DRAFT - Modifications to DMR Calculation Procedures - Aggregation and Estimation Methods[1]

Contents

1 Introduction

Halibut discard mortality rates (DMRs) are estimates of the proportion of incidentally captured halibut (halibut PSC) that do not survive after being returned to the water. DMRs are applied in-season to estimated halibut discards, as they are reported for the groundfish fisheries in the Gulf of Alaska (GOA) and the Bering Sea and Aleutian Islands (BSAI). Halibut mortalities, the product of DMR and PSC, accumulate over the course of the season, and once the specified limit is reached for a given fishery, that fishery must be closed. For the in-season application of DMRs by management, DMRs are projections based on historic estimates. Annual estimates of DMRs are also used by the International Pacific Halibut Commission (IPHC) to account for discard mortality in halibut stock assessments.

Since the late 1990s, halibut DMRs have been calculated by the IPHC and provided to the National Marine Fisheries Service (NMFS) for application in managing halibut bycatch in Alaska fisheries.

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Applied DMRs have historically consisted of simple, long-term averages of annual estimates within target fisheries as defined by region, gear, target species. DMRs have also been separately estimated and specified for fisheries operating under (and those outside of) community development quota (CDQ) programs. Long-term averages are taken from annual estimates for the most recent ten-year period with the number of years with data to support annual DMR estimates varying among fisheries. Fishery-specific DMRs, once calculated, have generally been put in place for three-year increments. In other words, as part of the specification process, a fishery-specific DMR value is kept constant by management for three years, after which a new DMR is calculated based on the average from an updated time series.

A transition in responsibility for calculating DMRs (from IPHC staff to NPFMC support staff) occurred in 2015. Additionally, improvements in the methodology for calculating DMRs as well as the application of DMRs are needed for a number of reasons. These are examined in a review that was provided by the Halibut DMR working group at the April 2016 North Pacific Fishery Management Council (Council) meeting (NPFMC 2016 - attached). At that meeting, the Council directed the Halibut DMR working group to begin to develop alternative methods for calculating DMRs so as to provide the opportunity to revise the DMRs currently specified for 2017. A range of improvements along four different stages in the estimation/application process (unit of estimation, estimation method, temporal smoothing, duration of application) were outlined in NPFMC (2016). The proposed methodology discussed here is responsive to that outline, and is considered by the working group to be more consistent with the data collection methods that provide the inputs for DMR calculation.

The methods explored here represent a single step within the context of continued development of improved estimation procedures. As part of that process, this initial attempt at alternative estimation methods is undergoing review by the Joint Groundfish Plan Team at its September 2016 meeting. Following a description of the methods and a brief presentation of results, a short series of specific questions relative to the recommendations of the Working Group are provided in **Review/Questions** for the Plan Team**, below. These questions are submitted in order to facilitate feedback for refining the proposed methods for further Plan Team review in November, and potential application for management beginning with the 2017 fishing year.**

1.1 General Approach

DMR calculation has been and continues to be based upon the distribution of discarded halibut among condition or viability categories as assessed through standardized observer program methods. The proposed improvements are envisioned as being intrinsically **consistent with Observer Program sampling design** hence reducing the potential for bias, and also to be more **consistent with the operational causes of variation in DMRs** among fisheries.

1.2 Consistency with Observer Sampling Design

The proposed estimation process follows the observer sampling hierarchy more closely than the previous method by expanding condition (viability) data from the haul, trip, and gear-based stratum levels. This adjustment is possible because of the random assignment of observers at the trip level within strata that began with the restructuring of the observer program in 2013. The observer program's Annual Deployment Plan (e.g., NMFS 2015) defines strata and the sampling intensity for each stratum for the following year. Currently strata are defined by gear type, while previously strata were small and large vessels. Since the previous estimation method did not include the trip or stratum levels of the hierarchy, differential sampling intensities may have introduced bias into the DMR estimates. Estimating within the sampling design will allow appropriate expansion and weighting at each level of the sampling hierarchy (see Cahalan et al. 2014 for a description of the sampling and estimation hierarchy). Estimating in accordance with the sampling hierarchy will also allow changes in sampling methodology to be assimilated into the DMR estimation methods.

1.3 Replacing Target Fisheries with Operational Groupings

In addition, in the proposed method, data are grouped (within each gear-based stratum) according to vessel operations that impact the condition of discarded halibut (vessel operations) including sorting and handling practices, gear type, and processing sector. In the status quo methods, the calculation of DMRs grouped observer information based on the assignment of a fishery target to a trip (defined as a week on CPs and a delivery on CVs), where the fishery target is defined by the predominant landed species for the trip, regardless of the predominant species of any given haul (see Cahalan et al 2014). However, fishery targets do not necessarily characterize statistical and/or operational differences in the sampling or handling of halibut.

In some cases, limiting estimation to trip target aggregations may have reduced the quality of mortality rate estimates due to small sample sizes or by combining operations with very important differences in sampling and handling characteristics. By basing the new groupings on vessel operational characteristics and by taking onto consideration the sampling intensity within strata and trips, this proposed DMR estimation method is expected to result in DMR estimates that have lower potential for bias and for which statistical properties can be estimates (i.e. variance).

Until an alternative basis for estimating DMRs is developed (e.g., model-based approaches), DMRs will continue to be based on observer assessments of halibut condition collected as a routine part of observer sampling. In assessing the proposed alternative methods, the DMR working group agreed that halibut DMR estimation should be consistent with observer sampling methods and fishery operational characteristics. Hence, the proposed approach is focused on calculating DMRs at the gear and operational level which is discussed in detail in the next section.

Finally, we note that these proposed aggregations are for the calculation of the DMRs only and do not change current PSC estimation methods in Catch Accounting System (CAS). Total halibut mortality will continue to be calculated and reported to the IPHC using CAS PSC estimation methods. The DMRs published in the harvest specifications will be applied to the CAS PSC estimates using the methods in this paper, and halibut mortality will be reported by fishery target where necessary.

2 Operational Groupings

Among the most important influences on the viability of released halibut are the onboard methods of handling halibut, which vary depending on the type of vessel, and the gear used for capture. These operational differences drive both the sampling challenges faced by observers and the methods used by crew to handle halibut. As a result, vessel operation and gear type are the broad groupings that will minimize differences between DMRs. Vessel categories are currently proposed to be designated as Catcher Vessel (CV), Catcher Processor (CP), and Mothership (M) and gear categories are proposed to be separated into pelagic trawl, non-pelagic trawl, hook and line, and pot. Additionally, trips in the BSAI Pollock (AFA) pelagic trawl category and trips in the Rockfish Program CVs are grouped separately. Handling of catch and the likely impacts to discarded halibut for each operation type are described in general terms below with the descriptions being drawn from Observer Program experience. Figures 1 and 2 illustrate these groupings for each FMP area and within each operation type.

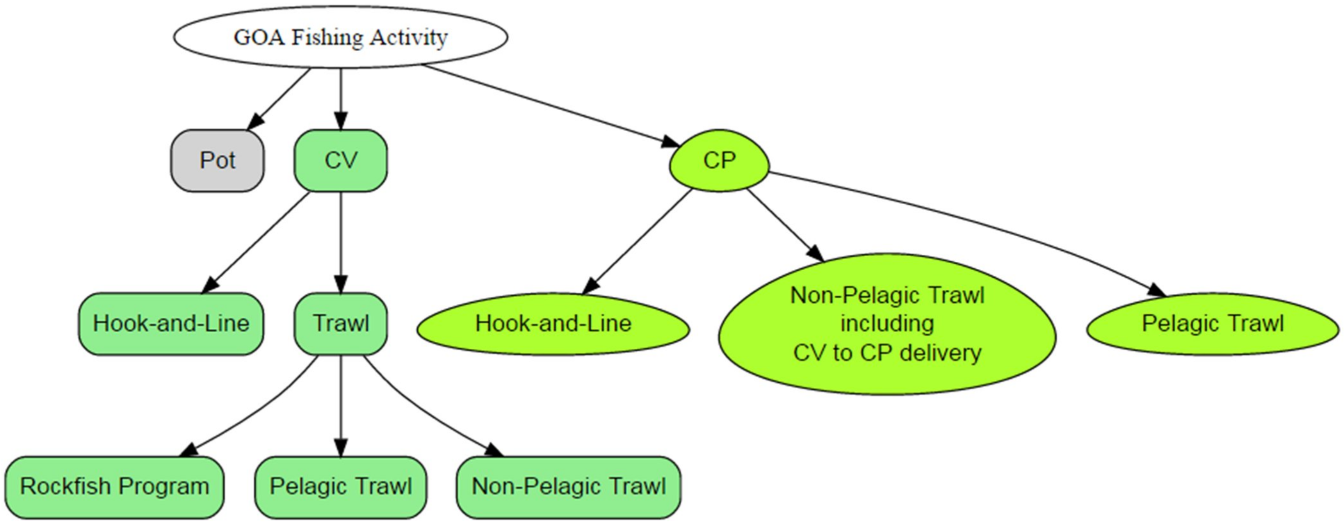

Figure 1. Proposed fishery-level aggregation scheme for the calculation of DMRs in the Gulf of Alaska.

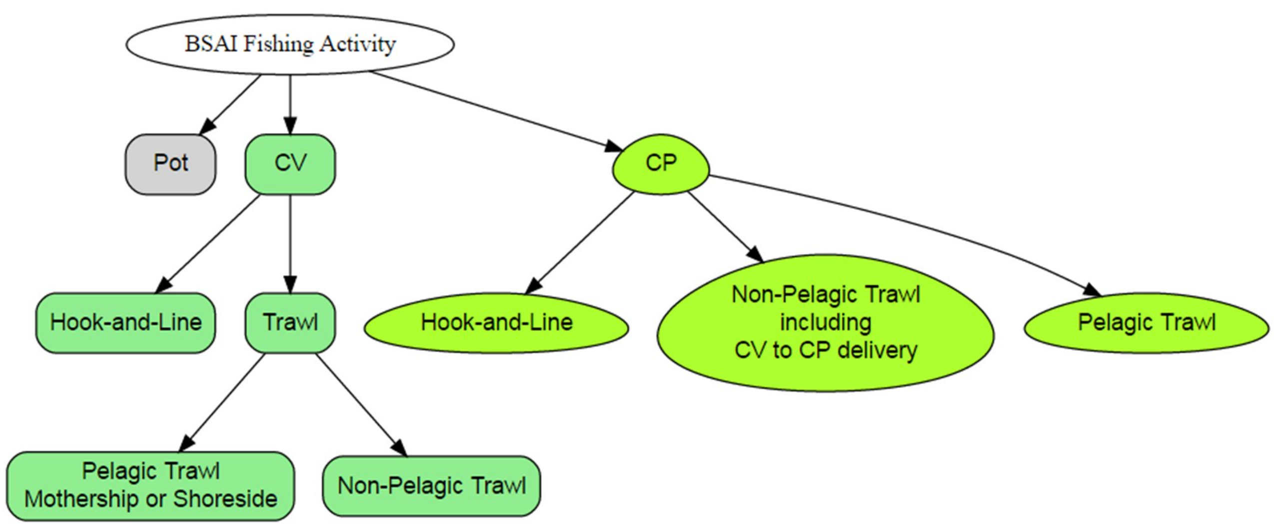

Figure 2. Proposed fishery-level aggregation scheme for the calculation of DMRs in the Bering Sea.

2.1 Catcher Processors – Trawl Gears

2.1.1 Non-pelagic Trawl Gear

The logistics and handling of catch is different on vessels fishing non-pelagic trawl gear (NPT) than on vessels fishing pelagic trawl gear (PTR). Catches associated with vessels fishing NPT gear are generally smaller, have higher species diversity, and have operationalized at-sea sorting and discarding of catch (e.g. Amendment 80 flatfish fisheries). Sorting of catch on CPs is prohibited by regulation from occurring on deck and all sorting occurs in the factory. Operationally, this means halibut remain on the vessel until sorting can occur, which is different from CVs where halibut are sorted on deck shortly after being brought onboard. An important exception to this regulation is the current Experimental Fishing Permit in the BSAI (deck-sorting of Pacific halibut), however, vessels participating in that program are exempt from the normal DMR assignment done by CAS.

The amount of handling and injury experienced by halibut on CPs fishing NPT gear is associated more with vessel operational characteristics rather than species targeted; crew sorting and handling behaviors are often consistent between hauls while dominant species in the retained catch (trip target) is unknown until the catch is processed. Observers sampling NPT hauls collect halibut viability data in the factory as close to the point of discard as possible, in order to minimize changes in the condition of halibut between the time of observation and the discarding event. Depending on the factory layout, an observer may not have access to halibut near enough to the point of discard to enable the collection of viability data. These sampling exceptions likely vary depending on the vessel, weather and fishing conditions, or a suite of other factors such as an abnormal volume of fish. Of note is that observers do not collect viability data from halibut that do not represent "true crew handling" or in situations where a factory has obstacles that affect the viability (i.e., incline belts).

Although the dominant species of a haul (i.e., target species) may vary, the size and general handling of the catches is similar regardless of the predominant species caught. As a result, the viability of the halibut does not vary greatly between target species on CPs fishing NPT gear. Thus, target is not an import DMR estimation factor and, under certain target groupings, may result in small sample sizes. For these reasons, **we recommend DMRs be calculated separately for CPs using NPT gear.**

2.1.2 Pelagic Trawl Gear

Vessels fishing pelagic trawl gear tend to have large, relatively low diversity catches. For vessels in the BSAI pollock fishery (AFA), fish are unsorted and transferred directly from the trawl net into the live tanks where they are 'aged' for several hours before being processed in the factory. Hence, the survivability of any halibut in the catch is impacted by being pressurized in the net (especially for larger catches) and aged[2] for several hours before it is sorted from the catch and discarded. When observers encounter halibut and are able to collect viability data, the halibut are rarely alive. Based on these operational characteristics, **we recommend all halibut caught on CPs fishing PTR gear and targeting pollock ("P" or "B" target) in the BSAI be assumed dead (i.e., DMR of 100%).**

Similarly, in other pelagic gear fisheries such as the Rockfish Program, most catches are unsorted prior to processing and bycatch is transferred directly to the live tanks. Although rockfish are not aged prior to processing, they tend to remain in holds for long periods due to large tows and the constant need for crew to facilitate the movement of rockfish towards the exit points in the hold. In addition, rockfish spines are a source of injury to halibut that can be substantial in rockfish-dominant tows (e.g.., Pacific Ocean Perch). While most hauls on these trips may be dominated by rockfish species and not sorted on deck, often the

[2] Aging refers to the practice of letting the fish reach rigor mortis prior to processing.

last haul(s) may be dominated by P. cod or other species and will be sorted on deck. On these hauls where catch is sorted and halibut are discarded, observers are more able to collect condition data. This differential sorting of catches for different hauls is another reason for the estimation process to follow the sampling hierarchy. **These differences warrant CPs using PTR gear in the GOA be assessed separately from other GOA CP activity (Figure 1).**

2.2 CPs acting as motherships

There are special situations in the Bering Sea and Aleutian Islands (BSAI) and in the Gulf of Alaska (GOA) where CVs deliver unsorted catch to CPs. This activity is often referred to as "bags over the side", in reference to fish being retained in the codend and being transferred from one vessel to another (unsorted codends are defined in federal regulation). This activity mainly occurs in the BSAI when trawl vessels are targeting Pacific cod, yellowfin sole, Pacific ocean perch, or Atka mackerel. This activity may also occur in the GOA for vessels using trawl gear, but is not used as much as in the BSAI. **To the extent feasible, we recommend collecting viabilities for these trips and assessing mortality separately from other fishing activities, and estimating DMRs by trawl gear type and FMP area when viability samples are available and the resultant DMRs are not confidential. In situations where samples are unavailable or confidentiality issues arise, this activity should be assessed as CV activity by gear type and FMP.**

2.3 Catcher Processors - Hook-and Line Gear

Sorting of bycatch on hook and line vessels (both CPs and CVs) occurs on deck, generally at the hauling station as the line comes over the rail. Hence, bycaught halibut are rarely transferred to the factory or hold. Observers collect data on injuries to halibut on deck of both CPs and CVs. Injuries are often a result of release from the hook, entanglement in the groundline, or sand flea infestations. Of note is that on either CPs or CVs, large halibut have a higher tendency to drop off the line and are more difficult to bring onboard and release in a typical fashion. If the halibut is not released using typical handling methods, the observer is instructed not to assess injuries of the halibut.

Although catches are generally handled on CPs and CVs in a similar fashion, CPs tend to set longer groundlines with retrieval times that can be in excess of 10 hours. As a result, halibut remain on the hook for long periods and are susceptible to sand flea infestation. In addition, larger vessels (most CPs) are more likely than smaller vessels (e.g., many CVs) to straighten hooks in order to release bycaught halibut. Hook straightening is a release method where the hook is straightened against the roller and the halibut can easily slide off the straightened hook. This release method causes fewer and less severe injuries to the discarded halibut. Unfortunately, since the hook is straightened by the action of the gangion coming over the rail against the roller, this release method is very difficult to replicate inboard of the rail so that the halibut is available to the observer. Injury assessments are often not recorded on vessels that use this release method. The hook straightening release method is used primarily on CPs.

These important operational differences between hook-and-line CPs versus CVs should be captured in the DMR calculation. **We recommend that hook-and-line DMRs for CPs be estimated separately from CV operations, resulting in separate DMRs for hook-and-line CPs versus CVs for each FMP area.**

2.4 Catcher Vessels – Trawl Gears

Trawl catcher vessels (CVs) deliver their catch either to a CP or mothership (at-sea) or to a shoreside / stationary floating processor. In either scenario, catches are sorted immediately from the trawl deck or, in cases where the catch is less diverse, the vessel may not sort at-sea but rather deliver unsorted catch to the shoreside processing facility. The type of gear used, fishery, and vessel operational differences often dictate onboard sorting behavior and the ability of the observer to sample halibut for viabilities.

2.4.1 Non-pelagic Trawl Gear

CVs fishing with non-pelagic trawl gear have different crew sorting and processing behaviors than those using pelagic gear. These vessels fish smaller tows than pelagic trawl CVs and sort their catches prior to delivery to the shoreside or stationary floating processor. Halibut on these vessels are actively sorted and viability data can generally be collected by an observer. Recorded viabilities for halibut sorted from the catch at-sea will vary based on a number of factors including handling and crew sorting behaviors, access to the closest point of discard, weather conditions, and the amount of time the halibut is out of the water. These factors are similar across a range of dominant target species (e.g., for various flatfish species). **We recommend calculating a DMR specific to an FMP and CVs fishing NPT gear.**

2.4.2 Pelagic Trawl Gear

CVs fishing pelagic trawl gears tend to have large tows with low species diversity, and these tows are not sorted at-sea. In the pollock fishery, catch is transferred directly from the trawl to an RSW tank where it remains until it is delivered to the shoreside or at-sea processor. Pollock catches delivered to at-sea processors (i.e., motherships) are 'aged' prior to being processed, hence any halibut in the catches will rarely be alive. Thus, halibut caught by CVs making either a shoreside or mothership delivery are likely dead prior to discard. **We recommend 100% mortality (DMR=1) be assumed for all halibut caught by CVs in the pollock fishery ("P" or "B" target).**

2.4.3 Rockfish Program

Operational characteristics in the rockfish fishery both increase the DMR and complicate sample collection by an observer. When crew is actively sorting halibut, an observer is able to collect viability data. However, when the catch is dumped directly into the RSW tanks and the crew is not actively sorting for halibut, viability data cannot be collected. In these situations, all halibut are delivered to a shoreside processing facility. Halibut delivered to the shoreside processing facility are dead. Even in situations where the crew is sorting halibut and observers obtain viabilities, the presence of rockfish spines tends to decrease the overall condition of the halibut. For these reasons, **we recommend Rockfish Program trips be assessed for DMRs separately from non-rockfish trips.**

2.5 Community Development Quotas

All CDQ hauls are required to be observed (full coverage). CDQ status can be assigned after the haul is processed (regulations allow this assignment up to two hours after processing). Hauls with less bycatch (halibut or salmon) will tend to have a higher probability of being designated as CDQ hauls while those with higher amounts of bycatch will tend to be designated as non-CDQ. Although the amount of bycatch may vary with CDQ status, the size of the haul, fishing operations, and catch handling process does not tend to differ. For this reason, **CDQ is not a recommended aggregation factor for estimating DMR.**

2.6 Catcher Vessels - Hook-and Line Gear

Similar to CPs, sorting of bycatch on hook and line vessels occurs on deck at the hauling station as the line comes over the rail. Bycaught halibut are discarded at the rail and observers collect data on injuries to halibut prior to discard. Injuries are often a result of release from the hook, entanglement in the groundline, or sand flea infestations. Again similar to CP vessels, large halibut have a higher tendency to drop off the line and are more difficult to bring onboard and release in a typical fashion. If the halibut is not released using typical handling methods, the observer is instructed not to assess injuries of the halibut.

2.7 Catcher Processors and Catcher Vessels - Pot Gear Vessels

Observers on pot vessels (CP or CV) rarely have difficulty accessing halibut and collecting viability data. Catches are sorted on-deck before being transferred either to the factory to be processed or the RSW tanks where they are stored until delivered to the shoreside processor. Due to on-deck sorting of discards from the catch of individual pots as they are brought onboard, bycatch species are not transferred to the factory or delivered to the shoreside processor. Since halibut are accessible on deck regardless of whether the vessel is a CP or CV, and the halibut are handled similarly between the vessel types, **we recommend combining CVs and CPs into a single DMR calculation for pot gear (by FMP area). Note that there is not a halibut PSC limit for pot gear, but halibut mortality is estimated and provided to the IPHC.**

3 DMR Estimation Methods

Apart from the rationale for aggregating collected viability data according to meaningful fishery characteristics, the expansion of viability assessments from individual fish up through hauls, trips, vessels, and into larger fishery groupings involves a number of steps. In general, the observer sampling design starts with randomized selection of trips within each of the sampled strata; within each trip hauls are randomly selected and catch from within selected hauls is sampled for species composition and the collection of biological data (Figure 3). The estimation process starts with these sample data and expands the condition data to the haul, across hauls within a trip and then to the stratum. The specific steps in the estimation process are described below according to methods agreed upon by the working group.

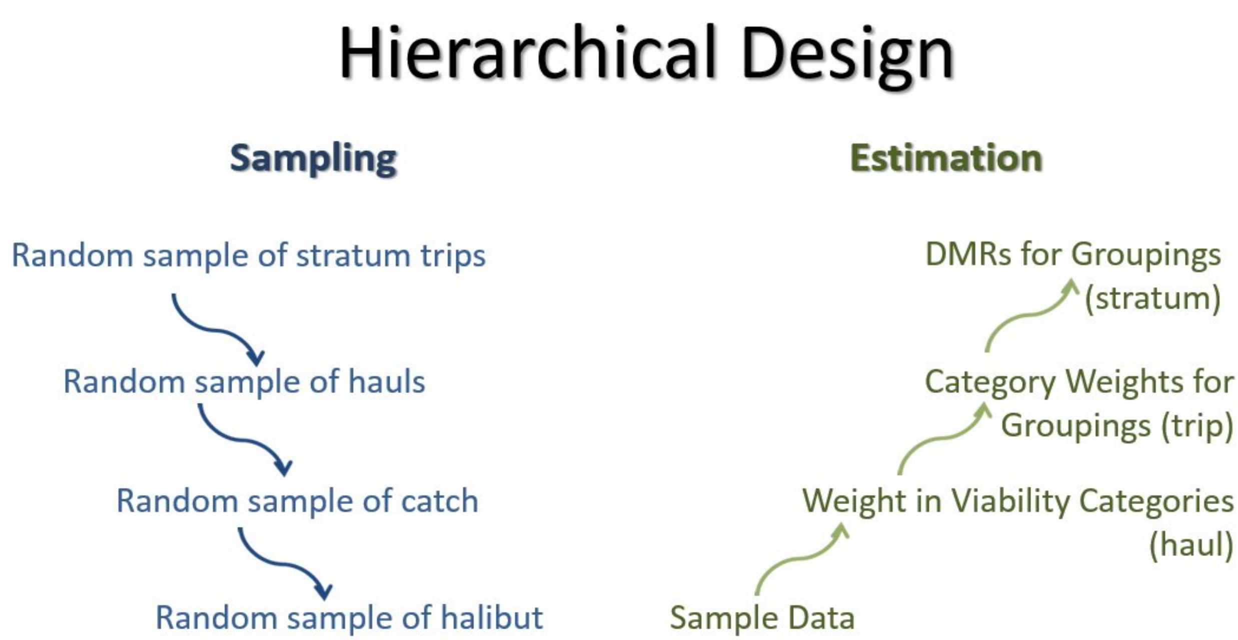

Figure 3. Estimation method, in general terms, relative to sampling hierarchy.

3.1 Proposed Outline of DMR Estimation Method

In general, this proposed estimation process expands halibut condition data collected at the haul level up through the sampling hierarchy within each sampling strata. These are weighted estimates, weighted by the estimated weight of discarded halibut at each level. Since sample rates (sampling intensities) vary not only at each level of the hierarchy, but between sample units (e.g. proportion of halibut assessed varies between hauls on a fishing trip), this weighting is important to ensure unbiased estimation. Overall, this method is similar to the method that the IPHC used in the past.

Hierarchy for the method being proposed to expand sample data from the haul, to the Trip, to the Operational Group within each sampling stratum (Figure 3).

For each haul, the proportion of halibut weight in each category is

$$\hat{p}_{cj} = \frac{\sum_{k=1}^{K_j} w_{cjk}}{\sum_c \sum_{k=1}^{K_j} w_{cjk}} = \frac{w_{cj}}{w_j}$$

and the weight of halibut in that category for the haul is

$$\hat{D}_{cj} = \hat{D}_j \hat{p}_{cj},$$

where j indexes hauls within a trip, k indexes the number assessed halibut, w_k is the weight of halibut *k*, *c* indexes the condition categories, *c* = {dead, poor, excellent} or {severe, moderate, minor, dead}, and *D* is the discarded weight of halibut.

The mortality for the haul is

$$\hat{M}_j = \sum_c R_c \hat{D}_{cj} = \sum_c R_c \hat{D}_j \hat{p}_{cj}.$$

The DMR for the haul is

$$D\hat{M}R_j = \frac{\hat{M}_j}{\hat{D}_j}.$$

Note that the total estimated mortality for the haul and the estimated DMR for the haul is not needed in subsequent computations. It is presented here as ancillary information and for completeness.

For the trip, we computed the weighted mortality estimate where the weighting is by the estimated halibut discard for that haul. At this point we add subscripts identifying the covariates that define the operational groups (*g*).

For each trip (*t*) and operational grouping (*g*), the proportion of halibut weight in each category is:

$$\hat{p}_{ctg} = \frac{\sum_{j=1}^{J_t} \hat{D}_{cjtg}}{\sum_c \sum_{j=1}^{J_t} \hat{D}_{cjtg}} = \frac{\hat{D}_{ctg}}{\hat{D}_{tg}}.$$

The total discard for the trip in each category is

$$\hat{D}_{ctg} = \hat{D}_{tg} \hat{p}_{ctg}.$$

The mortality for the trip is

$$\hat{M}_{tg} = \sum_c R_c \hat{D}_{ctg} = \sum_c R_c \hat{D}_{tg} \hat{p}_{cj}.$$

The DMR for the trip is

$$D\hat{M}R_{tg} = \frac{\hat{M}_{tg}}{\hat{D}_{tg}}.$$

Note that the total estimated mortality for the trip and the estimated DMR for the trip is not needed in subsequent computations. It is presented here for completeness.

The next step is to combine mortality estimates across trips to the operational group. Similar to previous computations, we compute the weighted mortality estimate where the weighting is by the estimated halibut discard for that trip. The proportion of halibut in each condition category is computed as

$$\hat{p}_{cg} = \frac{\sum_{t=1}^{T} \hat{D}_{ctg}}{\sum_{c} \sum_{t=1}^{T} \hat{D}_{ctg}} = \frac{\hat{D}_{cg}}{\hat{D}_{g}}.$$

The total discard for the operational grouping in each category is

$$\hat{D}_{cg} = \hat{D}_{g} \hat{p}_{cg}.$$

The mortality for the operational grouping is

$$\hat{M}_{g} = \sum_{c} R_{c} \hat{D}_{cg} = \sum_{c} R_{c} \hat{D}_{g} \hat{p}_{cg}.$$

The DMR for the operational grouping, within each stratum, is

$$D\hat{M}R_{g} = \frac{\hat{M}_{g}}{\hat{D}_{g}}.$$

The computational steps used in implementing this estimation process are detailed in the following sections.

3.1.1 Haul DMR

1. Sum the weight of assessed halibut in each viability category for each haul where halibut are assessed (A). You will end up with separate sums for each viability category.
2. Sum the total weight of assessed halibut (sum across all viability categories for that haul) (B)
3. Compute the proportion (by weight) of the assessed halibut that are in each category for the haul (A/B)
4. Apply the proportion from #3 to the total estimated weight of discarded halibut for that haul (i.e., the extrapolated weight in obs_haul_species). This gives the total estimated weight in each viability category for each sampled haul (C). ***This is the only value that is used in the next steps of the estimation process.*** *These additional steps will generate haul-specific DMR estimates that might be useful to assess potential post-stratification, domain definitions, and minimum sample sizes.*
5. For each of the viability categories, apply the mortality rate (i.e., poor = mortality rate of 0.9) to the total estimated weight in #4. This is the total mortality by viability category.
6. Total mortality for the sampled haul is the sum, across all viabilities categories, of the mortality weight from #5.

7. DMR for the haul is the haul specific mortality divided by the total discarded weight of halibut.

Estimates of DMRs for subpopulations of the fishery need to align with CAS estimation goals (monitored quotas). The subpopulations are called domains and are defined by a set of covariates (e.g. a DMR for GOA shallow water flatfish target). Hence, in addition to the haul-specific estimates of halibut discard weight for each category, each haul is linked with the fields necessary to define the domain (e.g., trip target (from CAS), NMFS Reporting Area, processing sector (CP+M or CV), potentially trip target).

Note that for some hauls, only a few halibut are assessed. The minimum proportion of halibut assessed and the total number of assessed halibut should be evaluated. Prior to 2016, we should expect few halibut per haul, depending on how many hauls the vessel is fishing per day. It would not be unreasonable to have only 3 to 5 halibut assessed.

3.1.2 Trip DMR

1. Sum the total estimated weight of halibut in each viability category across all sampled hauls within a domain where halibut are assessed (A). This is the value from step #4 above. You will end up with separate values (sums) for each viability category.
2. Sum the total estimated weight of halibut across all viability categories and hauls within the same domain. This is the sum across hauls of #2 above, but ignoring the viability category (B).
3. Divide step #1 by step #2 (i.e., A/B). This gives you the proportion of halibut by viability category for the trip for hauls with viability information collected.
4. Obtain the total estimated weight of halibut discard for the sampled trip (from CAS).
5. Multiply the ratios "A/B" (#3) by the total discard from #4. This will create an estimate of total estimated halibut for each viability category and domain within a trip. *This is the value that will be used going forward in the analysis.*
6. For each viability category, apply the appropriate mortality to the estimate from step #5 and sum across viability categories. This gives you an estimate of domain-specific total mortality for the trip.
7. DMR estimate for domain for the trip is the total mortality divided by the total discarded weight of halibut

As previous, for each trip we will want to identify the set of covariates that will define the domain, potentially including NMFS Area or FMP, fishing sector (vessel type), and gear type. Estimation from the sample through the trip levels is described in Figure 4.

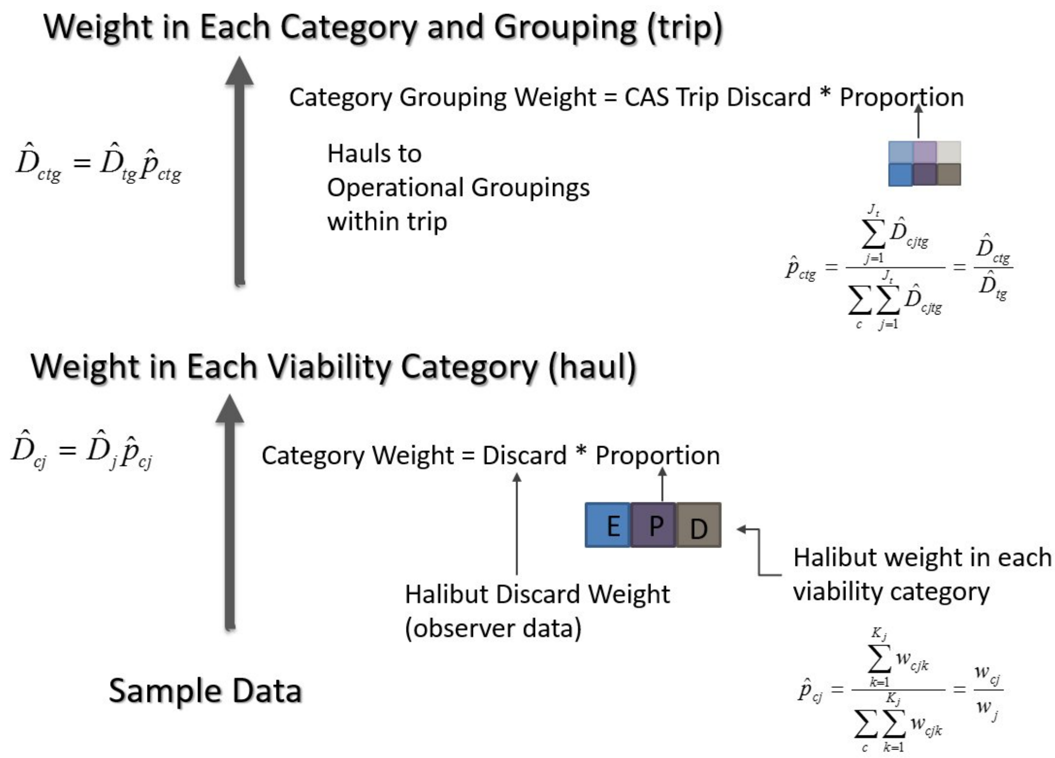

Figure 4. Estimation method, for going from haul to trip.

3.1.3 Stratum (grouping) DMR

1. Sum the total estimated weight of halibut in each viability category across all sampled trips within a domain where halibut are assessed (A). The total estimated weight is from step #5 above. You will end up with separate sums for each domain for each viability category.
2. Sum the total estimated weight of halibut across all viability categories and trips, but within the domain. This is the sum of #5, but ignoring the viability category (B).
3. Divide step #1 by step#2 (i.e., A/B). This gives you the proportion of halibut by viability category for the domain.
4. Obtain the total estimated weight of halibut discarded for the domain (from CAS).
5. Multiply the ratios “A/B” by the total discard from #4. This will create an estimate of total estimated halibut for each viability category within a post-strata/domain.
6. For each viability category, apply the appropriate mortality to the estimate from step #5 and sum across viability categories. This gives you total mortality for the domain.

DMR for the domain is the sum of the total mortality by the total discarded weight of halibut for each domain. This is the DMR that is applied to estimates of discard from CAS to generate the mortality. Estimation from the trip through the strata level is depicted in Figure 5.

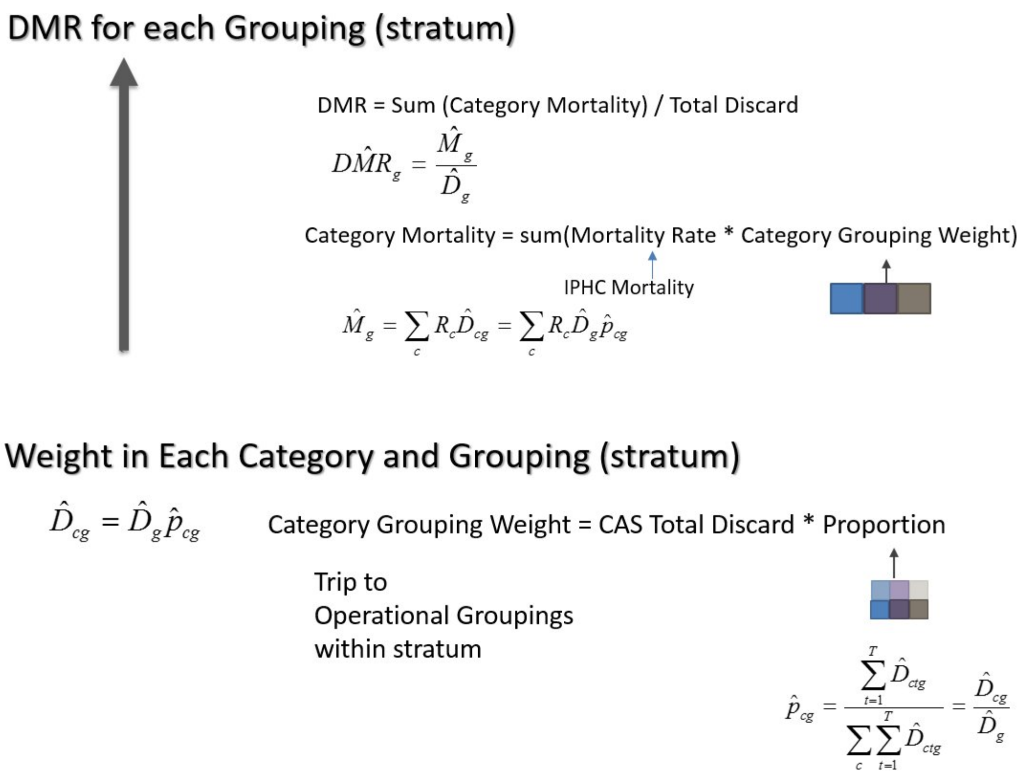

Figure 5. Estimation method, for going from trip to operational grouping.

3.2 Applied DMRs for Operational Groupings

In all cases, applied DMRs generated by the methods above would be, as they have been in the past, based on time series of annual estimates. As described in NPFMC (2016), current DMRs are simple annual averages for each fishery from the most recent 10-year period, with there being variability in the number of years with adequate data for annual estimates among fisheries. Until alternative smoothing procedures, such as Kalman filtering, is attempted, averages of annual DMRs may continue to be used, though, importantly, they could be applied using alternative length reference time series.

4 Results (DMR estimates)

For the most part, viability sampling and number of vessels was adequate, however, challenges were encountered in estimating within some of the strata envisioned above. Table 1 contains the breakout of operational groupings as well as an indication of sample size. In all cases, except PTR pollock, the working group would suggest an observer-based estimate be desired, however, this does not appear to be possible for some operations (e.g., PTR non-pollock). **Halibut PSC in non-pollock PTR fisheries is trivial, and so these trips are proposed to be grouped with pollock PTR (100% mortality) based on operational similarities, however the Working Group would welcome alternative suggestions.** CV HAL in BSAI has only recently begun to receive viability sampling coverage, however, sample sizes since then are fairly good (samples/vessel are proportionate to CP HAL).

Unresolved, is the number of years to include in the averaging. The estimates presented below are 3-year averages of annual estimates (long term averages are also included). Because the proposed operational groupings are somewhat based on current operational management structure, going back in time before, for example, AM80 or into an era with different landings accounting (e-landings pre-2009) presents computational difficulties.

In addition, the changes that have been implemented in observer data collection methods over time result in several periods, or stanzas, of sampling design. As stated in the introduction, prior to 2013, observer deployments into the fishing fleet was not randomized. Prior to 2016, viability sampling was not subject to the same randomization methods used in other aspects of observer sampling. Hence, pooling years subject to less potential bias (2013 fwd) with years subject to greater potential bias (pre-2013) may not be advisable and would not take advantage of key improvements made in recent annual estimates.

We recommend using years 2013 forward as the reference period unless sample availability is constraining.

Table 1 Operational groups and sample sizes.

Operational Group					
Sector	Region	Gear	Target	Sample Size (Mean $N_{Viabilities}$)	Estimate DMR?
CP	BSAI	PTR	non-pollock	*in process*	N (100%)
		NPT[a]	all	4,306	Y
		HAL	all	10,266	Y
		POT	all	686[b]	Y
	GOA	PTR	non-pollock	*in process*	N (100%)
		NPT[a]	all	493	Y
		HAL	all	1,234	Y
		POT	all	523[c]	Y
CV	BSAI	PTR	non-pollock	0	N (100%)
		NPT	all	2,174	Y
		HAL	all	48[d]	Y
		POT	all	686[b]	Y
	GOA	PTR	non-pollock	*in process*	N (100%)
		NPT	all	1,465	Y
		HAL	all	493	Y
		POT	all	523[c]	Y

[a] Very few CP NPT in GOA – pooled with BSAI
[b] CV, CP in same group by design
[c] CV, CP in same group by design
[d] Viability sampling began in 2013

Tables 2-4, below, provide counts of vessels, hauls, and viability samples, as well as estimated DMRs for each operational grouping. Shaded red cells indicate where sampling involved <3 vessels and blank cells indicate no samples. Long term and recent (2013 fwd) average DMRs are also provided.

Table 2 Time series of numbers of vessels, hauls, and viabilities, as well as annual DMRs for **trawl** operational grouping in the BSAI and GOA. Long term and short term (2013 fwd) average DMRs are also provided.

	VESSELS							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
CP	**45**	**39**	**44**	**34**	**39**	**36**	**24**	**31**
BSAI	**35**	**35**	**36**	**29**	**33**	**34**	**23**	**28**
NPT	21	21	22	16	19	20	10	15
PTR	14	14	14	13	14	14	13	13
GOA	**10**	**4**	**8**	**5**	**6**	**2**	**1**	**3**
NPT	9	4	8	5	6	2	1	3
PTR	1							
CV	**109**	**91**	**84**	**93**	**77**	**64**	**74**	**92**
BSAI	**74**	**54**	**53**	**57**	**43**	**39**	**50**	**52**
NPT	27	28	25	35	24	22	34	41
PTR	47	26	28	22	19	17	16	11
GOA	**35**	**37**	**31**	**36**	**34**	**25**	**24**	**40**
NPT	32	32	30	36	32	25	24	40
PTR	3	5	1		2			
Grand Total	**154**	**130**	**128**	**127**	**116**	**100**	**98**	**123**

	HAULS							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
CP	**3964**	**3344**	**2960**	**1853**	**2549**	**1896**	**1162**	**2058**
BSAI	**3747**	**3174**	**2759**	**1775**	**2382**	**1823**	**1161**	**2023**
NPT	1680	1717	801	600	892	535	186	1362
PTR	2067	1457	1958	1175	1490	1288	975	661
GOA	**217**	**170**	**201**	**78**	**167**	**73**	**1**	**35**
NPT	216	170	201	78	167	73	1	35
PTR	1							
CV	**1129**	**1040**	**1202**	**1098**	**772**	**849**	**628**	**866**
BSAI	**752**	**566**	**921**	**592**	**609**	**727**	**532**	**597**
NPT	200	411	514	430	459	581	446	562
PTR	552	155	407	162	150	146	86	35
GOA	**377**	**474**	**281**	**506**	**163**	**122**	**96**	**269**
NPT	374	464	280	506	161	122	96	269
PTR	3	10	1		2			
Grand Total	**5093**	**4384**	**4162**	**2951**	**3321**	**2745**	**1790**	**2924**

Table 2. (continued) Time series of numbers of vessels, hauls, and viabilities, as well as annual DMRs for **trawl** operational grouping in the BSAI and GOA. Long term and short term (2013 fwd) average DMRs are also provided.

	VIABILITIES							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
CP	**22236**	**13797**	**12189**	**8614**	**9310**	**6139**	**2853**	**11659**
BSAI	**21065**	**13228**	**11286**	**8023**	**8886**	**5975**	**2852**	**11537**
NPT	8967	7375	2363	1410	2868	1928	463	9074
PTR	12098	5853	8923	6613	6018	4047	2389	2463
GOA	**1171**	**569**	**903**	**591**	**424**	**164**	**1**	**122**
NPT	1170	569	903	591	424	164	1	122
PTR	1	0	0	0	0	0	0	0
CV	**3724**	**4825**	**5899**	**5803**	**3067**	**3547**	**2552**	**3884**
BSAI	**1937**	**2428**	**4234**	**2921**	**2406**	**3002**	**2112**	**2503**
NPT	765	2151	2972	2228	2090	2780	1977	2431
PTR	1172	277	1262	693	316	222	135	72
GOA	**1787**	**2397**	**1665**	**2882**	**661**	**545**	**440**	**1381**
NPT	1783	2369	1664	2882	657	545	440	1381
PTR	4	28	1		4	0	0	0
Grand Total	**25960**	**18622**	**18088**	**14417**	**12377**	**9686**	**5405**	**15543**

	DMRs								
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	long term average	2013-2015 average
CP									
BSAI									
NPT	88.34%	85.24%	83.08%	84.22%	86.99%	85.52%	83.65%	85.29%	85.38%
PTR	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.00%	100.00%
GOA									
NPT	79.37%	82.66%	76.42%	84.61%	80.98%	86.81%	90.00%	82.98%	85.93%
PTR	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.00%	100.00%
CV									
BSAI									
NPT	83.57%	72.12%	62.32%	68.00%	44.13%	51.58%	59.03%	62.96%	51.58%
PTR	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.00%	100.00%
GOA									
NPT		60.24%	52.73%	58.23%	60.50%	65.29%	64.69%	60.28%	63.49%
PTR	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.00%	100.00%

Table 3 Time series of numbers of vessels, hauls, and viabilities, as well as annual DMRs for **HAL** operational grouping in the BSAI and GOA. Long term and short term (2013 fwd) average DMRs are also provided.

	VESSELS							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
CP	**53**	**48**	**38**	**35**	**38**	**38**	**37**	**33**
BSAI	36	33	29	30	30	29	29	27
GOA	17	15	9	5	8	9	8	6
CV	**3**	**2**	**1**	**2**	**31**	**81**	**72**	**44**
BSAI					2	11	11	2
GOA	3	2	1	2	29	70	61	42
Grand Total	**56**	**50**	**39**	**37**	**69**	**119**	**109**	**77**

	HAULS							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
CP	**2597**	**2376**	**2766**	**2747**	**3569**	**3306**	**3325**	**1314**
BSAI	2380	2101	2412	2667	3449	2986	2894	1202
GOA	217	275	354	80	120	320	431	112
CV	**22**	**27**	**9**	**42**	**205**	**332**	**253**	**128**
BSAI					2	26	21	2
GOA	22	27	9	42	203	306	232	126
Grand Total	**2619**	**2403**	**2775**	**2789**	**3774**	**3638**	**3578**	**1442**

	VIABILITIES							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
CP	**11551**	**10704**	**13373**	**13156**	**15994**	**11781**	**10977**	**4465**
BSAI	10323	9015	11261	12837	15348	10332	9356	3658
GOA	1228	1689	2112	319	646	1449	1621	807
CV	**90**	**163**	**18**	**127**	**933**	**1236**	**1048**	**519**
BSAI					11	82	94	5
GOA	90	163	18	127	922	1154	954	514
Grand Total	**11641**	**10867**	**13391**	**13283**	**16927**	**13017**	**12025**	**4984**

	DMRs									
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	long term average	2013-2015 average
CP										
BSAI	9.56%	8.42%	9.83%	7.80%	8.97%	8.49%	7.86%		8.70%	8.44%
GOA	8.2%	9.3%	9.1%	8.7%	12.2%	9.5%	10.5%		9.64%	10.73%
CV										
BSAI	NA	NA	NA	NA	NA	21.92%	3.50%		12.71%	12.71%
GOA	NA	9.52%	5.32%	37.28%	12.66%	8.94%	15.06%		14.79%	12.22%

Table 4 Time series of numbers of vessels, hauls, and viabilities, as well as annual DMRs for **POT** operational grouping in the BSAI and GOA. Long term and short term (2013 fwd) average DMRs are also provided.

	VESSELS							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
BSAI	16	25	32	26	21	20	24	18
GOA	9	11	16	15	26	17	32	22
Grand Total	**25**	**36**	**48**	**41**	**47**	**37**	**56**	**40**

	HAULS							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
BSAI	129	236	348	428	259	264	310	95
GOA	42	40	200	228	163	68	208	66
Grand Total	**171**	**276**	**548**	**656**	**422**	**332**	**518**	**161**

	VIABILITIES							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
BSAI	231	616	1259	1502	491	498	723	165
GOA	78	179	1067	1070	363	179	891	357
Grand Total	**309**	**795**	**2326**	**2572**	**854**	**677**	**1614**	**522**

	DMRs									
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**		long term average	2013-2015 average
BSAI	NA	23.68%	15.28%	8.60%	5.19%	3.06%	6.87%		10.45%	5.04%
GOA	NA	7.53%	4.31%	16.27%	16.20%	10.25%	2.38%		9.49%	9.61%

Tables 5 and 6, taken from NPFMC (2016) present the current DMRs as specified for GOA and BSAI groundfish fisheries. The recommended methods replace target fisheries with operational groupings and separate by CV, CP rather than CDQ, non-CDQ. As such, it is difficult to present a 1:1 comparison to status quo DMR values in a similar table.

Table 5 2016 and 2017 Pacific Halibut Discard Mortality Rates for the **BSAI**, as established in the annual harvest specifications

Non-CDQ				**CDQ**		
Gear	**Fishery**	**DMR (%)**		**Gear**	**Fishery**	**DMR (%)**
Trawl	Alaska plaice	66		Trawl		
	Arrowtooth flounder	84				
	Atka mackerel	82			Atka mackerel	82
	Flathead sole	72			Flathead sole	79
	Greenland turbot	82			Greenland turbot	89
	Non-pelagic pollock	84			Non-pelagic pollock	86
	Pelagic pollock	81			Pelagic pollock	90
	Other flatfish	88				
	Other species	63				
	Pacific cod	66			Pacific cod	87
	Rockfish	66			Rockfish	70
	Rock sole	86			Rock sole	86
	Sablefish	66				
	Yellowfin sole	84			Yellowfin sole	85
Hook and line	Greenland turbot	11		Hook and line	Greenland turbot	10
	Other species	9				
	Pacific cod	9			Pacific cod	10
	Rockfish	9				
Pot	Other species	9		Pot		
	Pacific cod	9			Pacific cod	1
					Sablefish	41

Table 6. 2016 and 2017 Pacific Halibut Discard Mortality Rates for the **GOA**, as established in the annual harvest specifications

Gear	**Fishery**	**DMR (%)**		**Gear**	**Fishery**	**DMR (%)**
Trawl	Arrowtooth flounder	76		Hook and line	Other fisheries[1]	10
	Deepwater flatfish	62			Pacific cod	10
	Flathead sole	67			Rockfish	10
	Non-pelagic pollock	58				
	Other fisheries[1]	62		Pot	Other fisheries[1]	15
	Pacific cod	62			Pacific cod	15
	Pelagic pollock	65				
	Rex sole	72				
	Rockfish	65				
	Sablefish	59				
	Shallow-water flatfish	66				

[1]"Other fisheries" includes all gear types for skates, sculpins, squids, octopuses, and hook-and-line sablefish.

Tables 7-10 incorporates the new estimates, and assign them to the recommended operational groupings. Target species and the current DMR associated with harvest those grouping are included in the table to provide for comparison. As stated above, there is not a halibut PSC limit for pot gear, but halibut mortality is estimated and provided to the IPHC.

Table 7. Estimated Pacific halibut mortalities for the **GOA** in **2015**, under the DMRs calculated through the proposed alternative methods. Comparison with status quo DMRs is also provided.

2015 Gulf of Alaska Halibut Mortality using proposed DMRs (as of August 30, 2016)										
					Current Halibut		New	New Halibut	Current minus	PSC limit
Gear	Sector	Program	Halibut	DMR	mortality	Target	DMR	mortality		
HAL	CP	OA	628	0.11	69	Pacific cod	0.11	67	2	
HAL	CP	OA	0	0.11	0	Other species	0.11	0	0	116
HAL	CV	OA	1,262	0.11	139	Pacific cod	0.12	154	(15)	145
PTR	CV	RPP	0	0.6	0	Bottom pollock	1.00	0	(0)	
PTR	CV	RPP	5	0.66	3	Rockfish	1.00	5	(2)	
NPT	CV	RPP	0	0.6	0	Bottom pollock	1.00	0	(0)	
NPT	CV	RPP	22	0.62	14	Pacific cod	1.00	22	(8)	
NPT	CV	RPP	30	0.66	20	Rockfish	1.00	30	(10)	
NPT	CV	RPP	3	0.71	2	Shallow water flatfish	1.00	3	(1)	
								-	-	
PTR	CV	OA	6	0.6	4	Bottom pollock	1.00	6		
PTR	CV	OA	1	0.62	1	Pacific cod	1.00	1	(0)	
PTR	CV	OA	7	0.71	5	Pelagic pollock	1.00	7	(2)	
								-	-	
NPT	CV	OA	150	0.6	90	Bottom pollock	0.63	95	(5)	
NPT	CV	OA	757	0.62	469	Pacific cod	0.63	480	(11)	
NPT	CV	OA	99	0.67	66	Shallow water flatfish	0.63	63	3	
NPT	CV	OA	0	0.66	0	Rockfish	0.63	0	0	
NPT	CV	OA	3	0.71	2	Pelagic pollock	0.63	2	0	
NPT	CV	OA	-	0.71	-	Shallow water flatfish	0.63	-		
NPT	CV	OA	488	0.73	356	Arrowtooth flounder	0.63	310	46	
NPT	CV	OA	8	0.69	5	Rex sole	0.63	5	0	
									-	
NPT	CP	OA	0	0.6	0	Bottom pollock	0.85	0	(0)	
NPT	CP	OA	1	0.62	1	Pacific cod	0.85	1	(0)	
NPT	CP	OA	-	0.43	-	Deep water flatfish	0.85	-	-	
NPT	CP	OA	62	0.67	41	Shallow water flatfish	0.85	53	(11)	
NPT	CP	OA	46	0.66	30	Rockfish	0.85	39		
NPT	CP	OA	4	0.65	2	Flathead sole	0.85	3	(1)	
NPT	CP	OA	0	0.71	0	Sablefish	0.85	0	(0)	
NPT	CP	OA	306	0.73	223	Arrowtooth flounder	0.85	261	(38)	
NPT	CP	OA	35	0.69	24	Rex sole	0.85	30	(6)	
NPT	CP	RPP	77	0.66	51	Rockfish	0.85	65	(15)	
NPT	CP	RPP	3	0.73	2	Arrowtooth flounder	0.85	3	(0)	
PTR	CP	OA	-	0.66	-	Rockfish	1.00	-	-	
Total			4,002		1,620			1,706	(86)	2,021

Trawl only	Trawl only	Trawl only	Trawl PSC limit
1,413	1,485	(72)	1,760

Table 8 Estimated Pacific halibut mortalities for the **GOA** in **2016**, under the DMRs calculated through the proposed alternative methods. Comparison with status quo DMRs is also provided.

2016 Gulf of Alaska Halibut Mortality using proposed DMRs (as of August 30, 2016)										
					Current		New	New	Current minus	PSC limit
Gear	Sector	Program	Halibut	DMR	Halibut mortality	Target	DMR	Halibut mortality		
HAL	CP	OA	459	0.10	46	Pacific cod	0.11	49	(3)	128
HAL	CV	OA	1,509	0.10	151	Pacific cod	0.12	184	(33)	129
NPT	CV	RPP	35	0.7	23	Rockfish	1.00	35	(12)	
NPT	CV	RPP	6	0.6	4	Sablefish	1.00	6	(3)	
PTR	CV	RPP	1	0.7	0	Rockfish	1.00	1	(0)	
PTR	CV	OA	2	0.6	1	Bollom pollock	1.00	2	(1)	
PTR	CV	OA	1	0.7	0	Shallow water flatfish	1.00	1	(0)	
PTR	CV	OA	1	0.7	0	Pelagic pollock	1.00	1	(0)	
NPT	CV	OA	56	0.6	33	Bollom pollock	0.63	36	(3)	
NPT	CV	OA	537	0.6	333	Pacific cod	0.63	341	(8)	
NPT	CV	OA	51	0.7	34	Shallow water flatfish	0.63	32	1	
NPT	CV	OA	10	0.7	6	Flathead sole	0.63	6	0	
NPT	CV	OA	-	0.6	-	Other species	0.63	-	-	
NPT	CV	OA	0	0.7	0	Pelagic pollock	0.63	0	0	
NPT	CV	OA	550	0.8	418	Arrowtooth flounder	0.63	349	69	
NPT	CV	OA	18	0.7	13	Rex sole	0.63	12	2	
NPT	CP	OA	3	0.6	2	Pacific cod	0.85	3	(1)	
NPT	CP	OA	26	0.7	17	Shallow water flatfish	0.85	22	(5)	
NPT	CP	OA	24	0.7	15	Rockfish	0.85	20	(5)	
NPT	CP	OA	2	0.7	1	Flathead sole	0.85	1	(0)	
NPT	CP	OA	139	0.8	105	Arrowtooth flounder	0.85	118	(13)	
NPT	CP	OA	2	0.7	1	Rex sole	0.85	1	(0)	
NPT	CP	RPP	56	0.7	37	Rockfish	0.85	48	(12)	
NPT	CP	RPP	2	0.8	2	Arrowtooth flounder	0.85	2	(0)	
PTR	CP	OA	-	0.7	-	Rockfish	1.00	-	-	
Total			1,521		1,047			1,038	9	1,963

Trawl only
1,047

Trawl only	Trawl only	Trawl PSC limit
1,038	9	1,706

Table 9 Estimated Pacific halibut mortalities for the **BSAI** in **2015**, under the DMRs calculated through the proposed alternative methods. Comparison with status quo DMRs is also provided.

					Current			New	New	
Gear	Sector	Program	Halibut	DMR	Halibut mortality	Target		DMR	Halibut mortality	Current minus New
HAL	S	OA	17	0.09	2	Pacific cod		0.13	2	(1)
HAL	CP	CDQ	221	0.1	22	Pacific cod		0.08	19	3
HAL	CP	IFQ	-	0.04	-	Rockfish		0.08	-	-
HAL	CP	OA	0	0.09	0	Bottom pollock		0.08	0	0
HAL	CP	OA	3,207	0.09	289	Pacific cod		0.08	271	18
HAL	CP	OA	2	0.09	0	Other species		0.08	0	0
HAL	CP	OA	24	0.13	3	Greenland turbot		0.08	2	1
PTR	M	AFA	2	0.88	2	Pelagic pollock		1.00	2	(0)
PTR	S	AFA	4	0.77	3	Bottom pollock		1.00	4	(1)
PTR	S	AFA	29	0.88	25	Pelagic pollock		1.00	29	(3)
PTR	S	OA	1	0.71	1	Pacific cod		1.00	1	(0)
NPT	M	CDQ	0	0.8	0	Rockfish		0.52	0	0
NPT	M	CDQ	0	0.86	0	Atka mackerel		0.52	0	0
NPT	M	CDQ	15	0.86	13	Yellowfin sole		0.52	8	5
NPT	M	CDQ	1	0.88	1	Rock sole		0.52	0	0
NPT	M	OA	23	0.71	16	Pacific cod		0.52	12	4
NPT	M	OA	6	0.77	4	Atka mackerel		0.52	3	1
NPT	M	OA	0	0.77	0	Bottom pollock		0.52	0	0
NPT	M	OA	1	0.79	1	Rockfish		0.52	1	0
NPT	M	OA	84	0.83	69	Yellowfin sole		0.52	43	26
NPT	M	OA	8	0.85	7	Rock sole		0.52	4	3
NPT	S	OA	297	0.71	211	Pacific cod		0.52	153	58

Table 9. (continued) Estimated Pacific halibut mortalities for the **BSAI** in **2015**, under the DMRs calculated through the proposed alternative methods. Comparison with status quo DMRs is also provided.

2015 BSAI Halibut Mortality using proposed DMRs (run on 8/30/2016, does not include decksorting EFP)									
Gear	Sector	Program	Halibut	DMR	Current Halibut mortality	Target	New DMR	New Halibut mortality	Current minus New
NPT	CP	A80	-	0.64	-	Greenland turbot	0.85	-	-
NPT	CP	A80	51	0.71	36	Pacific cod	0.85	44	(7)
NPT	CP	A80	3	0.71	2	Alaska Plaice	0.85	2	(0)
NPT	CP	A80	-	0.71	-	Other flatfish	0.85	-	-
NPT	CP	A80	61	0.73	44	Flathead sole	0.85	51	(7)
NPT	CP	A80	58	0.76	44	Kamchatka flounder	0.85	49	(5)
NPT	CP	A80	82	0.76	62	Arrowtooth flounder	0.85	70	(7)
NPT	CP	A80	111	0.77	85	Atka mackerel	0.85	94	(9)
NPT	CP	A80	23	0.77	18	Bottom pollock	0.85	20	(2)
NPT	CP	A80	75	0.79	60	Rockfish	0.85	64	(5)
NPT	CP	A80	696	0.83	578	Yellowfin sole	0.85	592	(14)
NPT	CP	A80	559	0.85	475	Rock sole	0.85	475	-
NPT	CP	CDQ	3	0.76	3	Arrowtooth flounder	0.85	3	(0)
NPT	CP	CDQ	0	0.79	0	Flathead sole	0.85	0	(0)
NPT	CP	CDQ	0	0.8	0	Rockfish	0.85	0	(0)
NPT	CP	CDQ	1	0.83	1	Bottom pollock	0.85	1	(0)
NPT	CP	CDQ	8	0.86	7	Atka mackerel	0.85	7	0
NPT	CP	CDQ	48	0.86	42	Yellowfin sole	0.85	41	0
NPT	CP	CDQ	27	0.88	24	Rock sole	0.85	23	1
NPT	CP	CDQ	12	0.9	11	Pacific cod	0.85	10	1
NPT	CP	OA	18	0.71	13	Pacific cod	0.85	15	(2)
NPT	CP	OA	3	0.73	2	Flathead sole	0.85	3	(0)
NPT	CP	OA	1	0.77	1	Atka mackerel	0.85	1	(0)
NPT	CP	OA	0	0.77	0	Bottom pollock	0.85	0	(0)
NPT	CP	OA	66	0.83	55	Yellowfin sole	0.85	56	(1)
NPT	CP	OA	1	0.85	1	Rock sole	0.85	1	-
				0.7835					
PTR	CP	AFA	7	0.77	5	Bottom pollock	1.00	7	(2)
PTR	CP	AFA	78	0.88	69	Pelagic pollock	1.00	78	(9)
PTR	CP	AIP	-	0.77	-	Bottom pollock	1.00	-	-
PTR	CP	AIP	-	0.79	-	Rockfish		-	-
PTR	CP	AIP	-	0.88	-	Pelagic pollock	1.00	-	-
PTR	CP	CDQ	0	0.83	0	Bottom pollock	1.00	0	(0)
PTR	CP	CDQ	8	0.9	8	Pelagic pollock	1.00	8	(1)
Total			5,942		2,312			2,335	(22)

Table 10 Estimated Pacific halibut mortalities for the **BSAI** in **2016**, under the DMRs calculated through the proposed alternative methods. Comparison with status quo DMRs is also provided.

					Current			New	New	Current
Gear	Sector	Program	Halibut	DMR	Halibut mortality	Target		DMR	Halibut mortality	minus New
HAL	S	OA	0	0.09	0	Pacific cod		0.13	0	(0)
HAL	CP	CDQ	209	0.1	21	Pacific coc		0.08	18	3
HAL	CP	IFQ	0	0.09	0	Pacific cod		0.08	0	0
HAL	CP	IFQ	0	0.09	0	Rockfish		0.08	0	0
HAL	CP	IFQ	1	0.09	0	Arrowtooth flounder		0.08	0	0
HAL	CP	OA	1,486	0.09	134	Pacific cod		0.08	125	8
HAL	CP	OA	14	0.11	2	Greenland turbot		0.08	1	0
PTR	M	AFA	-	0.81	-	Bottom pollock		1.00	-	-
PTR	M	AFA	1	0.88	1	Pelagic pollock		1.00	1	(0)
PTR	S	AFA	-	0.81	-	Bottom pollock		1.00	-	-
PTR	S	AFA	19	0.88	17	Pelagic pollock		1.00	19	(2)
PTR	S	OA	2	0.66	1	Pacific cod		1.00	2	(1)
NPT	M	CDQ	-	0.7	-	Rockfish		0.52	-	-
NPT	M	CDQ	-	0.82	-	Atka mackerel		0.52	-	-
NPT	M	CDQ	14	0.85	12	Yellowfin sole		0.52	7	5
NPT	M	CDQ	10	0.86	8	Rock sole		0.52	5	3
NPT	M	CDQ	-	0.87	-	Pacific cod		0.52	-	-
NPT	M	OA	33	0.66	22	Pacific cod		0.52	17	5
NPT	M	OA	0	0.81	0	Bottom pollock		0.52	0	0
NPT	M	OA	1	0.82	0	Atka mackerel		0.52	0	0
NPT	M	OA	-	0.83	-	Rockfish		0.52	-	-
NPT	M	OA	93	0.84	78	Yellowfin sole		0.52	48	30
NPT	M	OA	33	0.86	29	Rock sole		0.52	17	11
NPT	S	OA	391	0.66	258	Pacific cod		0.52	202	56

Table 10. (continued) Estimated Pacific halibut mortalities for the **BSAI** in **2016**, under the DMRs calculated through the proposed alternative methods. Comparison with status quo DMRs is also provided.

2016 BSAI Halibut Mortality using proposed DMRs (as of 8/30/2016, does not include decksorting EFP)										
					Current			New	New	Current
Gear	Sector	Program	Halibut	DMR	Halibut mortality	Target		DMR	Halibut mortality	minus New
NPT	CP	A80	15	0.63	10	Other flatfish		0.85	13	(3)
NPT	CP	A80	30	0.66	20	Pacific cod		0.85	25	(6)
NPT	CP	A80	4	0.66	2	Alaska plaice		0.85	3	(1)
NPT	CP	A80	39	0.72	28	Flathead sole		0.85	33	(5)
NPT	CP	A80	10	0.81	8	Bottom pollock		0.85	8	(0)
NPT	CP	A80	51	0.82	42	Atka mackerel		0.85	43	(2)
NPT	CP	A80	1	0.82	1	Greenland turbot		0.85	1	(0)
NPT	CP	A80	15	0.83	13	Rockfish		0.85	13	(0)
NPT	CP	A80	19	0.84	16	Kamchatka flounder		0.85	16	(0)
NPT	CP	A80	55	0.84	46	Arrowtooth flounder		0.85	47	(1)
NPT	CP	A80	329	0.84	276	Yellowfin sole		0.85	280	(3)
NPT	CP	A80	532	0.86	457	Rock sole		0.85	452	5
NPT	CP	CDQ	0	0.7	0	Rockfish		0.85	0	(0)
NPT	CP	CDQ	7	0.82	6	Atka mackerel		0.85	6	(0)
NPT	CP	CDQ	28	0.85	24	Yellowfin sole		0.85	24	-
NPT	CP	CDQ	-	0.86	-	Bottom pollock		0.85	-	-
NPT	CP	CDQ	24	0.86	20	Rock sole		0.85	20	0
NPT	CP	CDQ	13	0.87	11	Pacific cod		0.85	11	0
NPT	CP	CDQ	0	0.89	0	Greenland turbot		0.85	0	0
NPT	CP	OA	6	0.66	4	Pacific cod		0.85	5	(1)
NPT	CP	OA	0	0.81	0	Bottom pollock		0.85	0	(0)
NPT	CP	OA	-	0.82	-	Atka mackerel		0.85	-	-
NPT	CP	OA	57	0.84	48	Yellowfin sole		0.85	48	(1)
NPT	CP	OA	22	0.86	19	Rock sole		0.85	19	0
PTR	CP	AFA	6	0.81	5	Bottom pollock		1.00	6	(1)
PTR	CP	AFA	-	0.83	-	Rockfish		1.00	-	-
PTR	CP	AFA	62	0.88	55	Pelagic pollock		1.00	62	(7)
PTR	CP	CDQ	0	0.86	0	Bottom pollock		1.00	0	(0)
PTR	CP	CDQ	9	0.9	8	Pelagic pollock		1.00	9	(1)
Total			3,641		1,701				1,697	4

5 Review/Questions for the Plan Team

In keeping with direction provided by the Council, the process for evaluating the proposed DMR estimation methods as the basis for application in 2017 will go through the typical, two-part Groundfish Plan Team-SSC-AP-Council specifications review. In addition to this document, a presentation will be provided to the Plan Team to aid in discussion of salient issues associated with transition to new methods.

The Working Group has laid out an alternative approach to defining "fisheries" in the GOA and BSAI based on halibut handling differences (operational groupings) rather than on target species (Operational Groupings).

1. *Does the Plan Team support the general approach of using operational groupings for DMRs as opposed to target fishery-specific DMRs?*

2. *Are the specific operational groupings described by the Working Group appropriate?*

The Working Group has described methods for expanding viability samples from the haul level to defined operational groupings or strata (DMR Estimation Methods**).**

3. *Are the methods for expanding viability samples into strata appropriate?*

The Working Group developed the methods for possible application in 2017.

4. *Can the proposed methods be used for management in 2017 (given adequate response by November to PT recommendations)?*

The Working Group is recommending using annual DMR estimates from 2013 forward unless this results in inadequate sample size.

5. *Is this the appropriate reference period for calculating DMRs at this time?*

Some identified strata may have issues with number of vessels and number of viabilities upon which to estimate annual DMRs.

6. *Are strata for which sample size is an issue appropriately addressed for management purposes?*

6 References

Cahalan, J., J. Gasper, and J. Mondragon. 2014. Catch sampling and estimation in the federal groundfish fisheries off Alaska, 2015 edition. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-286, 46 p.

NMFS (National Marine Fisheries Service). 2015. 2016 Annual Deployment Plan for Observers in the Groundfish and Halibut Fisheries off Alaska. National Oceanic and Atmospheric Administration, 709 West 9th Street. Juneau, Alaska 99802.

NPFMC (North Pacific Fishery Management Council). 2016. Halibut discard mortality rates for the Alaska groundfish fisheries. Discussion Draft. April 2016. 46 p.