Data considerations for BSAI O26 Pacific halibut PSC performance standard

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Contents

1 Introduction

The Council is interested in evaluating a prohibited species catch (PSC) performance standard associated with over 26" (O26) halibut that could potentially be included in the forthcoming Bering Sea/Aleutian Islands halibut abundance-based management analysis. As noted in deliberations at the April 2018 Council meeting, however, some preliminary understanding of the available O26 data from the groundfish fisheries suggests that there may be limitations to the utility of these data in establishing a performance standard. Therefore, as an interim step, the Council requested a discussion paper describing the available O26/U26 PSC and mortality data and a description of sampling protocols within and outside of the deck sorting exempted fishing permit (EFP) and any potential sources of bias or anomalies in the PSC data.

We provide an overview of the existing data, data issues relative to deck sorting EFP, length-to-weight extrapolation for halibut, sampling protocols as well as some correlation considerations between the O26 PSC data and the O26 abundance from the two primary indices to be considered in the forthcoming

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halibut abundance-based management (ABM) alternatives: the EBS trawl survey and the IPHC setline survey in 4ABCDE.

The Council also requested that staff develop O26 performance standard options and evaluate the ability of such options to achieve the objectives of this action. At this time, we are providing an overview of considerations in developing a performance standard. The Council and the public can evaluate the data and issues described in this paper and provide direction to the working group as to what performance standard options could be developed and what objectives these options would achieve. With this direction, the working group would then provide a discussion of specific performance standard options at the October Council meeting. The Council could then decide whether to pursue a performance standard in the ABM alternative set or as a follow up action.

This paper is organized into three parts. The first section describes the methodology for assessing halibut intercepted in BSAI groundfish fisheries, including differences that occur when a vessel is deck sorting. Next, we provide data from various sources about the percentage of halibut that are over 26 inches, and finally there is a discussion of considerations for developing a performance standard using this data.

2 Methodology to assess weight and size of halibut PSC in groundfish fisheries

2.1 North Pacific Observer Program Halibut data collection protocols: 2010-2018

This section of the document provides a brief description of observer sampling protocols used by the Alaska Fisheries Science Center Fisheries Monitoring and Analysis Division (AFSC FMA Division), relative to Pacific halibut, highlighting how those protocols have changed over time in response to changing management needs. In particular, methods are described for sampling for species composition data used in discard estimation, discard condition sampling used in estimation of post-discard mortality, and length data used in estimating the size distribution of halibut discards. This paper is broken into three sections outlining the sampling protocols for species composition sampling, biological specimen (condition and length data) sampling, and special sampling considerations under halibut deck-sorting Exempted Fishing Permits (EFP).

2.1.1 Species Composition Data

The collection of data on the total number and weight of halibut encountered in a composition sample is a standard data collection and consistent with all other species encountered by an observer while collecting composition data. The methods used by observers to collect these data are dependent on access to catch, which varies by fishery and gear type being observed.

For vessels using longline gear, every halibut encountered in the randomly collected composition sample is counted and a weight is determined one of three ways: (1) when the halibut is not brought aboard the vessel, observers visually estimate the length of each fish to the nearest 10 cm; (2) when the halibut can be brought aboard, the observer may weigh the halibut; or (3) when the halibut is brought on board but is too large to fit on the observer's scales, observers obtain a length measurement, to the nearest centimeter. Halibut length data, both those estimated to the nearest 10 cm and actual measurements, are converted to weight using the IPHC length-weight table so that an aggregate number and weight of all halibut in the composition sample is recorded.

For vessels using trawl or pot gear, every halibut encountered in the randomly collected composition sample is counted and weighed. Prior to 2011, observers assigned to catcher vessels using trawl gear while fishing for pollock counted every halibut encountered during the offload and reported a total number and weight of all halibut associated with the delivery. Halibut encountered at the delivery were apportioned back to individual hauls associated with that deliver. In 2011, following the implementation of AM91 and the associated redirected focus on the collection of salmon genetics data within the pollock fishery, halibut sampling activities conducted during pollock offloads were eliminated and no halibut data were collected shoreside.

Since 2011, the collection of composition data related to halibut has remained unchanged for all vessels with the exception of vessels that elected to participate in the halibut deck-sorting Exempted Fishing Permit (EFP).

In 2015, catcher processors in the AM80 Sector began an EFP focused on the sorting of halibut on deck. EFP sea samplers were used to document both halibut sorted on deck and those that made it into the factory. All halibut were removed from the catch prior to observers sampling for species composition. Estimates of the total number and weight of halibut for these vessels were obtained directly from the participants per the EFP guidelines.

In 2016, as the EFP developed and the observer program became more involved, observers resumed reporting the total number and weight of all halibut encountered in their species composition samples taken in the factory. Also in 2016, observers began reporting the total number of halibut encountered during the deck sorting operations. Weights of halibut sorted from the catch on-deck are determined by converting length measurements (nearest cm) to weight (kgs) using the IPHC length-weight table. Total weight of halibut discarded on-deck was determined one of three ways: (1) estimated using an average weight (converted from length) from an approximate 20% random sample of the halibut encountered on deck, applied to the remaining halibut for which a length (proxy for weight) was not collected; (2) if fewer deck-sorted halibut occurred than would have been required to get to the observer's random 20% start, the observer measured the non-random first fish to calculate discard weight; (3) if the observer had no length data from discarded data, the Fisheries Monitoring and Analysis Division staff would assist in determining an average weight to apply to that haul. Because observers were recording both actual and calculated-from-like-hauls weights in the database, it is not possible to differentiate observed data from calculated data for 2016. In addition to these changes, in 2016 the flow of data was redirected through the Observer Program's NORPAC database and into the Alaska Regional Office's Catch Accounting System (CAS).

In 2017, the observer data collections on vessels fishing under the EFP remained relatively unchanged aside from changing from a simple random sample of halibut to a systematic random (1 in 5; 20%) sample of the halibut sorted from the catch on deck. These randomly selected fish were used to estimate average weight of halibut for that haul; this average was then applied to all other fish for which a length measurement was not obtained in order to estimate the total discard weight of halibut.

In 2018, further updates have been made to the data collection processes on vessels fishing under the EFP. Observers continue to count and weigh all halibut encountered in the observer sample in the factory and continue to count all halibut discarded from the deck. The total weight of these discarded halibut is either based on an actual measurement of every fish encountered converted to weight or based on the average weight from a combination of a random 20% sample and additional measurements from the first 15 (or more) fish discarded. These changes addressed several problems that were identified during 2017, including: decreasing the frequency of calculating weight estimates for hauls without a haul-specific weight per fish; and eliminating recording estimates of average weight in the database that were not clearly identified to be computed values and not direct observations made by the observer.

2.1.2 Condition and Length Data

Halibut condition data are used to estimate the post-capture mortality of discarded halibut. Hence, halibut condition assessments are conducted on a random sample of the halibut which will be discarded and have been handled in a manner that represents the discard methods typically used by the crew. To meet this goal, the collection of halibut condition data is randomly collected at or near the point of discard. If the point of discard is inaccessible and/or the common handling practices of the crew prevent the observer from having access to halibut handled in a fashion that it is representative of crew handling, a length measurement is collected with a condition assessment of 'unknown'.

The collection of halibut length measurements is paired with these condition assessments (viability assessment for trawl and pot gear; injury assessment for longline gear). When the condition of a halibut cannot be assessed, the condition code of unknown is recorded along with the halibut length. Otherwise, halibut length data are not collected by observers independently of the condition assessment. Halibut length data is captured within the ATL Length table of the NORPAC database.

As with all other observer data collections, the collection of halibut condition and associated length data uses a randomized sampling design, to the extent possible given the constraints imposed on sampling by the commercial fishing environment. The sampling design used by the observer will vary depending on how catch is handled. Halibut condition and length data collections may come directly from the hierarchical sampling design (sample frame) used by the observer for the majority of standard data collections; fish encountered in a randomly selected species composition sample (sample level of the hierarchy) are assessed for condition and measured. Collection of data at this level is the most efficient method for the observer since they can utilize the fish within a randomly collected sample for multiple data points. However, when the halibut in the observer's species composition have not been handled in a manner consistent with the vessel's discard practices, the observer does not collect condition data but rather must establish and sample from a secondary sample frame (second sampling design overlaid on the standard sampling design). This secondary sample frame will include access to halibut that are representative of typical crew handling practices; halibut condition assessments are collected at the haul level, independent of the species composition data. Whether this secondary sample frame must be established, will vary by vessel, fishery, observer, and any combination thereof. On many vessels, in particular on trawl catcher processors, the collection of halibut condition and length data is only possible at the haul level, from the secondary sample frame. The collection of these data separate from the fish encountered in the species composition sample (primary sampling frame) creates a significant burden on the observer. Under the secondary sampling frame, sampling must occur at the point of discard where halibut can be collected, and accurate assessments of condition obtained. This generally occurs outside of the observer's standard work area. In many cases the configuration of the observer's standard work area (observer sample station) is defined in federal regulation and is designed to provide the observer with adequate space, lighting and access to catch to facilitate the collection of quality data. Having to work outside of these areas presents safety concerns and sampling challenges that often precludes the collection of data.

On vessels using pot gear the collection of halibut length and condition data is straightforward since these data are generally collected from within the observer's species composition sample; data are collected from the fish after they are removed from a pot before and being returned to the water. The use of halibut excluders on the pots minimizes the amount of halibut encountered in these fisheries. Hence, there are fewer data collections from these fisheries.

On vessels using longline gear, a secondary sampling frame is generally established since observer's species composition sample consists of a tally of fish caught on a randomly selected portion of the retrieved gear. Therefore, halibut condition and length data are collected from halibut caught on a randomly selected section of gear (not the same section from which species composition data are collected). With this gear type, these data collections are complicated by the relative abundance (or lack thereof) of halibut in the catch, as well as the ability of the crew to release fish from the hook inboard of the vessel so that the halibut are available to the observer for assessment and measurement. In many cases, the release method cannot be duplicated in-board the vessel (e.g., hook straightening) and the data collection is limited to lengths and 'unknown' injuries.

The collection of halibut length and condition data has evolved over time as observer duties have increased and/or been refocused, observer's access to catch has changed, and other factors have impacted the observer's ability to sample randomly. Prior to 2010, the observers were trained to collect a targeted number of 20 halibut per day from which they would obtain condition and length data. These 20 condition assessments and length measurements were expected to be randomly collected from within a haul or sample, but the which hauls to sample was not expressively randomized. As a result, these data collections occurred when the observer had opportunity, e.g. not during standard sampling, not during breaks, etc.

In many cases observers were able to achieve the goal of obtaining 20 condition assessments and length measurements by collecting these data from every halibut encountered in their species composition samples. However, if more than 20 halibut were encountered within the species composition samples for a given day, observers were able to cease the collection of these data until the following day. Since this curtailment of data collection did not fit within the observer program randomization standards, observers were uncertain whether additional assessments and length measurements should be collected (maintain randomization) or not. This sometimes resulted in the collection of more than the target of 20 halibut assessments and length measurements.

In 2011, Amendment 91 to the Bering Sea Fishery Management Plan was implemented and the collection of halibut condition and length data from shoreside deliveries of pollock (offloads) was eliminated; observers were redirected to obtain counts of all salmon in the delivered catch (complete enumeration), along with an additional systematic random collection of tissues from chinook and chum salmon to be used for genetic and stock-of-origin analysis. The addition of this time intensive data collection precluded the collection of other data during monitoring of the offload. The investment made by the industry to collect these salmon data further emphasized the priority of salmon-related data over the collection of data from other species. As a result of this redirection of observer's sampling effort, all halibut data is collected while the observer is deployed at sea.

In addition to redirecting observers to focus on the collection of salmon data in the BSAI pollock fishery, instructions to observers were altered in 2011 to better address questions of sample size and randomization that were being raised by observers, and to advise observers on how to best achieve these goals in various fisheries. At this time, the instructions to observers put greater emphasis on developing a sampling design specifically for the collection of halibut condition and length data that took into account the vessels' operations and crew handling of halibut to be discarded. This change in emphasis more closely aligned the collection of halibut data with the randomized methods used for specimen collections from other species.

In 2016, the observer program, in consultation with the IPHC, improved the randomization of the collection of halibut condition and condition data; halibut sampling was integrated into standard protocols for the collection of biological data for other species and sampling rates were specified on the Length and Specimen Collection Priority Chart (2018 Observer Sampling Manual, Pages 13.24-13.29). This method fully randomized the collection of these data by providing clear guidance on randomization of haul selection as well as guidance on randomization of individual fish selection consistent with collection of length and specimen data for other species.

2.1.3 Sampling under the Halibut Deck-sorting EFP

In 2015, the implementation of the Halibut Deck Sorting EFP altered the collection of halibut length and condition data on those catcher processors fishing under Amendment 80 that participated in the EFP. The intent of the EFP is to decrease post-capture mortality of halibut by sorting and discarding halibut from the catch before catch is transferred to below deck to the factory. As part of the EFP, these vessels were exempted from regulations requiring that all catch be transferred below decks and over the vessel's flow scale and regulations specifying that halibut must be returned to the sea in a timely manner with minimal physical stress (careful handling). This allowed halibut sorted on-deck and those encountered in the factory to be completely enumerated by at-sea samplers hired by the EFP participants. These at-sea samplers collected data associated with the EFP while NMFS observers continued to sample using their standard protocols. The change in handling of the halibut by the crew (i.e. deck-sorting and complete enumeration of halibut in the factory) eliminated observer sampling of halibut; total discard weight and viability data were provided to the AK Regional Office by the EFP holders.

In 2016 as the EFP data collections were transferred to NMFS observers and EFP data were incorporated into the Observer Program databases (NORPAC), sampling protocols for the collection of halibut condition and length data on participating vessels were updated. With this transfer and as the EFP data were incorporated into the NORPAC database, observers began sampling halibut and collection condition and length data from the deck-sorted halibut using a simple random sample design (20% sample rate). Halibut continued to be retained in the factory by the crew, hence condition and length data was not collected from halibut found in the factory. This remained the case through 2017.

In 2018, the EFP was renewed and the retention of halibut in the factory by the crew was eliminated from the project. At this point, observers resumed collecting halibut condition and length data from halibut in the factory following the standard observer program protocols and using the sample rates established in the Length and Specimen Priority Charts. Condition and length data collections continued for halibut sorted from the catch on-deck using protocols similar to those specified in 2017. In addition to the collection of conditions and length data from a random (20%) systematic sample of sorted halibut, the first 15 halibut discarded were measured. This additional sample increased the proportion of hauls sampled where weights were obtained (through length to weight conversion) for all halibut sorted on deck (completely enumeration) and allowed database conventions to be maintained (e.g. computations not entered into the database as observations).

2.2 CAS halibut PSC accounting for vessels participating in deck sorting

When halibut deck sorting occurs on a non-pollock trawl CP or mothership, there are two components of the total halibut PSC in the catch accounting system (CAS): 1) the weight and mortality of halibut sorted on deck; and 2) the weight and mortality of halibut in the factory.

Halibut sorted on deck: When deck sorting occurs, the observer identifies a sample of halibut for taking length and viability measurements. In 2018 for example, a systematic random sample, one out of every five halibut, of discarded fish is selected (20%) and in addition the first 15 halibut are sampled, unless the observer is able to sample additional fish. The lengths of the all sampled halibut are converted to a weight using the IPHC's length weight table (see below). The average weight of the sampled halibut is calculated and multiplied by the number of unsampled halibut to estimate the total weight of unsampled halibut. The weight of the sampled and unsampled halibut comprise the total weight of deck sorted halibut. The total weight of deck sorted halibut reported by the observer is posted in CAS as discarded halibut.

Next a halibut DMR is applied to the halibut PSC. The observer identifies the viability, or health, of the halibut in the systematic random sample; note that the additional 15 halibut are not included in the computation of mortality rate. The qualitative viabilities assessed by the observer correspond to a quantitative post-capture mortality rate. For each deck sorted haul, a weighted average discard mortality rate (DMR), based on the weight of halibut at each viability level, is calculated. That average DMR is applied to the total weight of deck sorted halibut in the haul, calculating a halibut PSC weight, which is posted in CAS. In the rare event there are no viabilities collected for a deck sorted haul, an annual average DMR from the vessel's other deck sorted hauls is used. If it is the vessel's first deck sorted haul for the year, and there are no other hauls from which to generate an average, then an annual average DMR from the deck sorted hauls of all vessels in the year is used. As other deck sorted hauls are sampled throughout the year and additional viability data become available, the annual average DMRs will be recalculated and reapplied to the vessel's deck sorted haul that is missing viability data.

Halibut recovered in the factory: The second component follows the CAS PSC estimation process described in Cahalan et al (2014), and the weight of halibut in an observer's species composition samples in the factory are extrapolated to the entire haul. In 2015 through 2017, a standard DMR of 90% was applied to the halibut recovered in the factory. Beginning in 2018, a DMR is applied to the halibut recovered in the factory based on DMRs published in harvest specification tables in the **Federal Register**. The appropriate DMR is applied based on gear, sector, and year to calculate a halibut PSC mortality weight. The sum of the two estimates—halibut mortality from the deck sorted fish plus the halibut mortality of fish from the factory—is posted in CAS.

2.3 Length to Weight extrapolation for halibut

Observed weights for Pacific halibut are not often available from various fisheries and even surveys, thus a standard weight-length relationship is used to convert length to weight that is used in the calculation of biomass or catch weight. The NMFS observer program uses this table in their calculations.

Stewart (2018; IPHC-2018-AM094-09) provided a brief summary of the weight-length relationship, which is repeated here.

> The weight-length relationship for Pacific halibut was developed in 1926, re-evaluated in 1991 (Clark), and has been applied as standard practice for all years of IPHC

management. The relationship between fork length (Lf), and individual net (headed and gutted) weights (Wn) is given by:

$$W_n = 0.00000692 \times L_f^{3.24}$$

This relationship reflects the slightly greater than cubic increase in weight with increasing length (Figure 54). In 2013, the IPHC staff initiated a program to begin sampling individual weights during port sampling. Since 2015 this program has included data collection on survey vessels and during routine port sampling in almost all ports; recent results are reported in Webster and Erikson (2017). Over the next several years these data should allow for a reanalysis of the length-weight relationship, as well as an improved understanding of the differences in measurements collected on freshly dead fish, fish that have been stored on ice, as well as the relative contributions of head-weights, ice and slime on standardization to net weight.

Clark (1991) also reported equations for gross weight (eviscerated, head on), net weight (eviscerated, head off, exclusive of ice and slime), and round weight (whole fish).

Gross weight	$W_g = 0.000008025 \times L_f^{3.24}$
Net weight	$W_n = 0.000006921 \times L_f^{3.24}$
Round weight	$W_r = 0.000009205 \times L_f^{3.24}$

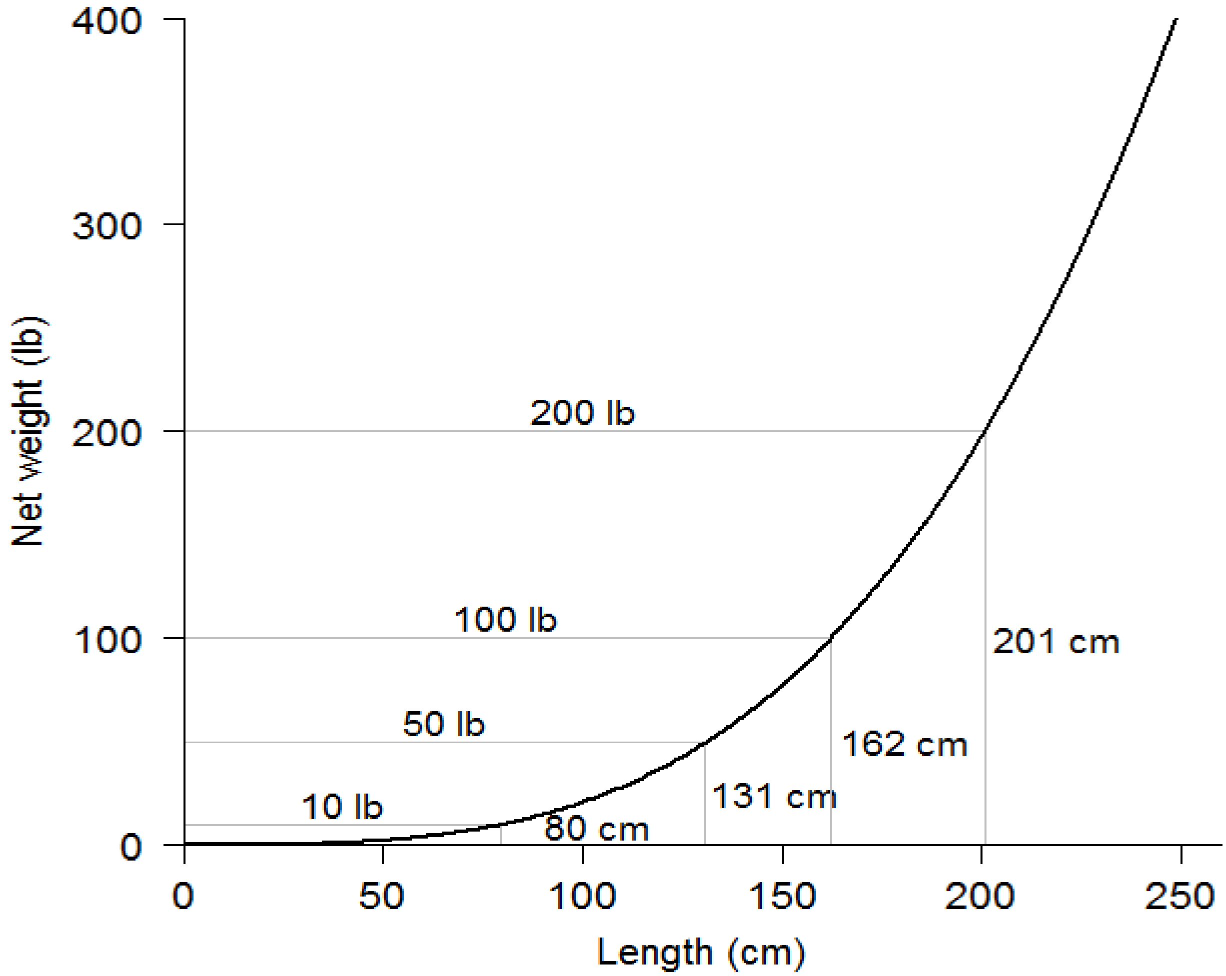

Figure 1. The conversion relationship for length in centimeters to net weight in pounds. (Figure 54 from Stewart & Webster 2018).

2.4 Data sampling differences during deck sorting

Draft data (subject to revision) provided by industry on sampling and catch prior to and during the development of the deck sorting EFP are shown in the tables below (J. Gauvin, pers comm). The tables illustrate some of the issues noted in the changes to sampling in 2016 and 2017 and the differences between the number of lengths taken on deck and in the factory across years as well as what stage the EFP was in at that time and relative participation by vessels in the EFP. This highlights some of the data issues as described for 2016 and 2017.

Table 1. Number of lengths collected on deck and in the factory for Amendment 80 sector.

Year	# observer factory lengths	# factory lengths on EFP vessels	# ob lengths on deck (EFP)*	Total # measured halibut	DS EFP affected collection of length data?
2008	34,194	-	-	34,194	no DS EFP
2009	30,791	-	-	30,791	small scale DS EFP, data not entered into NMFS CAS
2010	29,683	-	-	29,683	no DS EFP
2011	20,229	-	-	20,229	no DS EFP
2012	17,683	-	-	17,683	small scale DS EFP, data not entered into NMFS CAS
2013	18,364	-	-	18,364	no DS EFP
2014	19,672	-	-	19,672	no DS EFP
2015	18,401	-	16,721	35,122	May EFP start; 9 EFP boats; EFP was 16% of A 80 BS catch, lengths not entered into CAS
2016	12,448	7,456	27,606	47,510	May start; 12 EFP boats; EFP was 29% of A 80 BS catch; lengths not collected in factory during EFP
2017	2,703	1,861	64,240	68,804	Jan start; 17 EFP vessels, EFP was 80% of A 80 BS catch; lenghts not collected in factory during EFP

Notes on data:
Sea samplers collected EFP lengths on deck in 2015
Data for # of lengths per year and groundfish catch was provided by Sea State
Sea State used the "R 16" code in the NMFS observer data to derive the # of lengths for deck sorting hauls

Table 2. Number of lengths collected on deck and in the factory for TLAS CPs participating in DS EFP.

Year	# observer factory lengths	# ob lengths on deck (EFP)*	Total # measured halibut	DS EFP affected collection of length data?
2008	1,235	-	1,235	no DS EFP
2009	1,873	-	1,873	small scale DS EFP, data not entered into NMFS CAS
2010	455	-	455	no DS EFP
2011	1,654	-	1,654	no DS EFP
2012	2,157	-	2,157	small scale DS EFP, data not entered into NMFS CAS
2013	1,294	-	1,294	no DS EFP
2014	1,275	-	1,275	no DS EFP
2015	843	-	843	no TLAS CPs in 2015 DS EFP
2016	818	4,683	5,501	May start; 2 TLAS CPsd in EFP boats; obs did not collect lengths in factory during EFP
2017	81	7,194	7,275	Jan EFP start; 2 TLAS CPs in EFP nearly all year, no lenghts in factory during EFP

Notes on data:
Data for # of lengths per year and groundfish catch was provided by Sea State
Sea State used the "R 16" code in the NMFS observer data to derive the # of lengths for deck sorting hauls

3 O26 Data

3.1 Data on O26 from Surveys

Survey data on the percentage of intercepted halibut that is O26 for the EBS trawl survey and the IPHC Setline survey in Areas 4 A, D and E are provided below and then used in the correlation discussion in the following section.

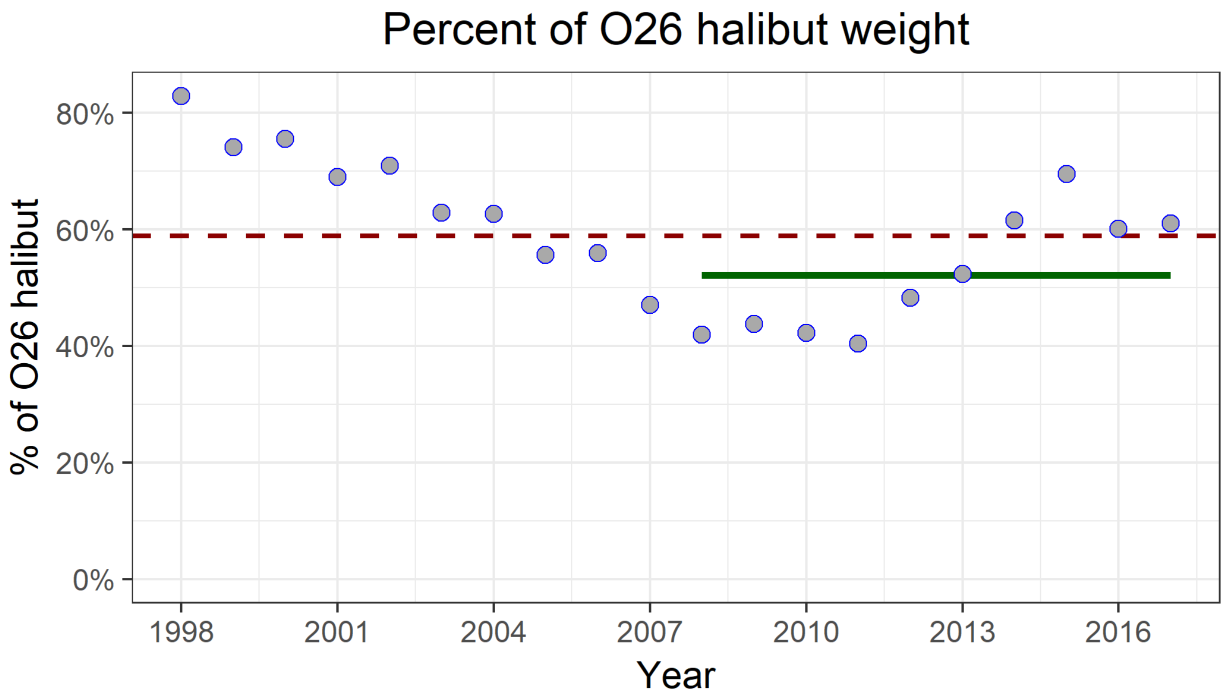

Figure 2. **Percentage of O26 halibut in the EBS Trawl survey by weight 1998-2017. The green solid line shows the mean percentage from 2008 to 2017. The dashed line shows the average over 1998–2017.**

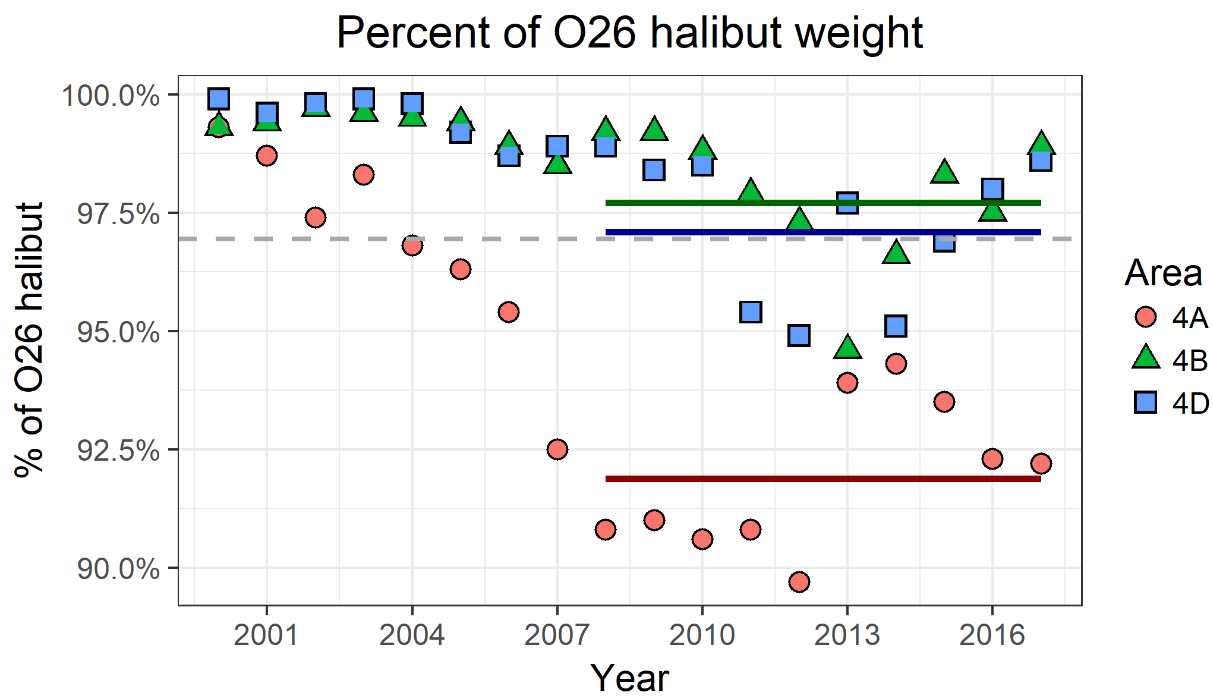

Figure 3. **Percent of O26 halibut by weight in Areas 4A, B, D of the IPHC Setline survey 2000-2017. The solid lines show the mean percentage from 2008-2017 for each area. The dashed line shows the average from 2000-2017.**

3.2 Data on O26 by Sector

Data on O26 percentage by sector are presented in Tables 3 through 6 per Council request. The estimation process follows the hierarchical sampling design used by observers (see Cahalan et al 2015 for a description of the sampling and estimation hierarchy) to estimate the proportion of halibut discards over 26 inches (O26). Halibut length data collected at the haul level are expanded within each level of the sampling hierarchy, within each sampling strata. Since sampling rates vary not only at each level of the hierarchy, but also between sample units (e.g. proportion of halibut measured varies between hauls on a fishing trip), this weighting is important to ensure unbiased estimation. Hence, to estimate the proportion of halibut discards over 26 inches, the estimates of proportion of halibut O26 are weighted by the total weight of discarded halibut estimated at each level. This estimated proportion can then be multiplied by the halibut discard (or mortality) to estimate the amount of O26 halibut discarded.

This methodology is similar to the one that is now used in the estimation of halibut discard mortality rates (DMRs; see Item D2 NPFMC meeting, October 2016) but differs from the estimation methodology employed in the 2015 Halibut PSC analysis (see Appendix 1). In the estimation of DMRs, the proportion of halibut in a condition category is estimated incorporating the sampling intensity at each level of the sampling hierarchy. The resulting DMR can then be applied to the total discard weight to estimate the total mortality of halibut.

Table 3 shows the relative percentage of O26 halibut PSC by sector, calculated by the weighted method detailed above. Tables show the total O26 by sector (Table 3; Figure 4), the percentage when deck sorting results are excluded (**Error! Reference source not found.**) and results from the deck sorting (only) in

	A80	TLAS	Longline	CDQ	AFA
2009	44.0%	22.1%	57.8%		34.9%
2010	37.2%	21.5%	57.0%	45.1%	37.6%
2011	45.3%	34.6%	53.1%	47.1%	32.3%
2012	49.7%	34.1%	51.2%	44.4%	26.0%
2013	52.1%	40.2%	50.7%	46.8%	37.9%
2014	50.6%	38.3%	57.9%	53.9%	45.3%
2015	41.9%	49.1%	59.1%	58.1%	67.5%
2016	26.8%	30.3%	56.3%	34.8%	36.0%
2017	39.3%	38.6%	51.7%	44.6%	40.0%
Average	44.4%	36.7%	54.7%	47.1%	36.9%

Table 5. Comparison of O26 percentages from non-deck sorting and deck sorting results show distinct differences for 2016-2017 due to the sampling issues described previously with deck sorting data indicating a larger proportion of O26 halibut than non-deck sorting results. This also impacts the totals as shown in Table 3 when deck sorted results for these years are included for those sectors.

For comparison between results with and without DMRs applied, the total percentage O26 by sector with discard mortality rates applied are also shown (Table 6). Monthly O26 percentages for the Amendment 80 sector though April of 2018 are shown in Table 7. Note that in 2018 the sampling issues have been addressed as described previously which likely contributes to the observed differences in percentages in the first few months of 2018 to date. Discard mortality rates employed as well as comparative tables using the non-weighted (i.e. 2015 halibut PSC analysis) methodology are contained in Appendix 1. Appendix 2 shows the proportion of O26 by number for survey, groundfish fishery and directed halibut fishery (from the October 2017 discussion paper).

Table 3. Percentage of O26 halibut PSC by weight and sector 2009-2017. These results include data from the deck sorting EFP years for 2016-2017. No DMRs are applied.

	A80	TLAS	Longline	CDQ	AFA
2009	44.0%	22.1%	57.8%		34.9%
2010	37.2%	21.5%	57.0%	45.1%	37.6%
2011	45.3%	34.6%	53.1%	47.1%	32.3%
2012	49.7%	34.1%	51.2%	44.4%	26.0%
2013	52.1%	40.2%	50.7%	46.8%	37.9%
2014	50.6%	38.3%	57.9%	53.9%	45.3%
2015	41.9%	49.1%	59.1%	58.1%	67.5%
2016	29.1%	30.5%	56.3%	35.1%	36.0%
2017	45.2%	38.3%	51.7%	44.8%	40.0%
Average	44.7%	36.7%	54.7%	47.1%	36.9%

Table 4. Percentage O26 by weight and sector 2009-2017. These results do not include data from the deck sorting EFP. No DMRs applied.

	A80	TLAS	Longline	CDQ	AFA
2009	44.0%	22.1%	57.8%		34.9%
2010	37.2%	21.5%	57.0%	45.1%	37.6%
2011	45.3%	34.6%	53.1%	47.1%	32.3%
2012	49.7%	34.1%	51.2%	44.4%	26.0%
2013	52.1%	40.2%	50.7%	46.8%	37.9%
2014	50.6%	38.3%	57.9%	53.9%	45.3%
2015	41.9%	49.1%	59.1%	58.1%	67.5%
2016	26.8%	30.3%	56.3%	34.8%	36.0%
2017	39.3%	38.6%	51.7%	44.6%	40.0%
Average	44.4%	36.7%	54.7%	47.1%	36.9%

Table 5. Deck sorting results (only) for 2016-2017. No DMRs applied.

	A80	TLAS	CDQ
2016	60.9%	51.8%	45.7%
2017	51.3%	46.7%	51.4%
Average	53.1%	46.8%	50.4%

Table 6. Percentage of O26 halibut PSC by weight and sector 2009-2017. These results include data from the deck sorting EFP years with DMRs applied.

	A80	TLAS	Longline	CDQ	AFA
2009	42.8%	20.2%	60.0%		34.9%
2010	35.7%	19.1%	55.5%	27.7%	37.6%
2011	44.1%	31.9%	48.4%	36.3%	32.3%
2012	49.8%	31.4%	52.3%	36.2%	26.0%
2013	51.9%	44.4%	48.1%	40.2%	37.9%
2014	49.2%	36.2%	53.8%	36.2%	45.3%
2015	39.1%	47.5%	62.0%	47.7%	67.5%
2016	29.5%	27.5%	57.0%	25.6%	36.0%
2017	44.0%	39.5%	56.7%	41.1%	40.0%
Average	42.9%	33.1%	54.9%	36.4%	36.9%

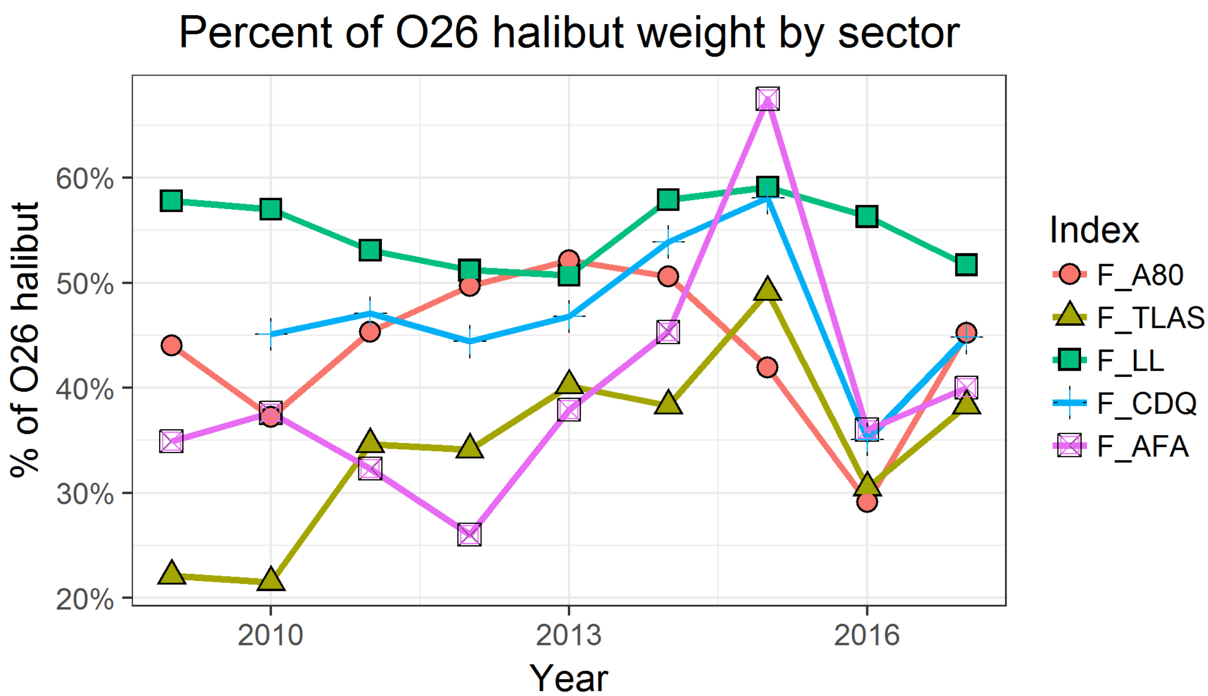

Figure 4. **Percentage of O26 halibut by weight and sector 2009-2017 from Table 3.No DMRs applied.**

Table 7. **O26 percentage by weight and month for the Amendment 80 Sector, no DMRs applied. 2009-2017. Data for 2018 is through April.**

	1	2	3	4	5	6	7	8	9	10	11	12
2009	28%	21%	14%	14%	39%	51%	62%	45%	75%	63%	39%	
2010	25%	19%	19%	28%	41%	46%	53%	43%	37%	37%	41%	
2011	21%	15%	15%	33%	60%	42%	59%	68%	66%	56%	50%	47%
2012	25%	17%	15%	16%	42%	53%	64%	72%	76%	55%	50%	37%
2013	41%	30%	19%	48%	55%	55%	63%	69%	70%	58%	56%	44%
2014	54%	24%	37%	38%	46%	56%	67%	78%	72%	56%	65%	37%
2015	35%	24%	23%	33%	53%	60%	74%	52%	62%	59%	37%	3%
2016	40%	13%	12%	8%	21%	32%	55%	81%	57%	57%	37%	33%
2017	22%	30%	37%	39%	38%	39%	50%	73%	78%	63%	34%	
2018	50%	50%	36%	29%								
Average	32%	22%	23%	30%	44%	49%	60%	61%	65%	55%	50%	41%

3.3 Correlation between survey O26 and fishery PSC O26

Pairwise correlations are shown in Figure 5 between the survey O26 percentages shown in Figure 2 (EBS trawl) and Figure 3 (IPHC setline by area) and the O26 percentages in halibut PSC by sector in the groundfish fishery from Table 3. Ideally O26 in the survey (used for candidate index of abundance for ABM alternatives) and O26 in the fishery (for which a performance standard is being developed) would be highly correlated. Of the surveys the EBS trawl survey is correlated more with all sector O26 percentages except for the Amendment 80. This may be due to the limited number of years over which the correlation is being done (2009-2017) and the data issues with the sampling and deck sorting results in 2016-2017 as described previously. The IPHC setline is 4A is the most correlated to O26 percentages in the fishery of the IPHC setline areas likely due to its overlap with more of the fishing areas in the Bering sea. Area 4D occurs further on the shelf edge and does not overlap with much of the fishing areas.

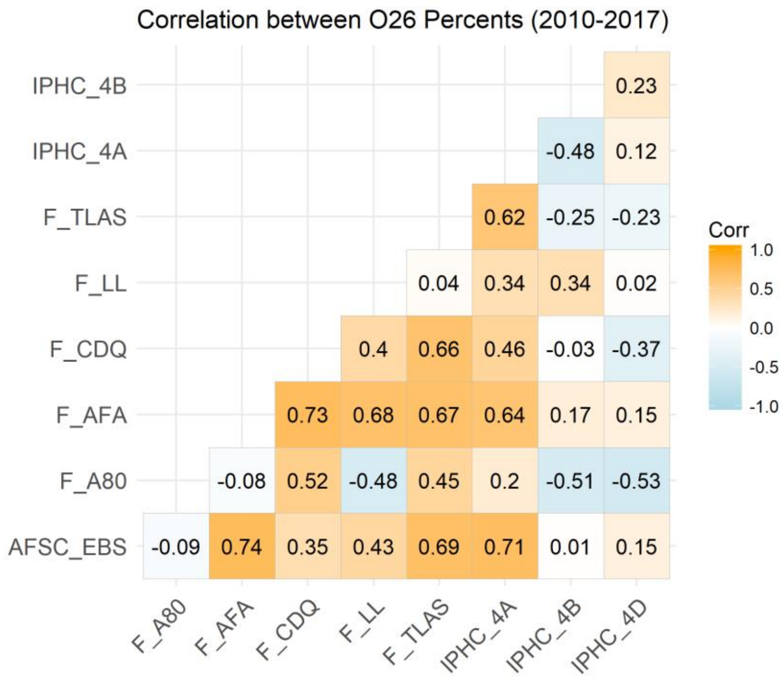

Figure 5. **Correlations between survey for EBS trawl, Setline for IPHC in Areas 4A, 4B, 4D and sector o26 percentages from Table 3.**

4 Considerations relative to creating a performance standard

The Council is considering development of a performance standard in conjunction with the ABM analysis that would utilize the O26 ratio. The following information is a revised version of some discussion items that were included in the October 2017 ABM discussion paper as it relates to the development of a performance standard. Designing a system to manage halibut bycatch in groundfish fisheries requires the balancing of several MSA national standards – most notably NS 1 (Optimum Yield) and NS 9 (minimize bycatch to the extent practicable). Halibut bycatch rates vary across time and space in a manner that has both predictable and unpredictable characteristics. Halibut and target groundfish populations are comingled to differing degrees depending on the local environment, therefore the cost of avoiding halibut is not consistent across time, location, or individual events. The cost of avoiding halibut might also vary across individual participants (vessels) depending on gear type, quota allocations, target fishery (time/area/species), cooperative tools, and technical capacities such as skill, local knowledge/experience and access to mortality-reducing tools such as excluder devices and deck sorting.

Recent instances where the Council prescribed incentive tools or called on stakeholders to develop them cooperatively include the BSAI salmon bycatch management program (BSAI Ams. 91 and 110), the "earned incentive buffer" for GOA non-pollock trawl Chinook salmon PSC limits (GOA Am. 97), and directives to the A80 trawl fleet as part of BSAI Amendment 111. The most effective measures prompt the fleet to avoid bycatch regardless of whether a season is nearing its end or a PSC hard cap is likely to be reached. Effective measures set clear benchmarks with adequate time to respond, while providing latitude for operators to flexibly experiment with methods in a dynamic environment. The BSAI groundfish fleet is distinct in that most of its operators are connected through regulated or voluntary cooperative arrangements. The ABM program under consideration can and should make use of the fact that, for the most part, the groundfish sectors subject to BSAI halibut bycatch limits have infrastructure in place to take proactive bycatch avoidance measures. The measures currently in practice are generally framed around monitoring, near real-time communication, cooperation, internal accountability, and experimentation.

Previous sections of this paper provide the data that is currently available for use in developing an O26 performance standard. As noted above there are specific considerations in the use of the data based upon recent deck sorting activities and changes to sampling protocols. The metric for the standard could be defined as a measure that aims to achieve a resource-building goal such as a ratio of O26:U26 bycatch. In making this choice, the Council should consider two things: (1) does the agency have the necessary information on the required timeline to track and manage the standard, and (2) can the fleet reasonably be expected to take steps towards this goal throughout the fishing year and under all circumstances – years of high/low halibut abundance, high/low groundfish TACs. Because different groundfish targets tend to carry different expected halibut PSC rates, a sector's PSC limit (or performance standard) might be more or less constraining depending on the harvest specifications for the year. Those specifications are foremost based on stock assessment but also have an element of policy choice, particularly as the Council determines how to parcel out the 2 million metric ton BSAI groundfish cap. A performance standard that carries penalties for sectors that do not meet it could affect choices about where to set groundfish TACs. If the standard is denominated (e.g., size ratio) in a way that the fleet does not have tools to achieve when acting in good faith, then it functions more so as an item of chance.

Depending upon the performance standard developed, other data-related factors include data availability for enforcement of the standard and for adjudicating appeals in the event of a violation or dispute regarding data. Additional consideration should be given to the timeline for assessment of performance against the standard and incorporating any resulting change in the next year's PSC into the fall groundfish specifications cycle. Timing affects review and public input into the Council's harvest specification process, public notice and business planning for the upcoming fishing year. For those reasons, the timing of the data availability and notification of the 3 River index against the threshold for Chinook salmon bycatch in the pollock fishery was developed to provide information before proposed and final harvest specifications.

For regulations that might entail sanctions, the Council should bear in mind that NMFS must provide an appeal process. Therefore, it is important that the metric for the incentive is well collected information and verifiable on the appropriate timeline. Regulatory standards that are judged on a short timeline (e.g., quarterly as opposed to annually) might be difficult to enforce. Standards that are based on a very refined metric, such as a ratio of small to large fish, should only be chosen if the Agency is confident in its ability to monitor catch and discards to the level at which the standard is applied (sector, cooperative, or vessel).

The Council will need to consider the level at which the performance standard would be set. Presumably a performance standard would be established at the sector level as per PSC allocations, rather than at the vessel level or the cooperative level where applicable. The Council should also consider whether a sector has control over the factors that influence performance relative to the standard. Specifically, the Council might want to have data or a strong belief that vessels are able to exert at least a measure of control over the general size of the halibut that they encounter as PSC. In addition, the Council should consider whether the fleet's tools that could potentially influence size selectivity of halibut bycatch would be sufficient to meet the performance standard in a future regime with a different ratio of large/small halibut in the stock as a whole.

In general, allocating additional PSC to good performers or reallocating PSC from poor performers by regulation requires an action by NMFS that is subject to close scrutiny. The Agency would need to carefully consider whether or not the available sources of data – at the relevant level of granularity – can demonstrate the difference between an adequate and a poor performer for the purpose of adjudicating an appeal. The degree of this challenge is somewhat simplified if the standard is applied at the sector level, but a sector-wide standard has other drawbacks that are discussed below (individual incentives, free-riders, etc.).

Fishing cooperatives sometimes receive greater management flexibility if they establish a harvest plan, that includes bycatch avoidance procedures. Amendment 80 cooperatives and CDQ groups can trade halibut PSC internally. The ability to trade PSC creates an incentive to minimize bycatch at an individual or cooperative level so that it may be used as a tool to optimize aggregate harvest when necessary. Allowing trading likely results in more halibut mortality than would occur with no trading, as some entities would otherwise have to cease fishing when they do not have halibut bycatch to support their target fishery. Policies that allow trading reflect a desire to optimize harvest *within* the PSC limit constraint. Individuals can benefit by reducing their own bycatch and trading that quota, creating an incentive for individuals and cooperatives to experiment with technological or knowledge-based approaches to halibut avoidance. The strength of the trading incentive for an individual or cooperative to reduce halibut mortality depends on how bycatch limits are currently allocated, which varies across sectors (e.g. A80 vessels, AFA-affiliated TLAS vessels, or the FLC).

The Council always weighs the flexibility afforded to the fleet under a regulatory solution to a problem against the desire to ensure all stakeholders are adjusting their behavior as desired. In the context of groundfish fisheries, flexibility is giving entities within sectors – those that do the actual fishing – the freedom to seek the most appropriate means to a desired end. The cost of avoiding halibut differs across gear groups, targets, time, location, and otherwise similar vessels. Commanding that all vessels achieve the same standard of bycatch avoidance is inefficient and has distributional impacts; it could also result in all vessels making the same choice to avoid a certain target species or time of year, which affects the achievement of optimum yield. Commanding that all vessels adopt a certain avoidance strategy, such as excluders, stifles experimentation with other methods that might not work in concert with that tool (i.e., deck sorting). There will always be vessels within a sector that are more easily able to avoid halibut. This could be due to their target, their gear, or their experience with a particular fishery or area. Allowing flexibility for entities within the sector to work together towards the goal of bycatch minimization *in the aggregate* reduces total costs and takes advantage of cooperative infrastructures that already exist.

On the other hand, the Council might take a more rigid approach to individuals' minimum bycatch performance levels. If the vessels within a sector for which avoidance is relatively costly are able to free-ride on the efforts of others, the "tide" of the program does not "lift all boats." In other words, it does not make sense to hold all entities to the same standard, but all entities should be held to some standard. The gradient along which that occurs is most efficiently determined by participants. For this reason, sectors have chosen to focus on outlier vessels when asked to design a voluntary plan to address halibut bycatch. Examples of plans that focus on outliers include the A80 halibut avoidance plan, and some of the EBS pollock fishery's Chinook salmon incentive plan agreements.

Regulations tend to be rigid by definition and might not be easily adapted to changes in the environment, markets, or technology if the regulations are overly specific. For example, target bycatch rates or size ratios that are specified in regulation for each groundfish species could fall out of step with how the fishery is prosecuted or improvements in our understanding of how the resource moves. The Council would not want to set up a system that needs frequent adjustment through the NEPA process. In general, effective incentives place the responsibility to achieve an end with the persons who are making decisions on the fishing grounds.

Where cooperative structures already exist in the groundfish fleet, it makes sense to rely on them to translate sector-level performance standards to the vessels. Cooperatives are better situated than NMFS to establish and enforce incentives based on target-specific or seasonally-defined size ratios, and to revise them as they experience changes in the fishery environment. However, some vessels that are subject to halibut PSC limits are not affiliated with a cooperative. In developing this program, the Council might consider how such vessels can be incentivized to minimize bycatch at all times, and not to free ride on cooperatives' efforts to fish below sector-level PSC limits.

The Council's objectives include protecting the halibut spawning stock biomass, and (indirectly) providing opportunity for the directed halibut fishery. Those objectives might call for incentives that direct bycatch toward or away from certain segments of the halibut biomass. That could mean providing future rewards to sectors that maintain a desired ratio of halibut bycatch that is over or below a defined O26 ratio. A bycatch size ratio might be appropriate because a PSC limit denominated in weight could create a perverse incentive for groundfish vessels to stay in an area where they are encountering smaller halibut, which could have a delayed but important effect on future biomass. A reward could take the form of additional bycatch in years of higher abundance (e.g., a non-linear control rule applied to the sector). Conversely, a sector might be penalized if it overharvests a segment of the halibut population.

Generally speaking, the Council had defined performance standards as a bycatch limit that is less than the maximum allowable PSC limit defined in regulation. The limit, and thus the standard, can be enforced at any number of levels – FMP, sector, area, area/sector, cooperative, or the individual entity. The achievement or failure to achieve the standard at the relevant level triggers rewards or sanctions that could also take a variety of forms. There are no examples in this region, to date, of a standard based on a bycatch fish size ratio. Performance standards have been set in regulation for salmon bycatch in the GOA and Bering Sea pollock fisheries. Those are based on the ability to fish under a higher PSC limit in one year in one year if they met a performance standard in the previous year in the GOA. In the Bering Sea pollock fishery, the performance standard is a sector-level limit that can be exceeded but programs are designed to stay below this level annually as there is a penalty for exceeding it more than twice in a rolling 7-year period. The sector then is held to their sector performance standard as a PSC limit and no longer has access to the higher limit in subsequent years. The A80 sector developed a Halibut Avoidance Plan that sets internal rate-based performance standards at the vessel level for each key groundfish target. The plan includes a separate standard for the last calendar quarter when the incentive of the annual performance standard might be lower during a year in which, for any number of reasons, realized halibut bycatch is low relative to the limit.

Selecting a level or a size-ratio for a performance standard will be a complex task because, by definition, it triggers conversation about rewards or sanctions that have distributional impacts across entities and their business plans. Even the lack of a reward could be viewed as a sanction. Moreover, monitoring and managing performance relative to the standard carries a cost for NMFS. Therefore, the Council should consider whether the performance standard that it includes is meaningful. For the standard to be meaningful, there should be some expectation that the difference in halibut bycatch at the PSC cap versus bycatch at the performance standard level provides a benefit to the resource and to other users. In the case of a standard based on fish size ratio, meaningfulness or efficacy could be analyzed in terms of meeting ABM objectives such as long-term stock health or indirectly providing more harvestable biomass to the directed halibut fishery.

5 Council next steps

The Council requested this paper in order to better understand whether the data available on halibut fish size ratio is sufficiently robust to support the development of a performance standard to include in the forthcoming BSAI halibut ABM analysis. The Council also asked for staff to develop options for such a performance standard.

At this meeting, it will be helpful to have Council and public review of the O26 data, with a view to setting performance standards. The discussion in the previous section also references the types of performance standard that the Council has developed in the past, and some cautions about ensuring that the performance standard based on fish size ratio is linked closely to the Council's specific ABM objectives. Staff is looking for Council direction to the working group as to what performance standard options could be developed and what objectives these options would achieve, which can then be analyzed in a follow-on discussion paper and the Council can decide whether to modify the ABM alternative set or as a follow up action.

6 References

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Appendix 1 Halibut O26 data by sector, using Amendment 111 methodology

For comparison with the recommended weighted approach used in Tables 3-6 of this paper, the following tables provide the non-weighted approach employed in the analysis for Amendment 111.

Total

	A80	TLAS	Longline	CDQ	AFA
2008	61.5%	48.7%	74.0%	72.1%	69.6%
2009	61.4%	48.5%	67.1%	64.1%	57.7%
2010	55.3%	24.4%	69.4%	58.3%	63.3%
2011	64.7%	25.5%	61.4%	57.5%	52.2%
2012	63.1%	30.1%	58.0%	56.3%	36.6%
2013	62.1%	39.1%	59.7%	57.3%	48.7%
2014	63.1%	31.9%	66.0%	67.6%	59.6%
2015	50.4%	57.6%	65.4%	65.0%	78.2%
2016	66.3%	47.0%	68.5%	61.4%	58.4%
2017	70.4%	68.7%	65.1%	65.9%	50.2%
Average	64.6%	48.9%	64.8%	63.1%	58.7%

No Deck Sorting

	A80	TLAS	Longline	CDQ	AFA
2008	61.6%	61.7%	74.0%	72.1%	69.6%
2009	61.4%	56.7%	67.1%	64.1%	57.7%
2010	55.3%	38.4%	69.4%	58.3%	63.3%
2011	64.7%	38.8%	61.4%	57.5%	52.2%
2012	63.1%	48.8%	58.0%	56.3%	36.6%
2013	62.1%	50.0%	59.7%	57.3%	48.7%
2014	63.0%	41.1%	66.0%	67.6%	59.6%
2015	50.4%	56.3%	65.4%	65.0%	78.2%
2016	41.6%	49.9%	68.5%	55.1%	58.4%
2017	57.6%	59.0%	65.1%	64.0%	50.2%
Average	58.1%	50.1%	65.5%	61.7%	58.7%

Appendix 2 Catch and Abundance by Length for halibut

The table below (Table 6 from the October 2017 ABM discussion paper) provides the proportion of Pacific halibut **catch** (or abundance for surveys) by size categories (in cm, corresponding roughly with <13 inches, 13-26 inches, 26-32 inches, and >32 inches) for NPFMC groundfish fisheries, the directed longline fishery (from IPHC areas 4cde combined), selected AFSC trawl surveys, and the IPHC setline survey, 2008-2016. "NA" means no survey conducted in that year.

Length		2008	2009	2010	2011	2012	2013	2014	2015	2016	mean
EBS Shelf Trawl Survey											
<33cm	<13 in	33%	13%	9%	9%	3%	3%	16%	4%	13%	11%
33-65cm	13-26 in	58%	75%	78%	77%	77%	70%	52%	66%	65%	69%
	Total U26	91%	88%	87%	86%	80%	73%	68%	70%	78%	80%
66-80cm	26-32 in	6%	8%	9%	10%	15%	20%	22%	20%	14%	14%
>81cm	>32 in	3%	4%	4%	4%	5%	7%	9%	10%	8%	6%
	Total O26	9%	12%	13%	14%	20%	27%	31%	30%	22%	20%
IPHC Setline Survey											
<33cm	<13 in	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
33-65cm	13-26 in	7%	9%	11%	15%	13%	12%	11%	9%	6%	10%
	Total U26	7%	9%	11%	15%	13%	12%	11%	9%	6%	10%
66-80cm	26-32 in	30%	27%	27%	36%	36%	37%	38%	41%	42%	35%
>81cm	>32 in	63%	63%	62%	48%	51%	51%	51%	50%	52%	55%
	Total O26	93%	90%	89%	84%	87%	88%	89%	91%	94%	89%
EBS Slope Trawl Survey											
<33cm	<13 in	0%	NA	0%	NA	0%	NA	NA	NA	0%	0%
33-65cm	13-26 in	10%	NA	19%	NA	15%	NA	NA	NA	12%	14%
	Total U26	10%		19%		15%				12%	14%
66-80cm	26-32 in	35%	NA	29%	NA	48%	NA	NA	NA	28%	35%
>81cm	>32 in	55%	NA	52%	NA	37%	NA	NA	NA	60%	51%
	Total O26	90%		81%		85%				88%	86%
Aleutian Islands Trawl Survey											
<33cm	<13 in	NA	NA	0%	NA	0%	NA	0%	NA	0%	0%
33-65cm	13-26 in	NA	NA	69%	NA	82%	NA	62%	NA	51%	66%
	Total U26			69%		82%		62%		51%	66%
66-80cm	26-32 in	NA	NA	19%	NA	15%	NA	30%	NA	38%	26%
>81cm	>32 in	NA	NA	12%	NA	4%	NA	9%	NA	10%	9%
	Total O26			31%		19%		39%		48%	34%
Directed Halibut Fishery											
<65cm	Total U26	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
66-80cm	26-32 in	2%	2%	2%	2%	2%	3%	5%	5%	2%	3%
>81cm	>32 in	98%	98%	98%	98%	98%	97%	95%	95%	98%	97%
	Total O26	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Observer IFQ Longline											
<33cm	<13 in						0%	0%	0%	0%	0%
33-65cm	13-26 in						5%	5%	4%	5%	6%
	Total U26						5%	5%	4%	5%	6%
66-80cm	26-32 in						19%	36%	21%	26%	24%
>81cm	>32 in						76%	59%	76%	69%	70%
	Total O26						95%	95%	97%	95%	94%
Groundfish Non-Pelagic Trawl Fisheries											
<33cm	<13 in	63%	18%	9%	24%	7%	9%	18%	5%	3%	17%
33-65cm	13-26 in	34%	78%	83%	65%	80%	69%	63%	85%	72%	70%
	Total U26	97%	96%	92%	89%	87%	78%	81%	90%	75%	87%
66-80cm	26-32 in	2%	3%	6%	8%	10%	18%	16%	8%	20%	10%
>81cm	>32 in	1%	2%	2%	3%	2%	5%	4%	2%	6%	3%
	Total O26	3%	5%	8%	11%	12%	23%	20%	10%	26%	13%
Groundfish Pelagic Trawl Fisheries											
<33cm	<13 in	13%	7%	1%	8%	1%	0%	10%	3%	1%	5%
33-65cm	13-26 in	75%	90%	85%	81%	95%	84%	66%	66%	81%	80%
	Total U26	88%	97%	86%	89%	96%	84%	76%	69%	82%	85%
66-80cm	26-32 in	8%	2%	10%	10%	4%	13%	21%	23%	13%	12%
>81cm	>32 in	4%	1%	4%	2%	0%	2%	3%	8%	5%	3%
	Total O26	12%	3%	14%	12%	4%	15%	24%	31%	18%	15%
Groundfish Longline Fisheries											
<33cm	<13 in	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
33-65cm	13-26 in	52%	62%	60%	65%	64%	61%	50%	55%	47%	57%
	Total U26	52%	62%	60%	65%	64%	61%	50%	55%	47%	57%
66-80cm	26-32 in	37%	29%	33%	28%	31%	32%	38%	31%	32%	32%
>81cm	>32 in	11%	9%	8%	6%	5%	6%	13%	13%	21%	10%
	Total O26	48%	38%	41%	34%	36%	38%	51%	44%	53%	43%