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Methods to Determine Discards from Observed Trips

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A working paper in support of the Discard Estimation Methodology Review

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Review of the Northeast Region Discard Estimation Methods for Groundfish Quota Monitoring and Annual Catch Limits

Background: *Sector management to be implemented under Amendment 16 to the Northeast Multispecies Fishery Management Plan requires weekly monitoring and reporting of total catch (landings and discard) by sector, stock, and gear type. A method for estimating discards is required which must meet a broad range of performance standards beyond statistical robustness: because of the volume and frequency of the updates, a method which is not computationally intensive and does not require direct involvement of the analyst is desirable. Because total catch is prescribed by an associated Annual Catch Entitlement (ACE) for each stock within the sector, the method should minimize the possibility of under- or over-harvesting with respect to the ACE. Similarly, the method should balance responsiveness to temporal changes in fishing practices with stability in terms of status of total catch with respect to the ACE. Finally, because discard estimation processes have already been developed and reviewed in the contexts of both Standardized Bycatch Reporting Methodology and individual species stock assessments, the method should be as consistent with those approaches as possible. It is thus very desirable to minimize the difference between discard estimates for sector monitoring and discard estimates for stock assessments.*

Terms of Reference

1. *Compare and contrast the performance with alternative estimators of total discards with respect to precision and accuracy.*

2. *Evaluate impacts of trimming observations (e.g. large discard events) on the magnitude of bias and measures of precision.*

3. *Examine the cumulative method and temporally stratified cumulative method (with various time steps and discarding patterns) and recommend a preferred method with consideration of the following:*
   i. *Within-year pattern of precision and bias, including a review of historical data used to estimate landings and discards (precision/accuracy)*
   ii. *Feasibility/practical aspects, particularly implications of stratum size for small sectors and the ability to derive obtain fine-scale measures of total discard and its uncertainty.*
   iii. *Estimate the probability of premature closure.*

4. *Provide guidance of methods to measure uncertainty of the preferred method. e.g., asymptotic versus bootstrap estimates of variance.*

5. *Provide guidance on risks of alternative management actions given the uncertainty and/or behavior of the preferred discard estimation method. In particular, consider the costs to the industry/sector from premature cessation of fishing and the risk to the resource from excess harvests.*

6. *Consider implications of finer-scale stratification on performance of estimators that might be required for sector-specific discard rates and will be required for multi-stock species.*

Methods to Determine Discards from Observed Trips

Introduction

This working paper describes[1] the methods and data elements used in determining the stock discards from observed trips. While this working paper includes unobserved trips as one of the four types of trips and describes the data elements that are used in the estimation the discards for these trips, this paper does not describe in detail the methods used to estimate discards for unobserved trips. This is a companion working paper to the suite of working papers and documents that describe the methodology of groundfish quota monitoring and annual catch limits that include: discard estimation for unobserved trips with the same trip characteristic as observed trips (Nitshcke 2010), an investigation of separate ratio method via simulation analysis (Palmer 2010b), the use of assumed discard rates for unobserved trips without the same trip characteristics as observed trips (Wigley 2010), and the stock apportionment algorithm used for landings (Palmer 2010a) and other related working papers.

There are two components of total catch: landings and discards. The discard component is comprised of two sub-components: observed discards and unobserved discards.
Sector *s* catch (pounds, live) of stock *j* is characterized as

$$(1)\quad \hat{C}_{s,j} = \sum L_{s,j} + \sum \hat{D}u_{s,j} + \sum Do_{s,j}$$

where:

$L_{s,j,}$ is landings (pounds, live) of stock *j* from sector *s* trips;
$\hat{D}u_{s,j}$ is the estimated discards (pounds, live) of stock *j* from unobserved sector *s* trips;
$Do_{s,j}$ is the observed discards (pounds, live) of stock *j* from observed sector *s* trips.

Stock area is the collection of statistical areas associated with stock *j*; the subscript j will be used to denote both the stock and the statistical areas associated with that stock. Due to the differences in collections of statistical areas for each stock, haul by haul data must be aggregated to the subtrip level. Subtrip is defined as a unique gear-statistical area-mesh, a definition consistent with the Vessel Trip Reporting (VTR) requirements (NMFS, undated). In lieu of statistical area, aggregation could occur at the four 'broad reporting' areas described in Amendment 16 of the Northeast Multispecies Fishery Management Plan (NEFMC 2009), however, the 'broad reporting' area scheme does not support stock classification for three of the eight multi-stock species (i.e. monkfish, red hake and silver hake). While the use of the broad reporting area will not impact groundfish, it will impact the annual catch limits (ACL) of monkfish, red hake and silver hake. Thus, it is not recommended to use the four broad reporting area scheme for quota monitoring and annual catch limits when other data sources with statistical area resolution are available (see Palmer 2010a).

[1] Operational (database) terms have been used throughout this document to support the implementation of these methods.

When a trip is observed by a Northeast Fisheries Observer Program (NEFOP) observer or an at-sea monitor (ASM), there are three possible scenarios:

> Scenario 1: all hauls are observed for discards in stock area *j*, gear *g* and mesh *m*. Operationally, all the hauls have *obsrflag* = 1.
>
> Scenario 2: some hauls are observed for discards in stock area j, gear *g* and mesh *m* and some hauls are not observed for discards in stock area j, gear *g* and mesh *m*. Operationally, some hauls have *obsrflag* = 1 and some hauls have *obsrflag* = 0 for stock area j.
>
> Scenario 3: no hauls are observed for discards in stock area j, gear *g* and mesh *m*. Operationally, all hauls have *obsrflag* = 0 for stock area j.

Thus, the observed discard weight of stock *j* from observed subtrips in stock area *j* and sector *s* is the sum of discard weight, over gear *g* and mesh *m*, from scenarios 1 and 2. Discards from scenario 3 trips will be discussed below.

(2) $$Do_{s,j} = \sum Do1_{s,j} + \sum \hat{D}o2_{s,j}$$

The NEFOP Manual describes an observed haul as:
"*An observed haul is defined as one where all of the catch is recorded, regardless of whether it is kept or discarded. An unobserved haul is defined as one where complete discard information from the haul is not collected. Discard data is collected only for incidental takes and those species that are recorded on the Individual Animal Log. A haul may be unobserved because an observer is conducting a marine mammal haul watch, or is below deck for weather related safety reasons, illness, etc.* ***Do not record any discard information for unobserved hauls on haul logs."*** (page 24)
http://www.nefsc.noaa.gov/femad/fishsamp/fsb/

Species hail weights are recorded for the kept portion of the catch on all hauls (observed or unobserved) and may be actual or estimated weights by the observer or the captain. Given the standard fair labor laws, most observed trips will occur according to scenario 1 or 2; only rarely does a trip fall into scenario 3 occur (Appendix Table 1) at the trip level. This scenario may occur more frequently when hauls are summarized at a subtrip level. Scenario 2 may occur more frequently for multi-day trips than for single day trips.

The fishing trips that do not have an observer on board are partitioned into two scenarios:

> Scenario 4 (U1): unobserved trips that have the *same* trip characteristics as observed trips Operationally, trips with no corresponding tripid (unique trip identifier) in the NEFOP database, AND the trip has the same trip characteristics (gear, stock area j, mesh) to observed trips.
>
> Scenario 5 (U2): unobserved trips that have *different* trip characteristics from the observed trips. Operationally, trips with no corresponding tripid (unique trip identifier) in the NEFOP database, AND the trip does not have the same trip characteristics (gear, stock area j, mesh) to observed trips.

(3) $\hat{D}u_{s,j} = \sum \hat{D}u1_{s,j} + \sum \hat{D}u2_{s,j}$

For these scenarios, it may be necessary to have a temporal identification to support the in-season discard estimation method.

Methods

Data collected by Northeast Fisheries Observer Program observers or at-sea monitors are used to characterized the component of the catch that is discarded at sea. Observers and monitors record trip, haul and species information on observed trips. An observer or monitor collects numerous data during an observed trip. The data elements relevant to discard estimation include: departure and land dates, hull number, permit number, number of hauls made during the trip, gear and mesh size used, latitude/longitude, statistical area, species hail weight[2] for all species encountered by disposition and grade (dressed or round) as well as whether or not the haul was observed for discards. Observer or monitors may make actual or estimated species hail weights, however, no distinction is made between the weight types when species hail weight data are used. Species hail weights are categorized by disposition: kept (catch disposition *catdisp* = 1) or discarded (catch disposition *catdisp*= 0). Species hail weights are further classified by grade: dressed (*drflag* = 1) or round (*drflag* = 2). For discard estimation, all species weights must be in the same unit of measure (pounds) and grade (live weight). All dressed species hail weights must be converted to round (live weight). Species with dressed hail weights (*drflag* = 1) are multiplied by the species-specific conversion factor[3] to convert dressed weight to live weight. For fish discard estimation, only observed trips with sampling protocols associated with 'complete' fish sampling are used (*tripext* = 'C' or null). Observer trips that are classified as aborted (no gear hauled or set) or have 'limited' fish sampling are not used and would be considered unobserved trips for estimation purposes. Species hail weights with an unknown value or an unknown catch disposition are not used in the calculation of discards from an observed trip. Species hail weights with an unknown *drflag* code are assumed to be round. Species hail weights categorized as discarded and which have a discard reason of '039' representing 'previously discarded' are not used in the calculation of discards from observed trips. Species information from the Individual Animal Log and the Species Log are utilized (NMFS 2010).

Table 1 provides a summary of the data elements needed, by variable, for discards for the three types of observed trips/subtrips and the two types of unobserved trips/subtrips. There are five data elements originating from observed trips, two data elements from Dealer data, and two 'meta' data elements needed to obtain or derive the discard component of catch.

The discard weight (d_j) of a stock from observed trips are used as direct estimates for trips with all hauls observed (Eq 4) and is used as the numerator of the discard ratio for observed trips with some unobserved hauls (Eq 5) and for unobserved trips (Eq 6). The kept weight of each stock/species from observed trips is obtained by the observer or monitor, regardless of whether the haul was observed for discards or not. The kept weight (k_j) of a stock from observed hauls is used to calculate the sum of the kept weight of all species ($kall_o$) and is used in the denominator of the

[2] to the nearest tenth of pound
[3] Species conversion table is species, grade and disposition specific.

discard ratio (Eq 5). The kept weight (k_j) of a stock from unobserved hauls is used to calculate the sum of the kept weight of all species ($kall_u$) and is used together with the $kall_o$ to the expand the observed discard ratio to the entire trip (Eq 5).

Amendment 16 states that if a trip is observed, than the observed discards will be used for that trip[4]. Amendment 16 does not specify what should be used for the landed portion of the catch from observed trips. For consistency among observed and unobserved trips, the Dealer kept weight of a stock (K_j) and the sum of Dealer kept weight of all species landed (*Kall*) should be used for all trips. The Dealer kept weight is converted to live weight (pounds) using species-grade-unit of measure-specific conversion table. The Dealer data has been identified as the primary data source for landings, with the VTR data as a secondary source, as described in the stock apportionment (Palmer 2010a). The stock landings (Palmer 2010a, Table 4c, column Q) and the landings of all species (Palmer 2010a Table 4c, column R) are tracked within the database using the stock apportionment trip code (Palmer 2010a, Table 4c, columns B and C). The sum of the kept weight of all species from a trip/subtrip include all species and all kept dispositions (home consumption, bait, etc.). For unobserved trips without in-season observed trips with the same trip characteristics, an assumed discard rate (r_j) based on previous year data is expanded by the sum of Dealer kept weight of all species landed (*Kall*) for the trip (see Wigley 2010). The Dealer kept weight is converted to live weight (pounds).

<u>Scenario 1 (O1)</u>: A trip/subtrip with all hauls observed for discards in stock area *j* from an observed trip *i* in sector *s*

Stock *j* discards, determined by the sum of the direct observation of all hauls for an observer trip *i* from sector *s* is defined as:

(4) $$Do1_{s,i,j} = \sum_{o=1}^{O} d_{s,i,j,o}$$

where

$d_{s,i,j,o}$ is the stock *j* discarded hail weight (live pounds) from an observed trip *i* in sector *s*. For simplicity, stratification variables that define a trip/subtrip (the statistical area comprising stock area *j*, gear *g*, and mesh *m*) have not been included in Equations 4 and 6.

Appendix Examples 1a and 1b will be provided for actual observed trips with 100% of the hauls for a single area and multiple areas, respectively, to support the programming implementation and testing.

<u>Scenario 2 (O2)</u>: A trip/subtrip with some observed hauls and some unobserved hauls for discards in stock area *j* from an observed trip *i* in sector *s*.

Stock *j* discards, extrapolated from the direct observation of observed hauls from <u>the</u> observed trip *i* from sector *s* is defined as:

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[4] "*If a trip is observed, the discards reported by the observer or at-sea monitor on that trip till be counted as the discards for that trip. Unobserved trips will use a discard estimate calculated from the observed trips*". Northeast Multispecies FMP Amendment 16 October 16, 2009 page 110

$$(5)\quad \hat{D}o2_{s,i,j} = \frac{\sum_{o=1}^{O} d_{s,i,j,o}}{\sum_{o=1}^{O} kall_{s,i,o}} * \left(\sum_{u=1}^{U} kall_{s,i,u} + \sum_{o=1}^{O} kall_{s,i,o} \right)$$

where

$d_{s,i,j,o}$ is the stock *j* discard weight (live pounds) from observed hauls in stock area *j* from trip *i* in sector *s*;

$kall_{s,i,o}$ is the kept weight (live pounds) of all species from observed hauls in stock area *j* from trip *i* in sector *s*;

$kall_{s,i,u}$ is the kept weight (live pounds) all of species from unobserved hauls in stock area *j* from trip *i* in sector *s*. These data are collected by the observer.

Appendix Example 2 illustrates an observed trip with two statistical areas and some unobserved hauls.

For scenarios 1 and 2, the total number of hauls and the number of observed hauls on an observed trip are not needed for the calculation of discards for a stock; however, these two variables provide useful information. These variables provide a cross-check for the observed trip type classification and can provide useful diagnostic information regarding the amount of information used in the observed discard rate (i.e. how many hauls were used to derive the discard rate for an observed trip or pool of trips).

Scenario 3 (O3): A trip/subtrip with no (zero) observed hauls[5] for discards in stock area *j* from trip *i* in sector *s*. This scenario of trip/subtrip can not be considered 'observed' for discard estimation purposes. Discards from these trips/subtrips are estimated using one of the methods described for unobserved trips (see Nitshcke 2010, and Wigley 2010) as described below.

Scenario 4 (U1): Data collected from observed trips with similar trip characteristics (i.e. stratification variables such as sector, gear, mesh, stock area j) are utilized in the discard estimation method described by Nitshcke 2010.

Stock *j* discards, extrapolated from the sum of direct observation of observed hauls from all observed trips *i* from sector *s* with the same stratification and the sum of the Dealer kept weight of all species from unobserved trips *i* from sector *s* with the same stratification, is defined as:

[5] It is important not to confuse this type of trip with the observed trip where hauls are observed but no discards occurred for a given stock (i.e. unobserved hauls are not observed hauls with no discards).

(6) $$\hat{D}u1_{s,j} = \frac{\sum_{i=1}^{I} d_{s,i,j,o}}{\sum_{i=1}^{I} kall_{s,i,o}} * \sum_{i=1}^{I} Kall_{s,i,u}$$

where
$d_{s,i,j,o}$ is the stock *j* discard weight (live pounds) from observed hauls in stock area *j* from trip *i* in sector *s*;

$kall_{s,i,o}$ is the kept weight (live pounds) of all species from observed hauls in stock area *j* from trip *i* in sector *s*;

$Kall_{s,i,u}$ is the Dealer kept weight (live pounds) of all species from <u>unobserved</u> trips i, in sector s with same stratification. It is important to expand the observed discard rate only by sum of the kept weight of all species from <u>unobserved</u> trips. Discards from observed trips have already been determined; therefore discards would be overestimated if the observed discard rate was expanded by the sum of kept weight of all species from both observed and unobserved trips. Equation 6 describes the calculation of stock discards at a sector level, not an individual trip level as the other equations specify.

<u>Scenario 5 (U2)</u>: Data collected from 'in-season' observed trips that do not have the same trip characteristics (i.e. stratification variables such as sector, gear, mesh, stock area j) as the unobserved trip are not be used for discard estimation. Amendment 16 states that when there are no corresponding observed trips, an assumed discard rate is used to estimate discards.

Stock *j* discards, extrapolated from an assumed discard rate and the sum of the Dealer kept weight of all species from an unobserved trip *i* from sector *s* with the same stratification, is defined as:

(7) $$\hat{D}u2_{s,i,j} = r_{s,j} * Kall_{s,i,u}$$

where
$r_{s,j}$ is a strata-specific assumed discard rate based on previous year's observer data;

$Kall_{s,i,u}$ is the Dealer kept weight (live pounds) of all species from <u>unobserved</u> trips i, in sector s with same stratification.

This scenario is viewed as a 'backstop' method to provide discard estimates when in-season observer coverage is not yet available, e.g. at the beginning of the fishing year. The expectation is that in-season observer coverage will exist for trips within the stratification scheme used and that discard estimates using this method early in the fishing year will be superseded by discard estimates derived from in-season data, when available (see Wigley 2010; VanHoosen/Caless 2010).

Meta data

Given the need to monitor annual catch entitlements and annual catch limits in near real-time, it is critical for Sector Managers and the Northeast Regional Office (NERO) monitoring staff to have the ability to track the information source of landings, the methods and information sources used for the discards, and the data quality of the data used. Information sources, methods of discard estimation, and data quality are expected to change over time as data become available through the different data collection programs (VMS, VTR, Dealer, NEFOP), thus it is useful to store this information on an appropriate time scale[6]. There are various methods to store such information (e.g. archiving, journal tracking, etc) and the method may vary depending on the particular features of the database.

To facilitate the tracking of information sources, methods, and data quality, two meta data elements are required: observer trip type and observer data quality. These meta fields are in addition to the two meta fields (trip type code and tier code) describe in the stock apportionment by Palmer (2010a). Each subtrip should be classified into an observer trip code indicating one of the three observed trip scenarios described above (O1, O2 or O3) or one of the two unobserved trip scenarios (U1, U2). Operationally, there will be six codes (O1, O2, O3U1, O3U2, U1, U2) to track both the trip/subtrip type and the method used (*note: subtrip level, not stock level*). The observed trip code should be recorded in the database for QA/QC purposes at the subtrip level and weekly time interval. This information enables the appropriate use of data collected and the application of the appropriate method for each subtrip and time interval used. The observed trip code should be independent of, but dovetail with, the stock apportionment methodology's Trip Type Code and Tier Code which describes the landings portion (the kept weight of the stock, and the kept weight of all the species) of the catch as reported by the Dealer, the official source of landings data. In addition to the observed trip code, it is equally important to store the number of observed hauls and total number of hauls in each subtrip.

To support near real-time monitoring, it is also important that a data quality code (observer data quality, *odq*) is stored in the database at the subtrip-haul level. The observer data quality code represents unaudited (raw) data or audited data. The data quality code may change over time as audits are conducted, thus a weekly time unit should also be stored. While hauls on a subtrip may have different observer data quality codes, if one of the hauls is designated as 'raw', then the subtrip is designated as 'raw'. These will be key data elements used in the resolution of data discrepancies between NERO and Sector Managers as both groups monitor annual catch entitlements and annual catch limits. These meta fields also support a complete accounting of all components of catch (Figure 1) and provide a qualitative measure of the uncertainty.

Discussion

The meta fields and the need for tracking information is put forth as a strawman for discussion. The actual values used for the meta fields, the methods of storage and timing should be determined by the Center and NERO database management staff.

[6] A weekly time frame is based upon the Sector's Managers Weekly Catch Report

For observed trips with some hauls observed and some unobserved hauls, a minimum of one observed haul per subtrip is needed, operationally, to estimate the stock discards from unobserved hauls. No examination of the minimum number of hauls needed, by species, gear, area have been undertaken. Statistically, it is desirable to have an adequate sample of hauls; however, given the reality of small sectors, this may not be achievable. At this time, it would be a policy decision to specify a number greater than one haul.

For unobserved trips with the same trip characteristics as observed trips, a minimum of one observed trip/subtrip is needed, operationally, to estimate the stock discards from unobserved trips. An examination of sample size and the performance of separate ratio was explored by Palmer (2010b). Statistically, it is desirable to have an adequate sample size of trips/subtrips; however, given the reality of small sectors, this may not be achievable.

The use of $kall_o$ and $kall_u$ to expand observed discard ratios is preferred over the Dealer *Kall* for several reasons: 1) consistency of estimates within the single database, 2) prevents the need to link trips between databases for discard rate calculation; and 3) may contain any bias in estimation of amounts with the trip.

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Table 1. Summary of five trip types and a list of variables associated with discard estimation (rows) and the meta fields used to track the data and methods used.

Variables	Observed Trip/subtrip (100% observed hauls)	Observed Trip/subtrip (<100% observed hauls)*	Observed Trip/subtrip with no hauls observed** OR Unobserved Trips with same trip characteristics as observed trips	Observed Trip/subtrip with no hauls observed** OR Unobserved Trip/subtrip with different trip characteristics of observed trips	Comments
Trip Type (meta data)	O1	O2	O3, U1	O3, U2	$D_j = \sum Do1_j + \sum \hat{D}o2_j + \sum \hat{D}u1_j + \sum \hat{D}u2_j$
Stock *j* discards (observer data) d_j	Used for stock discard (direct observation) (see $Do1_{i,j}$)	Used for stock discards: direct observations AND in the discard ratio to estimate stock discards for unobserved hauls (see $Do1_{i,j}$ and $\hat{D}o2_{i,j}$)	Variable not available for these trips; Stock discards are estimated from the pool of in-season observed trips with the same trip characteristics using Discard Estimation Method (see $\hat{D}u1_{s,j}$)	Variable not available for these trips; Stock discards are estimated using an assumed discard rate (see $\hat{D}u2_{i,j}$)	$Do1_{i,j} = \sum_{o=1}^{O} d_{i,j,o}$ $\hat{D}o2_{i,j} = \frac{\sum_{o=1}^{O} d_{i,j,o}}{\sum_{o=1}^{O} kall_{i,o}} * \left(\sum_{u=1}^{U} kall_{i,u} + \sum_{o=1}^{O} kall_{i,o} \right)$ $\hat{D}u1_{s,j} = \frac{\sum_{i=1}^{I} d_{i,j,o}}{\sum_{i=1}^{I} kall_{i,o}} * \sum_{i=1}^{I} Kall_{i,u}$ $\hat{D}u2_i = r_j * Kall_i$ Trip/subtrip *i*; sector *s*, gear *g*, area *j*, mesh *m*, are stratification variables not included in these equations; sector *s* is specified in Du1.

Variables	Observed Trip/subtrip (100% observed hauls)	Observed Trip/subtrip (<100% observed hauls)*	Observed Trip/subtrip with no hauls observed** OR Unobserved Trips with same trip characteristics as observed trips	Observed Trip/subtrip with no hauls observed** OR Unobserved Trip/subtrip with different trip characteristics of observed trips	Comments
Stock *j* kept (observer data) k_j	Variable not used for these trips; Used to derive the in-season observed kept sum of all species	Used to derive the in-season kept sum of all species on observed hauls and the in-season kept sum of all species on unobserved hauls	Variable not available for these trips. Data from in-season observed trips are used to form discard ratio.	Variable not available for these trips.	$kall_{i,o} = \sum_{o=1}^{O}\sum_{j=1}^{J} k_{i,j,o}$ $kall_{i,u} = \sum_{u=1}^{U}\sum_{j=1}^{J} k_{i,j,u}$ *where u = unobserved or O3; o = observed*
kept all (observer data) $kall_o$ and $kall_u$	Variable not used for these trips; Used to derive in-season observed discard ratio for unobserved hauls and unobserved trips with same trip characteristics	1) Used to derive in-season observed discard ratio for observed hauls; 2) the kept sum all species from observed hauls and kept sum of all species from unobserved hauls will be added together and used to expand the in-season observed discard ratio	Variable not available for these trips; data from in-season observed trips with same trip characteristics are used to form the discard ratio.	Variable not available for these trips.	*where u = unobserved or O3; o = observed*
assumed discard rate (observer data) r_j	Variable not used for these trips.	Variable not used for these trips.	Variable not used for these trips.	Used to estimate discards for these trips.	Strata-specific assumed discard rate based on previous year's observer data.

Variables	Observed Trip/subtrip (100% observed hauls)	Observed Trip/subtrip (<100% observed hauls)*	Observed Trip/subtrip with no hauls observed** OR Unobserved Trips with same trip characteristics as observed trips	Observed Trip/subtrip with no hauls observed** OR Unobserved Trip/subtrip with different trip characteristics of observed trips	Comments
Stock j KEPT (dealer data) K_j	Used for official stock landings	Used for official stock landings	Used for official stock landings	Used for official stock landings	This variable will be treated the same for all trips/subtrips (no difference based on observer)
KEPT all (dealer data) $Kall_i$	Variable not needed for these trips	Variable not needed for these trips	Needed for unobserved trips only, used to expand in-season discard ratio based on observed trips with same trip characteristics	Needed for unobserved trips only, used to expand assumed discard ratio	IMPORTANT: The expansion of unobserved trips shall use *Kall* from trips/subtrips with U1, U2, or O3. Must be able to identify observed trips so the Kall is not used in the expansion of unobserved trips (otherwise discards are double counted).
Number of observed hauls (observer data)	Used as a cross check	Used as a cross check	N/A	N/A	Needed for QA/QC; a calculated field based on observer flag (*obsrflag*)
Number of total hauls (observer data)	Used as a cross check	Used as a cross check	N/A	N/A	Needed for QA/QC; a calculated field based on observer flag (*obsrflag*)
Data quality code (meta data)	Raw or audited	Raw or audited	Raw or audited AND stock apportionment Trip Type and Tier Code for Dealer *Kall*	Use assume discard rate meta code AND stock apportionment Trip Type and Tier Code for Dealer *Kall*	Needed for QA/QC; if one or more hauls are 'raw' then subtrip is categorized as 'raw'.

* Operationally, a minimum of one observed haul per subtrip is needed.

* * An observer/monitor was on board; however, no observed hauls were recorded. Operationally, this type of trip/subtrip (O3) is treated like Unobserved Trip/subtrip (U1 or U2). The observer trip code indicates an observer was on board and this is important information for monitoring coverage, the appropriate use of the Dealer landings for this trip/subtrip, and QA/QC.

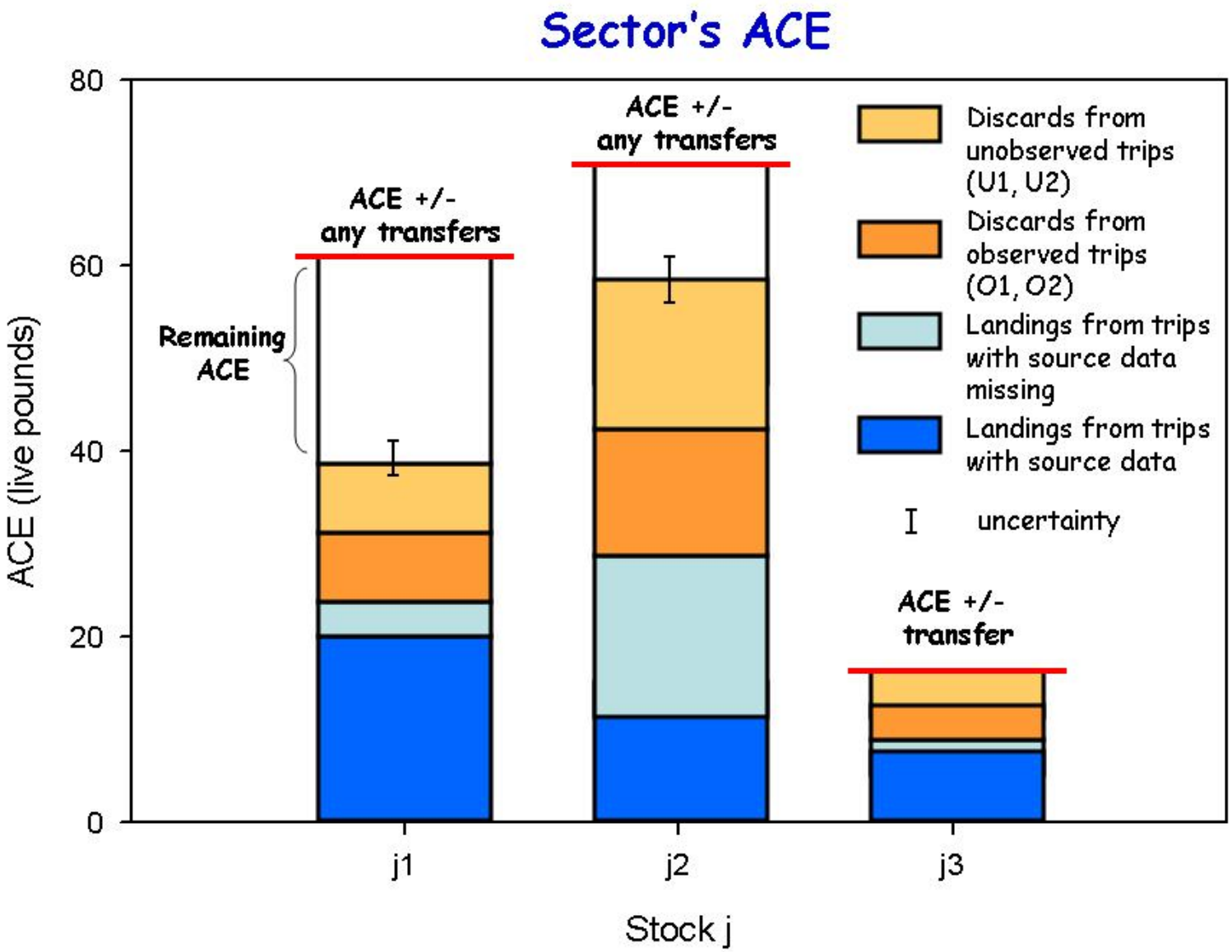

Figure 1. Schematic depicting a Sector's annual catch entitlement for three example stocks, by catch component: discards from direct observation, estimated discards, landings from primary data source, landings from secondary data sources (missing primary data source). This is for illustrative purposes only, actual pounds will vary by sector, stock and catch disposition.

Appendix Table 1. Number of trips, observed (OB) and unobserved (Unob) hauls for three gear types (longline, otter trawl and gillnet) and three trip coverage categories (0% observed hauls; <100% observed, and 100% observed) during 2005 through 2008. The percent of unobserved trips and hauls by gear type include <100% and 0% trip categories.

		Longline		Longline	Otter Trawl			Otter Trawl	Gillnet			Gillnet	Percent Unobserved			
YEAR	Data	< 100%	100%	Total	< 100%	100%	0%	Total	< 100%	100%	0%	Total		Longline	Otter Trawl	Gillnet
2005	**Trips**	**8**	**284**	**292**	**660**	**1,212**	**5**	**1,877**	**17**	**863**	**3**	**883**	trips	2.7%	35.4%	2.3%
	OB Hauls	52	1,429	1,481	15,695	7,988		23,683	80	3,628		3,708				
	Unob Hauls	16		16	2,968		9	2,977	28		10	38	hauls	1.1%	11.2%	1.0%
	Total Hauls	68	1,429	1,497	18,663	7,988	9	26,660	108	3,628	10	3,746				
2006	**Trips**	**3**	**98**	**101**	**352**	**570**	**4**	**926**	**4**	**212**	**6**	**222**	trips	3.0%	38.4%	4.5%
	OB Hauls	29	578	607	8,240	3,791		12,031	16	836		852				
	Unob Hauls	5		5	1,318		4	1,322	4		13	17	hauls	0.8%	9.9%	2.0%
	Total Hauls	34	578	612	9,558	3,791	4	13,353	20	836	13	869				
2007	**Trips**		**92**	**92**	**448**	**643**	**4**	**1,095**	**10**	**271**	**3**	**284**	trips	0.0%	41.3%	4.6%
	OB Hauls		461	461	9,611	3,303		12,914	39	1,191		1,230				
	Unob Hauls				1,982		33	2,015	11		10	21	hauls	0.0%	13.5%	1.7%
	Total Hauls		461	461	11,593	3,303	33	14,929	50	1,191	10	1,251				
2008	**Trips**	**2**	**77**	**79**	**566**	**518**	**3**	**1,087**	**14**	**262**		**276**	trips	2.5%	52.3%	5.1%
	OB Hauls	11	509	520	11,537	3,044		14,581	78	1,134		1,212				
	Unob Hauls	4		4	2,522		47	2,569	22			22	hauls	0.8%	15.0%	1.8%
	Total Hauls	15	509	524	14,059	3,044	47	17,150	100	1,134		1,234				

Appendix Example 1a. An actual example of Scenario O1 (single subtrip trip with all hauls observed) will be provided to support program implementation and testing.

Appendix Example 1b. An actual example of Scenario O1 (multi-subtrip trip with all hauls observed) will be provided to support program implementation and testing.

Appendix Example 2. An actual example of Scenario O2 (observed trip with some hauls observed fishing in two statistical areas will be provided to support program implementation and testing.

Trip id 130200807A54011:
Area 521 with 3 missing hauls and
Area 522 with 1 missing hauls
AND caught yellowtail flounder (two stocks)