from observed hauls divided by the sum of the kept pounds of all species from the observed hauls. The stock discard rate will be multiplied by the sum of kept pounds of all species on the trip to estimate stock discards for the trip (Equation 3 in Appendix 1).

*Discard estimates based upon some at-sea monitoring coverage:*

If a sector decides to have some at-sea monitoring in FY2010 and FY2011, a discard estimation approach utilizing the data collected by the at-sea monitors will be used. The data collected on trips with at-sea monitors will be aggregated by time (e.g., a 35-day moving window to capture seasonal trends) and applied to every trip within that time window. All sectors operating in this manner will use this discard estimation approach.

If a sector is using some at-sea monitoring coverage for estimating discard, it will employ a 35 day moving window of observer reports to estimate discards of stocks for their fleet. A separate discard rate will be calculated for each stock and gear type.

These daily discard rates will be calculated as follows:

- for each day, sum the observed stock discarded by gear and divide by total observed landings of all species and all gears
- do this for all observed trips sailing for the past 35 days. The discard rate calculation applies starting the day the observed trip sailed. Observed trips sailing 36 days before are dropped from the calculation.
- calculate a separate discard rate for each stock by gear

For the first 35 days of a fishery, a constant discard rate will be calculated and applied instead of the moving window calculation. Also, when there is a substantial change in fishery regulations that NMFS expects to cause a change in fishing behavior, for the first 35 days a constant discard rate will be calculated and applied. NMFS will inform sectors when this event occurs. The discard rate calculation will be similar to the moving window calculation:

- for each day, sum the observed stock discarded by gear and divide by total observed landings of all species and all gears
- do this for all observed trips sailing since the beginning of the fishery or regulation change. The discard rate calculation applies to the entire first 35 days of the fishery or regulation change
- calculate a separate discard rate for each stock by gear

The daily discard rate will be multiplied by the sector's landings to estimate discards on each trip. The discard rate for each stock by gear will apply to the trip's landings of each stock by

gear. The discard rate on the trip's landing date will apply to the sector's landings and that is the date when the discard will be counted.

NMFS may change the 35 day window to a different number of days if evidence warrants it.

*Coverage levels for some at-sea monitoring coverage:*

The coverage level needed for an at-sea monitoring program is described in the At-Sea Monitoring Provider document. As described there, the coverage level needed to meet SBRM requirements cannot be calculated yet; however the NMFS will work with sectors to develop a good faith approximation of necessary at-sea monitor coverage levels to achieve the desired level of precision based upon past data and gear types by 're-scaling' the SBRM prioritized sea days to each sector. This minimum coverage level will not address bias concerns and would not necessarily be reflective of operations under sectors. A stable coverage estimate would require experience under the proposed sector regime before it could be developed. NMFS will work with sectors to identify the appropriate coverage level for each sector once additional information regarding sector operations, including sector rosters and measures included in the operations plans, becomes available.

*Good faith approximation of coverage levels*

For each sector, a good faith approximation of the expected coverage, in terms of sea days, could be determined by re-scaling the SBRM sea days needed to achieve a 30% CV for each of the SBRM fleets. This approach would use the SBRM sea days based on the Northeast Fisheries Observer Program (NEFOP) and the Vessel Trip Reports (VTR) data from July 2007 to June 2008 (i.e., the same data used in the 2009 SBRM analysis to estimate the number of sea days needed to achieve a 30% CV), and the days absent in the VTR data for the same time period by trips made by vessels within a sector and by trips made by all vessels in the entire fleet.

The sea day coverage for each sector and gear type would be calculated as the days absent of all trips made by sector vessels multiplied by the ratio of SBRM sea days divided by the total VTR days absent for a gear type. The sea day coverage for each sector would then be summed over all gear types (Equation 4 in Appendix 1).

## Appendix 1

The assumed discard rates provided by NMFS will use a combined ratio estimator.

$$\text{Eq. 1} \quad r_{c,j} = \frac{\sum_{h=1}^Q N_h \sum_{i=1}^{n_h} \frac{d_{jih}}{n_h}}{\sum_{h=1}^Q N_h \sum_{i=1}^{n_h} \frac{k_{ih}}{n_h}}$$

where  $r_{c,j}$  is the combined discard ratio of stock  $j$ ;  $d_{jih}$  is discards of stock  $j$  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 Dealer trips in stratum  $h$ ;  $n_h$  is the number of observed trips in stratum  $h$ . Stratum  $h$  represents a calendar quarter. Each estimate of the discard ratio is associated with a gear type. The subscript for gear type has been dropped to improve readability.

The discard pounds of a stock for a trip are derived by multiplying the discard ratio ( $r_{c,j}$ ) by the total kept pounds of all species for the trip.

$$\text{Eq. 2} \quad \hat{D}_{ji} = r_{c,j} K_i$$

where  $\hat{D}_{ji}$  is discard pounds for stock  $j$  in trip  $i$ ;  $K_i$  is Dealer total trip kept pounds of all species with the same stock area and gear type as the discard ratio. (Note that the  $K_i$  implies that the total kept pounds are recorded by stock area within a trip.)

For trips with some unobserved hauls from sectors with 100% at-sea monitoring program, discard pounds of a stock will be estimated using a discard ratio based on observed hauls multiplied by the total trip kept pounds of all species in with the same stock area and gear type.

$$\text{Eq. 3} \quad \hat{D}_{ji} = \frac{\sum_{m=1}^M d_{j,m}}{\sum_{m=1}^M k_{all,m}} K_i$$

where  $\hat{D}_{ji}$  is discarded pounds for stock  $j$  in trip  $i$ ;  $d_{j,m}$  is the sum of the stock discard pounds from observed hauls of the trip  $i$ ;  $m$  is the index for the  $m$ th haul out of  $M$  total observed hauls within trip  $i$ ;  $k_{j,m}$  is the sum of the kept pounds of all species from observed hauls of the trip  $i$ ;  $K_i$  is Dealer total trip kept pounds of all species with the same stock area and gear type as the discard ratio. (Note that the  $K_i$  implies that the total kept pounds are recorded by stock area within a trip.)

Good faith approximation of expected sea day coverage.

$$\text{Eq. 4} \quad SD_s = \sum_{f \in \{s\}} a_{fs} \frac{n_f}{N_f}$$

where  $SD_s$  is the expected sea day coverage for sector  $s$ ;  $a_{fs}$  is the VTR days absent in the SBRM fleet  $f$  for members of sector  $s$ ;  $N_f$  is the total VTR days absent by all vessels in SBRM fleet  $f$ ;  $n_f$  is the SBRM sea days for 30%CV by SBRM fleet  $f$ ;  $f$  represents a given fleet defined as the combination of gear type, region, mesh size, access area, and trip category (the stratification used in the SBRM sea day analysis). Note that  $\sum_{f \in \{s\}} a_{fs}$  is the expected days absent for members of sector  $s$  given the previous years fishing patterns.

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Appendix 2: Illustrative Examples (will be available at the workshop)

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