Discussion Paper: Sablefish Discard Allowance

March 22, 2019

1 Background

A discussion paper[1] presented to the North Pacific Fishery Management Council (Council) at its October 2018 meeting[2] explored the potential to allow discarding of small sablefish in the Individual Fishing Quota (IFQ) sablefish fishery. The discarding allowance was suggested by stakeholders in April 2018[3] as a management response to potential inundation of directed fishing catches of small sablefish from the 2014 year class, the largest on record, and one that will likely dominate fishery landings for the next several years. Stakeholders and Council members expressed a desire to minimize fishing mortality for the year class, which has considerable potential to expand the spawning stock, and also to minimize the economic burden to the fishery of a massive shift in catches of small, low value sablefish.

Although a discarding option would undoubtedly add flexibility to sablefish fishery operations, a fundamental conclusion of the October 2018 discussion paper was that a regulatory change allowing discards of small sablefish could not occur in time to mitigate impacts of the 2014 year class. As to the potential for other year classes to present similar management challenges, the 2016 year class also appears to be above average size, though not nearly as large as 2014, but management action is not likely to catch up with it either. Another "2014" will likely come along in the future, but speculation on the timing of its arrival is a highly uncertain exercise given that it has never occurred before in the time series of recruitment on hand. Strings of above-average recruitment (e.g., 1997, 1998, 2000) have been observed multiple times and, for that reason, may be considered a more likely near-term scenario (pers. comm. Hanselman). The suitability of a regulatory change to accommodate these less extreme recruitment anomalies could be addressed in a future analytical effort.

Under the current circumstances, it appears that establishment of a discarding provision for sablefish and the ancillary adjustments to monitoring, catch-accounting, assessment, and enforcement protocols, are not

[1] http://meetings.npfmc.org/CommentReview/DownloadFile?p=b6b509dd-a14c-442b-867b-3f88fa9f8d98.pdf&fileName=D2%20Sablefish%20Discard%20Allowance.pdf
[2] http://meetings.npfmc.org/Meeting/Details/142
[3] http://npfmc.legistar.com/gateway.aspx?M=F&ID=f7e25c7f-12e1-4fc1-9b92-eb99b965b4be.pdf

issues in need of immediate decision-making and implementation. Instead, the Council has the benefit of considering a broad set of management options including the initiation of scientific studies on discard mortality, development of new fishery data collection efforts, and investments of resources necessary to bring those projects about. A speedier, less information-demanding approach could also be considered, but should be considered in the context of other options, and perhaps as a bridge to the establishment of a more empirically-based management solution in the future.

2 Introduction

This discussion paper briefly characterizes a range of decision points that are likely to require development through future analyses if the Council chooses to recommend action on a discarding provision for the IFQ sablefish fishery. The October 2018 motion[4] calling for this discussion paper, identifies nine specific challenges, listed in Table 1, below, that the Council felt were in need of further exploration (numbers added to aid in referencing). Table 1 also provides a brief summary of the take-aways from this discussion paper on the issues identified by the Council and lists the document sections to refer to for additional detail.

Table 1. Management issues related to an allowance for sablefish discarding that the Council identified in its October 2018 motion requesting preparation of this discussion paper, as well as brief summary statements from the sections of the discussion paper that address each issue.

Council-identified Issue	**Summary conclusion**
1. *A process for establishing species-specific and gear-specific discard mortality rates (DMR) for sablefish that outlines the work necessary to maintain the relevance of that DMR over time.* ***(3)***	A wide range of options exists for developing approaches for monitoring and estimating sablefish discards and mortalities. These present different costs related to demand for resources and time delays related to implementation. An approach similar to the non-target halibut DMR system would require initiation of extensive scientific studies to relate DMRs to fish condition or other factors, and dedication of significant in-season observer resources would be needed for continual mortality estimation.
2. *An assessment of the reliability of applying temporary proxy DMRs from other fisheries to the sablefish IFQ longline and pot fisheries* **(3.2)** *and the implications of increased monitoring necessary to establish observer-based DMRs.* **(3)**	The observer-based DMR issues are addressed under the previous issue in section 3.1. With regard to proxy DMRs, these represent the simplest approach in that they obviate the need for mortality estimation and monitoring. There are likely significant regional and depth issues that would challenge a simplistic approach throughout Alaska. The IFQ halibut approach may have aspects that are / are not directly translate-able to the sablefish fishery.

[4] http://meetings.npfmc.org/CommentReview/DownloadFile?p=cb4f3d0b-62d2-42a2-978e-0a339956f983.pdf&fileName=D2%20COUNCIL%20MOTION.pdf

Council-identified Issue	Summary conclusion
3. *The possibility of allowing discards during years of high abundance versus years of lower abundance and how to establish a threshold between high and low abundance years.* **(3.3)**	This is generally unadvisable as it makes unrealistic assumptions about the accuracy of early estimates of year-class strength which would need to be known with significant confidence in order to initiate and terminate the discard allowance across years. In combination with those concerns, this approach would require consideration of the approaches that associated with DMR estimation and in-season monitoring.
4. *The possibility of increased whale depredation if discarding is allowed.* **(3.4)**	The overall effects and extent of whale depredation in Alaska waters is still uncertain. It is unlikely that the practice of discarding small sablefish would result in a decrease in whale depredation. It is still very difficult to accurately assess the impact that whale depredation has on the sablefish commercial fishery, which makes any discussion of the effects of sablefish discarding on this matter purely speculative at this point.
5. *An exploration of gear modifications and methods of fishing that could aid in avoiding small sablefish.* **(3.5)**	A number of possible gear modifications could be adopted by industry in an effort to avoid small sablefish if another large year class were to be observed in the fishery. By increasing the size of fished hooks, IFQ sablefish fisherman could potentially reduce the number of smaller, younger year class sablefish while still effectively targeting larger, more valuable individuals. Escape rings installed into the sides of pot gear is one method that is already being utilized by Alaska state managed fisheries to reduce catch of small, immature sablefish. Across all gear types, younger (smaller) sablefish may possibly be avoided by fishing in deeper waters, although anecdotal evidence suggests this approach may not work when exceeding large year classes, such as the 2014 year class, occur.
6. *The implications of small sablefish discards increasing the probability of approaching the overall TAC or exceeding the ABC.* **(3.6)**	There is no set aside for non-sablefish IFQ incidental catch or discards for the fixed gear allocation of the TAC, and past incidental catch and discards have been absorbed by the trawl allocation of the TAC. If the trawl sector catches their full allocation, there is no buffer to account for the discards in the fixed gear allocation. Allowing for discards of small sablefish could add to the potential of exceeding the overall ABC. The chances of exceeding the TAC would be highly contingent on the chosen DMR.
7. *A discussion about the concerns of fishing down the existing spawning stock.* **(3.7)**	Comments from the 2018 SAFE report paint a cautionary tale regarding how preferential selection of large sized sablefish, as a result of small sablefish discard, could result in negative consequences for the existing spawning stock, which has been in decline over the last decade. Allowing many small immature individuals the chance to mature and reproduce even once could have a dramatic positive impact on

Council-identified Issue	Summary conclusion
	spawning stock biomass. One critical determination that the Council would need to consider is the longevity in which to allow small sablefish discarding to occur.
8. *Potential for and implications of high-grading under size-based management.* **(3.8)**	A discarding allowance sets the stage for discarding fish above the intended threshold size if a range of conditions are perceived to support that. This issues is also an enforcement concern and consistent with general concerns about effort on the limited biomass of larger, older fish.
9. *Add investigation of enforcement options.* **(3.9)**	If the Council intends to proceed to action on this issue, the exact regulatory language would need to be explored in an analytical document and be reviewed by the Council's Enforcement Committee in order to achieve consistency with the Council's enforcement precepts. It is likely that a regulatory change allowing or requiring sablefish discarding would affect each of those enforcement precepts. Enforcement concerns can be broken down into vessel-level operations and the effects of the regulations and other management structures on the fishery as a whole. Generally, as the regulatory changes get more complex, they involve more enforcement demands. The fundamental enforcement concern on the fishery as a whole is how discards impinge on IFQ accounting and the degree that this affects accuracy in discard reporting.

3 Issues for Evaluation

3.1 Sablefish Discard Mortality Rates (DMRs)

If an allowance for sablefish discarding were to be established for the IFQ fishery, a way of monitoring sablefish mortalities would need to be adopted, and this typically involves use of discard mortality rates (DMRs). The only discarding of sablefish currently allowed is in the non-target trawl and fixed gear fisheries and, for these fisheries, all discarded sablefish are counted as mortalities. The use of a 100% DMR for these non-target fisheries is a precautionary tool that accrues a maximum estimate of mortalities against the portion of the TAC allocated to those fisheries. Overestimating discard mortalities in the directed fishery, however, may create undesired management outcomes, especially if the IFQ TAC is achieved too quickly. A more appealing approach, then, may be to apply accurate estimates of DMRs to the directed fishery, but because no process to generate those estimates currently exists, new data gathering mechanisms would need to be initiated.

Currently, the only federal fisheries in Alaska for which discard mortality data are collected are the groundfish fisheries that incidentally capture Pacific halibut (halibut). For these fisheries, halibut DMRs are applied by in-season management to reported discards from defined fishery groupings, and the DMRs for those groupings are maintained on a continual basis through ongoing observer-based data collection. Annually, review of updated halibut DMR estimates is conducted by an interagency halibut DMR workgroup, and their recommendations are reviewed and specified as part of the groundfish harvest specification process. A similar process could be developed for estimating DMRs for the directed

sablefish fishery and would involve resource dedication approximately equivalent to duplicating the halibut DMR program.

Gear-specific DMRs are also used in the BSAI crab fisheries but are not based on the types of at-sea measurements used for halibut. These estimates are fixed values consistent with those used in crab stock assessments and are specific to gear and fishery types (i.e., groundfish trawl and pot fisheries or crab pot fisheries). Fixed sablefish DMRs are addressed in this paper in section 3.1.2.

3.1.1 Summary of Information Provided in the Previous Discussion Paper

Section 2.4 of the October 2018 discussion paper[5] touches on the need to initiate scientific field work and observer-based data collection protocols to establish and maintain sablefish DMRs. Drawing from the halibut example, Section 2.4.2 differentiates between National Marine Fisheries Service Alaska Regional Office (NMFS AKRO) application of DMRs to halibut discarded by groundfish fisheries and the IPHC stock assessment application of DMRs for estimating time series of total halibut removals in both halibut and non-halibut fisheries. Finally, Section 2.4.3 reports on sablefish DMRs in use by the Pacific Fishery Management Council (PFMC), Canada's Department of Fisheries and Oceans (DFO), and the Alaska Department of Fish and Game (ADF&G), which either allow discarding of live sablefish (ADF&G) or require sablefish discarding below a specified minimum size (PFMC, DFO).

3.1.2 Establishment of Gear-Specific Sablefish DMRs

3.1.2.1 Emulating the Non-target Halibut Fishery DMR Approach

The system in place for non-target halibut DMR estimation has been described in discussion papers prepared to support improvements in halibut DMR methods that were provided at the April 2016[6] and October 2016[7] Council meetings. Briefly, halibut DMRs are estimated annually for specific area-sector-gear combinations or "operational groupings" and are based on the distribution of "fish conditions" and associated mortality rates in the discards for those operational groupings.

Fish condition is determined through a systematic assessment of criteria by onboard observers of the extent of injury in individual fish just prior to the fish being returned to the water. Examples of fish conditions (i.e., excellent, poor, dead) from different gear types are in Table 2 along with the mortalities associated with the conditions. Though these categories appear to be simplistic, the assignment of fish into the condition categories is done through a rigorous assessment protocol described in annual Observer Sampling Manuals. Furthermore, the condition categories and the assessment protocol are informed by published scientific articles from projects that evaluated survival probability over a wide range of specific injury types. The protocols for assessment of condition criteria facilitate a thorough examination of each fish, with observers checking for injuries associated with the specific gear type used. The condition category assigned to a given fish is arrived at only after observers work through the entire assessment process. In order to establish gear-specific DMRs for sablefish, based on the approach used for halibut, basic research would have to be done to: (1) establish distinct fish condition categories, and (2) characterize robust mortality probabilities for those categories.

[5] http://meetings.npfmc.org/CommentReview/DownloadFile?p=b6b509dd-a14c-442b-867b-3f88fa9f8d98.pdf&fileName=D2%20Sablefish%20Discard%20Allowance.pdf
[6] http://npfmc.legistar.com/gateway.aspx?M=F&ID=92c019df-5cf9-467d-9bbc-f1b681e57d8b.pdf
[7] http://npfmc.legistar.com/gateway.aspx?M=F&ID=34847078-2ed2-4d3c-85a5-73e26235c1d5.pdf

Table 2. Assumed gear/condition-specific mortality probabilities for halibut in calculating DMRs.

Gear	Condition			
	Excellent	Poor		Dead
Trawl[a]	0.20	0.55		0.90
Pot[b]	0.00	1.00		1.00
	Minor	Moderate	Serious	Dead
Longline[c]	0.035	0.363	0.662	1.000

From [a] Clark et al. (1992)[8], [b] Williams (1996)[9], and [c] Kaimmer and Trumble (1998)[10]

A pathway for establishing sablefish condition categories for ongoing observer assessment would be to initiate a research project from scratch which would entail the entire process of soliciting the need for the research through the Council's research priorities and garnering the interest of research funding sources. There is no guarantee when funding resources would be made available, nor whether federal researchers, for example at the Alaska Fisheries Science Center (AFSC), would be able to justify sablefish DMR funding relative to other budget demands. A request for proposals from NPRB or some other funding source may be available if interested PIs can explain the value of the research within a particular funding theme. Cooperating industry partners would need to be identified and brought in to ensure that field conditions are achieved that would be transferable to management of the fisheries in question. Cooperating vessels would need to include both longline and pot gear and possibly catcher vessel (CV) and catcher/processors (CP) vessel types to the extent that operational differences may be important. Projects could employ fish holding devices for assessing near-term mortality, but assessment of long-term mortality would necessitate release of very large numbers of tagged sablefish to provide a realistic probability of recovering tagged fish at rates sufficient to assess mortality. Recapturing fish with extensive time at-large increases the robustness of mortality estimates from large scale tag-recovery projects, so years of recapture data may continue to be gathered. Stachura et al., (2012) included fish that had been at large as long as 19 years in their analysis. Replication of field work in shallow and deep water locations would likely be necessary since sablefish are taken from some of the deepest areas where fishing occurs. The point is that initiating a basis study on the survival of sablefish over a range of injury classifications for different gear types, vessel types, depths, and areas would likely not produce usable data for management for several years.

To bypass the multi-year process described above, Stachura et al., (2012) reviewed data on longline-survey-caught sablefish that were recaptured by survey and fishery gear. They developed a logistic regression model to identify significant factors related to sablefish survival including fish length, depth at capture, hook location, injury severity, injury type, and amphipod predation based on survey-caught sablefish. The overall estimated DMR from Stachura et al. (2012) was 11.71%, but the authors consider this to likely be an underestimate given that handling of sablefish is different in the survey, compared to fishery conditions, and also because fishery gear may vary compared to survey gear.

The translation of the injury factors from Stachura et al. (2012) into a manageable number of condition categories would likely be necessary to utilize them in observer-based assessments and make use of condition criteria worksheets similar to those used for halibut. Importantly, the study was restricted to a single gear type and the transferability of the results to pot-caught sablefish may be questioned.

[8] Clark, W. G., Hoag, S. H., Trumble, R.T., and Williams, G.H. 1992. Re-estimation of survival for trawl caught halibut released in different condition factors. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 1992:197-204

[9] Williams, Gregg H. 1996. Pacific halibut discard mortality rates in the 1990-1995 Alaskan groundfish fisheries, with recommendations for monitoring in 1997. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 1996: 173-183

[10] Kaimmer, S. M. and Trumble, R. J. 1998. Results from the 1995 trawl tagging charter investigating mortality of discarded halibut. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 1998:197-206.

Additionally, a "pot version" of Stachura et al. (2012) is unlikely to be done given that there is not a pot survey comparable to the long-term longline survey from which they drew their data.

For sablefish directed fishing, gear categories would be limited to hook-and-line and pot, and the importance of sector (CV, CP) would need to be addressed. Research could be initiated that would address the importance of other factors related to operational groupings, perhaps examining the influence of geographic subareas. This work could be done in conjunction with a larger tag-recapture or capture and hold projects, but would likely add time and expense to any such projects. Figure 1 provides a breakout of the different operational groupings that are used for halibut DMRs in the Gulf of Alaska. Among the most important influences on the viability of discarded fish are the onboard methods of handling them before release, 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 the discards.

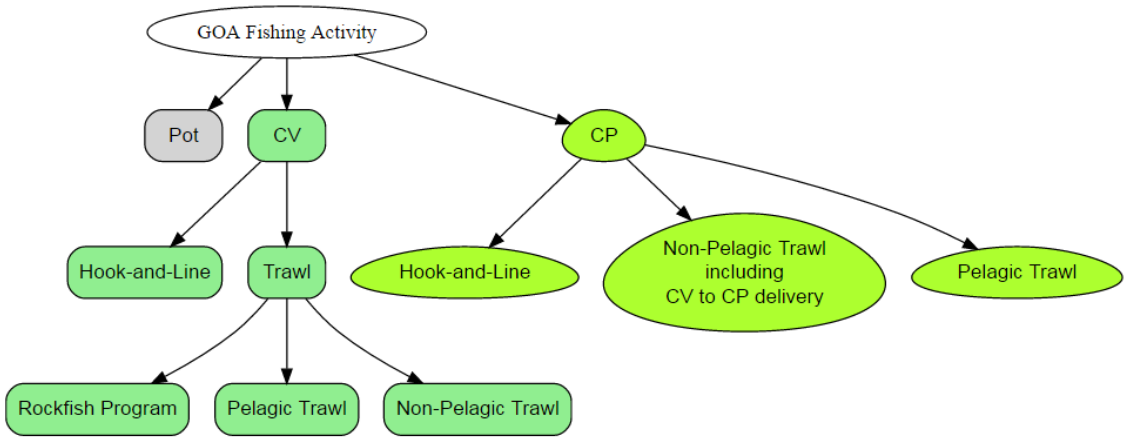

Figure 1. Halibut PSC fishery operational groupings for the calculation of DMRs in the Gulf of Alaska.

3.1.2.2 Variations on the Non-Target Halibut DMR Approach for Sablefish

A wide array of approaches is available for managing sablefish discards that do not directly imitate the halibut DMR approach. In the 2016 IPHC Report of Assessment and Research Activities, Leaman and Stewart (2016) surveyed several halibut DMR basis studies (Peltonen 1969, Clark et al. 1992, Pikitch et al. 1996, Williams 1996, Kaimmer and Trumble 1998, Davis and Olla 2001, Kaimmer et al. 2012) and their findings could be helpful in applying lessons-learned, as applicable, to the design of a targeted sablefish study.

Leaman and Stewart (2016) note that current halibut DMR methods fail to account for variables that may explain significant differences in mortality. For example, fish size is not factored into non-target halibut discard mortality estimation. Similarly, exogenous variables such as temperature, depth, and time on deck are likely to be important, although these may be challenging to monitor for at-sea observers. New tagging technologies, including satellite tags could be used in future DMR field studies to avoid limitations associated with holding fish in pens. Finally, and perhaps especially importantly for sablefish, Leaman and Stewart (2016) recommend associating DMRs with release method rather than release condition for hook-and-line fisheries, since discarding that is representative of normal fishing operations cannot logically be done for that gear type when fish are brought onboard for observer assessment.

As described above, there would be considerable time and resources involved in the initiation of basis studies that would evaluate and establish for management purposes empirically-based relationships between measurable sablefish condition or other criteria and release mortality. Other studies could be initiated that would explore DMRs without doing extensive multi-year tag-recovery projects. These could apply laboratory (i.e., physiological) methods that simulate stresses experienced by fish caught by commercial gear (e.g., Davis and Olla 2001). These studies can uncover important factors involved in the mortality of commercially discarded fish, but are generally valuable because they can focus verification studies that involve a field component. Modelling studies, e.g., Richards et al. (1994, 1995) and Stachura et al. (2012) can be extremely helpful in analyzing injury data along with other information such as gear, haul, and environmental characteristics, but these are limited to cases where established datasets are already available for analysis.

3.1.2.3 Maintaining the Relevance of Sablefish DMRs Over Time

Unless a decision has been made to assume a constant mortality rate for discarded sablefish, converting reported discards into estimates of sablefish mortalities will require that the characteristics of discards that are associated with mortality be measured on an ongoing basis. As in the halibut model, this would involve the dedication of onboard observer duties to assessing about-to-be discarded sablefish. Unlike the halibut model, discard data would be gathered on vessels that are targeting the species that needs to be assessed.

In obtaining representative catch data through observer-based programs, observers must sample at a rate and in a manner that adequately characterizes the measurements of interest under the desired circumstances. Observer measurements of halibut that will be discarded from trawl catches of groundfish focus on ensuring those halibut are handled in a manner representative of "typical" fishery operations. This goal becomes more challenging to achieve for longline operations where "typical" would involve shaking the halibut off the hook, but to measure and assess the fish, it must be brought onboard for the observer to work with. This situation is likely to characterize sampling the sablefish directed fishing catch as well. For this reason, the relationship between release condition and release method is being addressed which would allow discarding to proceed according to standard practice. Release method is so much easier to assess that electronic monitoring could be used which would allow sample sizes to be increased considerably compared to onboard observer measurements of release conditions.

Accounting for fish size, a potentially significant predictor of mortality, would challenge onboard observers and electronic monitoring reviewers in the sablefish fishery. The AFSC's Fishery Monitoring and Analysis Division (FMA) is considering EM review methods to apply for binning non-target halibut into 10 cm size categories. Techniques for accommodating smaller size categories would either need to be developed for sablefish, given their smaller overall size range, or a more simplistic sized-based approach (above/below a threshold size) would be required. Since a discarding allowance for the directed sablefish fishery would target small fish, corroboration with the defined threshold for "small" could be accommodated under EM, but those techniques would need to be developed.

3.2 Fixed (Including Proxy) Sablefish DMRs

The simplest approach from an analytical perspective would be to assume that mortality is a fixed proportion of the discards. This approach is taken by other agencies that manage sablefish including the PFMC, DFO, and ADF&G, and is also used in the BSAI crab fisheries for estimated discards. For those fisheries and agencies, a fixed DMR is applied to estimated discards, and therefore, in-season observer resources do not need to be dedicated to assessing fish condition or other contributing factors for DMRs. Instead, resources can be dedicated to achieving or improving accuracy in the estimation of total discards.

Justification for a fixed DMR approach could consider whether the marginal loss in sablefish available for harvest under an assumed but precautionary DMR is sufficiently tolerable when compared to the

investment cost of a more accurate empirically-based accounting approach. A cost-benefit analysis could define the boundaries of those options and would be the focus of a future analysis that uses critical inputs such as fishery encounter rates with discard-size fish as compared to retention-size fish. As a part of that analysis, simulations could be conducted that would explore different assumed discard ratios along with different assumed DMRs to explore a landscape of operational and revenue impacts.

Returning to the issue of fish size, the previous discussion paper identified clear market category differences in sablefish landings among FMP areas. The dominance of small market category fish in the Bering Sea, for example could affect the appeal to local harvesters and processors of a discard option or requirement linked to fish size. As size-based discarding becomes more likely, and as the assumed mortality of discarded fish increases, the portion of a vessel's IFQ that is used up by discard losses would tend to grow. Thus, on a per-weight of catch basis (retained and discarded) the cost of equivalent proxy DMRs for IFQ vessels in the Bering Sea would tend to be greater than for IFQ vessels in the Southeast district of the GOA.

Spatial differences in the size distribution of sablefish can also be linked on a more local scale to depth of capture which has been identified as a potentially important determining factor for DMRs by Stachura et al. (2012). This link is incorporated into the proxy DMRs used by the PFMC through differential mortality accounting for nearshore and offshore sablefish discards. An analysis of the revenue impacts from discarding would need to explore the interplay of nearshore and offshore DMRs (7% and 20%, respectively under the PFMC) with local depth-linked harvest patterns to account for the significance of these accounting options across areas.

3.2.1 Halibut IFQ Approach

A quite different approach is in place for the IFQ halibut fishery, for which a component of "wastage" includes fish that are captured and discarded because they are below the legal size limit of 32 inches. All U32 halibut (below 32") are assumed to be captured by the directed fishery at a rate equal to that observed by the IPHC's setline survey in each regulatory area. That rate, rather than direct estimates of discards, determines the amount of halibut discarded by the fishery, and a 16% DMR is applied to those discards for fisheries operating under the IFQ program. Additionally, a reduction of the overall harvest available to IFQ vessels is made based on assumed wastage for the upcoming harvest year.

The IFQ halibut approach bypasses all of the discard monitoring and DMR estimation steps involved in accounting for halibut in the non-target fisheries and would likely constitute an option for further analysis if the Council wants to move further with sablefish discarding. The existing trawl and longline survey for sablefish could serve to provide estimates of size-specific encounters by the fisheries. These would likely have to be region-specific as in the halibut fishery, and since sablefish show strong west-to-east size differences. The attribution of sablefish fishery encounters/discards/ mortalities of fish below a given size would merit considerable investigation in an analysis since there are likely to be a range of vessel level fishing techniques that relate to the size composition of the sablefish catch (e.g., see section 3.5). Additionally, and as stated above regarding estimates of year class strength, an analysis would likely focus on the reliability of survey encounters in predicting fishery catches of fish beneath a threshold size. The age structure of halibut associated with U32 catches has received considerable attention and the stability of sablefish ages associated with a threshold size would need to be addressed to support an action including this potential option. Finally, the assignment of a reasonable DMR to the assumed discards would require that resources at least be dedicated to either vetting existing estimates (e.g., Stachura et al., 2012) or initiating scientific projects for generating estimates. Unless proxy DMRs are preferred, the latter would be a minimum requirement for application to discards from the pot fishery for which there is no existing DMR estimate.

3.3 Episodic Allowance of Sablefish Discarding

A hypothetical management scenario exists in which discarding of small sablefish would only be allowed (or required) during episodes of significant year-class impacts to the sablefish population and fisheries. Under this arrangement, some signal would have to be detected that convinces managers that a large year class of sablefish is present, and that the discard switch should be flipped "on" so the fishery avoids negative impacts of the year class. Additionally, at some point, perhaps a year or two later, the discard switch would be flipped off because it is not necessary.

Fundamental to this episodic discarding arrangement is an unrealistic assumption about the utility of initial estimates of year class strength. Generally speaking, uncertainty about the size of year classes in stock assessments is considered to be greatest early on and to diminish as evidence of their size accumulates through repeated survey and fishery catches, in other words, over a several year period. For sablefish, trawl survey catches of age 1 fish could provide the primary indicator for initiating a discard allowance. The problem is that the initial estimate is always revised and, sometimes greatly, following the accumulation of more years of information. As stated in the 2018 SAFE, "The proportion of 1-year-olds in the trawl survey lengths does not always predict a strong year class as more data are collected. We examined recruitment strength compared to the presence of 1-year-olds (<32 cm) in the Gulf of Alaska trawl survey from 1984-2017 (Figure 2). When compared to the recruitments aligned with those respective surveys that would have detected them, only the 2001 survey detected one year olds at a high level, which also corresponded to the large 2000 year class. Recently, the 2015 and 2017 GOA trawl surveys appear to be showing very strong presence of 1-year-olds (Figure 3). However, because trawl survey lengths previously have not always been related to strong recruitment classes, except for moderately in 2001, we are unsure how to interpret the large number of age-1 fish in 2015 and 2017."

Also, from the 2018 SAFE, "The assessment model has typically performed well where the initial estimate of year class strength was similar as more data was added. However, the large 2014 year class has decreased 30% in its second year (2017) of being estimated. We showed in 2017 in a 20 year retrospective analysis, that large year classes follow a similar pattern of appearing to be very large for several years after the first estimation and then decreasing after they have been observed in the age composition for several years, although remaining above average. This could be related to time-invariant selectivity or an unmodeled age-dependent mortality process."

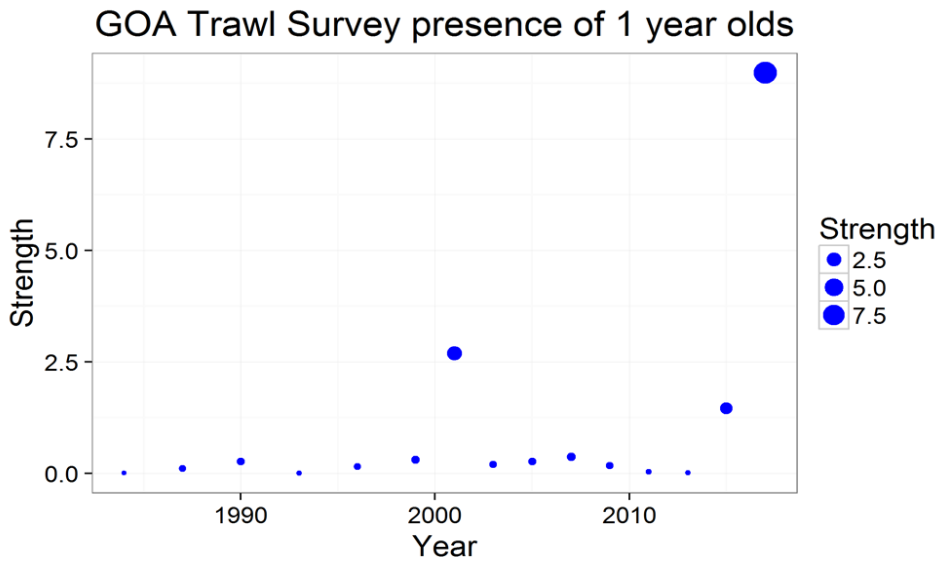

Figure 2. Presence of one-year-old (Length < 32 cm) sablefish in the Gulf of Alaska trawl survey. Strength is relative to the mean abundance (i.e., a strength of 7.5 is 7.5x average).

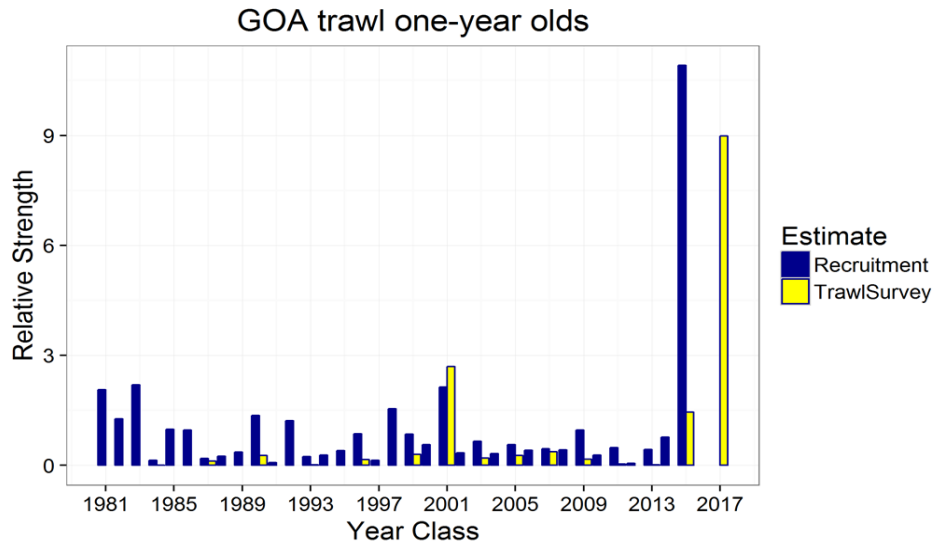

Figure 3. Strength of presence of one-year-old (Length < 32 cm) sablefish in the Gulf of Alaska trawl survey compared to the respective year classes of recruitment estimated by the stock assessment. Strength is relative to the mean abundance or recruitment (i.e., a strength of 7.5 is 7.5x average).

Another important consideration regarding this approach relates back to choices associated with accounting for discard mortalities. If a relatively simplistic application of constant DMR is used, then the major flaw with this approach lies in the belief that information is reliable enough to predict when it would be appropriate to allow discarding. If empirically-based DMRs were used, there would also be a need for ongoing observer-based collection of data. Following the halibut example, DMRs used for management are not collected and applied in real time, but are instead "projected" from annual DMR estimates collected in previous years. As such, there would need to be an ongoing observer data collection to be used in case the discard switch needs to get flipped on. The potential cost for this ongoing program would have additive costs associated with the risk for non-use of the information.

3.4 Whale Depredation

Killer whales have a long history of depredating the commercial sablefish fishery and AFSC longline survey, while sperm whales have become a problem more recently.

3.4.1 Killer Whales

Killer whale depredation predominates in western Alaska in the Bering Sea (BS), Aleutian Islands (AI), and Western Gulf of Alaska (WGOA), and to a lesser extent in recent years in the Central Gulf (CGOA). Depredation is indicated by reduced sablefish catches, the remains of mouthparts on hooks, as well as bent, straightened, or broken hooks. The AI and the BS were added to the domestic longline survey in 1996, and this is when killer whale depredation increased. It is unknown what proportion of western Alaska resident killer whales depredate on longline fishing gear. Statistical modelling approaches comparing CPUE between commercial fishery sets with and without killer whales present have shown that depredating killer whales can reduce sablefish CPUE by as much as 55-70% (Peterson et al. 2014)

3.4.2 Sperm Whales

Sperm whale interactions with longline fisheries have been documented since the mid-1980s. Sperm whale depredation on longline fisheries off Alaska generally occurs in the Central and Eastern GOA; although cases have been documented as far west as the AI.

Data on sperm whale depredation have been collected since the 1998 longline survey. Sperm whales are often observed from the survey vessel during haulback but do not appear to be depredating on the catch.

While sperm whale depredation does affect longline catches, evidence of depredation is not accompanied by obvious decreases in sablefish catch or common occurrence of lips and jaws or bent and broken hooks. As such, depredation is defined as sperm whales being present during haulback with the occurrence of damaged fish in the catch. A new approach has been developed using a generalized linear mixed model to adjust survey catch rates for sperm whales, and this approach was used starting in 2016 (Hanselman et al. 2018). Recent studies have found that the presence of sperm whales near a survey station may reduce the Alaska federal longline survey sablefish CPUE by 12% through depredation (Hanselman et al. 2018; Hanselman et al. 2014).

3.4.3 Possibility of increased whale depredation if discarding is allowed

It is unlikely that the practice of discarding small sablefish would result in a decrease in whale depredation. Killer whales and sperm whales take sablefish from gear while gear is being retrieved. In addition, killer whales may also swim alongside the vessel to take fish as they are discarded from the deck as has been observed for halibut discarded from vessels operating under the trawl halibut discard Exempted Fishing Permit (EFP). The level of whale depredation in the former case would likely not be affected by sablefish discarding since the amount of landed sablefish would probably not change significantly. In the latter case, if killer whales are waiting alongside the boat when sablefish are discarded, it is not unreasonable to assume that they would target those fish.

The overall effects and extent of whale depredation in Alaska waters is still uncertain. The effects of whale depredation on sablefish CPUE has more recently been the focus of both fisheries managers and industry operators as increased accounts of whale depredation on longline fisheries have resulted in significant reductions in CPUE. For example, in 2017, the Council and NMFS determined that authorizing longline pot gear in the GOA IFQ sablefish fishery could reduce the adverse impacts of depredation for those vessel operators who choose to switch from hook-and-line gear. The Council recommended and NMFS implemented regulations to authorize the use of longline pot gear in the GOA IFQ sablefish fishery beginning with the 2017 fishing season.

Even though increases in encounters with whales by commercial fisherman have been observed over the last decade, we are just now beginning to quantify the impact this has to commercial fishing and CPUE. Here is an excerpt taken from the 2018 sablefish Stock Assessment and Fisheries Evaluation (SAFE) report which highlights new methods for integrating sperm whale depredation on sablefish in the stock assessment:

"Longline survey catch rates had not been adjusted for sperm whale depredation in the past, because we did not know when measurable depredation began during the survey time series, because past studies of depredation on the longline survey showed no significant effect, and because sperm whale depredation is difficult to detect (Sigler et al. 2007). However, because of recent increases in sperm whale presence and depredation at survey stations, as indicated by whale observations and significant results of recent studies, we evaluated a statistical adjustment to survey catch rates using a general linear modeling approach (Appendix 3C, Hanselman et al. 2010). This approach had promise but had issues with variance estimation and autocorrelation between samples. A new approach has been developed using a generalized linear mixed model that resolves these issues (Hanselman et al. 2018) and was used starting in 2016 to adjust survey catch rates (see Whale Depredation Estimation)."

Although a promising development, it is still very difficult to accurately assess the impact that whale depredation has on the sablefish commercial fishery, which makes any discussion of the effects of sablefish discarding on this matter purely speculative at this point.

Increased stakeholder involvement on the issue of whale depredation may help to elucidate some of the uncertainties around whale depredation. To that end, a workshop focusing on whale depredation on sablefish is currently scheduled for April 1 to coincide with this Council meeting. This will provide an excellent information gathering opportunity and may help to highlight future research topics to allow us to better understand how sablefish discarding could impact whale depredation

3.5 Gear Modifications

A number of possible gear modifications could be adopted by industry in an effort to avoid small sablefish if another large year class were to be observed in the fishery.

3.5.1 Use of larger hooks on longlines

Prey selectivity for fish is limited by a variety of considerations. One of the most obvious is the size of the prey in relation to the size of the mouth, or gape, of the predator. This "gape-limitation" defines the range and types of prey fish may consume from the available prey field. In fish, gape size is typically observed to increase with body size and age. Thus, as fish get larger and/or older they are able to target larger prey. In contrast, smaller fish are more limited in the size of prey that they may target.

The notion of gape-limitation has been used in a variety of fisheries with the aim of targeting one species or size class while attempting to avoid others. For example, the optimum gear for sablefish and halibut, which co-occur in the IFQ sablefish fishery off Alaska, is quite different, with sablefish gear using smaller 9/0 – 15/0 circle hooks, while optimum gear for halibut may be larger 14/0 – 16/0 circle hooks (Leaman et al., 2012).

By increasing the size of fished hooks, IFQ sablefish fisherman could potentially reduce the number of smaller, younger year class sablefish while still effectively targeting larger, more valuable individuals. The sablefish SAFE report also notes a difference in the size of sablefish collected during the IPHC longline survey (larger sablefish on average) and that of the AFSC longline survey (smaller sablefish on average). The report explains the differences may be attributed to the larger sized hooks used by the IPHC survey which targets halibut rather than sablefish. This could be one voluntary measure adopted by fisherman to avoid collecting large numbers of small sablefish in the event of another larger year class

overwhelming the fishery with small, less marketable individuals. However, it is also possible that fishermen are already using as large as hooks as possible for sablefish given the better market value of larger sized individuals. We would need to consult further with fishermen and industry representatives to better address the practicality of this avoidance measure. If increasing hook size were to prove effective, this would be a relatively simple modification to adopt.

3.5.2 Use of escape vents on pots

Escape rings installed into the sides of pot gear is one method that is already being utilized by Alaska state managed fisheries to reduce catch of small, immature sablefish. In 2018, the Southern Southeast Inside (SSEI) annual harvest objective for sablefish was raised 12% due to, among other things, the introduction of escape rings for pot gear to reduce harvest of immature individuals. (http://www.adfg.alaska.gov/static/fishing/PDFs/commercial/southeast/ssei_2018_aho_memo.pdf).

New regulations were adopted at the 2018 Board of Fisheries meeting for the SSEI fisheries which include the use of two 4-inch diameter escape rings on opposing vertical walls and slopes of pots. Sablefish escape rings were implemented for pots to prevent targeting of immature fish in the live market, allow for immature fish the opportunity to reproduce before being harvested, and allow for increased sustainability of the SSEI stock due to the increased potential for pot gear utilization in the fishery. Escape ring size was based on sablefish length at 50% maturity (61 cm) for both management areas (North Southeast and SSEI) and sexes combined from 1988–2017. This length (61 cm or approximately 24 inches) corresponds to fish weighing 4 - 5 lbs, which would allow small sablefish to effectively escape.

One barrier to the widespread use of escape rings may involve the cost of purchasing new gear or installing rings on the pots themselves. Larger mesh size in pots may also accommodate escape by small sablefish. Further discussions with fishermen and industry representatives would be needed to determine actual costs and consequences borne by the stakeholders by using escape rings.

3.5.3 Changes in fishing depth

Across all gear types, younger (smaller) sablefish could be avoided by fishing in deeper waters. Juvenile sablefish are thought to spend their first two to three years near inshore coastal habitat and on the continental shelf. In contrast, adults occur primarily along the continental slope, shelf gullies, and in deep fjords, generally at depths greater than 200 m. Given that the spatial distribution of select size categories of sablefish appears to change with depth, focusing directed fishing efforts along the continental slopes or in deeper waters could reduce encounters with small sablefish.

The “Selectivities” chapter from the sablefish SAFE report discusses how this life history patterns correlates with recent fisheries composition:

> “*Selection of younger fish during short open-access seasons likely was due to crowding of the fishing grounds, so that some fishers were pushed to fish shallower water that young fish inhabit (Sigler and Lunsford 2001). Relative to the longline survey, younger fish are more vulnerable and older fish are less vulnerable to the trawl fishery because trawling often occurs on the continental shelf in shallower waters (< 300 m) where young sablefish reside. The trawl fishery selectivities are similar for males and females (Figure 3.40). The trawl survey selectivity curves differ between males and females, where males stay selected by the trawl survey longer (Figure 3.40). These trawl survey patterns are consistent with the idea that sablefish move out on the shelf at 2 years of age and then gradually become less available to the trawl fishery and survey as they move offshore into deeper waters*.”

However, some fisherman have already attempted this tactic in previous seasons when large numbers of small sablefish were first encountered and still found large numbers of small sablefish even in deeper

waters. Given that the 2014 year class was the largest in our time series, it is hard to predict and account for the spatial distribution of so many small sablefish. There are anecdotal accounts from fisherman stating that they tried many different areas and variable depths and still encountered high numbers of small sablefish. It is hard to imagine that the fleet would not voluntarily choose to fish in deeper waters if there was evidence of significant reductions in small sablefish catch.

3.6 Approaching/Exceeding the TAC and ABC

At present, the IFQ sablefish longline and pot fisheries in the GOA and BSAI require full retention of sablefish caught. The origin for this retention requirement can be found in the IFQ proposed rule, which notes the requirement was intended to prohibit fishermen from discarding bycatch of IFQ halibut or sablefish from any catcher vessel in favor of other more valuable species (57 FR 57130).

When the IFQ sablefish sector lands fish, it accrues against their quota. There is no set aside for non-sablefish IFQ incidental catch or discards for the fixed gear allocation of the TAC, and past incidental catch and discards have been absorbed by the trawl allocation of the TAC. The 2016 Twenty-Year Review of the Pacific Halibut and Sablefish IFQ Program (Twenty-Year Review) provides some background on why a set-aside for incidental catch by non-IFQ fixed gear sablefish fishing was not included in the IFQ Program.

Incidental catch of sablefish refers to sablefish that are caught while targeting other species. In a Supplemental Environmental Impact Statement for the development of the IFQ Program (NPFMC, 1992), the Council acknowledged that if the total fixed gear allocation were allocated as IFQs, the incidental catch in other fisheries could result in annually exceeding the fixed-gear TAC. The Council acknowledged that the simplest solution would be to set aside a percentage of the TAC to support incidental catch of sablefish and allocate the remainder as IFQ. However, at that time, an estimated bycatch mortality rate had not been established for sablefish as it had been for halibut. The Council acknowledged that to determine this rate would require continued monitoring of incidental catch through expanded observer coverage. Therefore, no set-aside was established for incidental catch of sablefish when the IFQ Program was implemented. At implementation of the IFQ Program, the Council believed that there would be enough unused sablefish TAC in the trawl allocations to absorb incidental catches without exceeding the overall sablefish TAC. Consequently, the fixed gear sablefish TACs are fully allocated to the IFQ Program, and none of the TAC is set aside for sablefish caught incidentally in other fixed gear fisheries (i.e., in the Pacific cod and IFQ halibut fisheries).

As the Twenty-Year Review notes, overages in the fixed gear allocation of the TAC were intended to be absorbed by the trawl gear allocation of the TAC. However, if the trawl sector catches their full allocation, there is no buffer to account for the discards in the fixed gear allocation. Overall both gear allocations in recent years are increasingly approaching closer to achieving the full TAC and there is less accommodation for fixed gear discards.

Modifying the requirements to retain small sized sablefish in the IFQ fisheries could reduce the amount of sablefish accrued against IFQ TAC/ABC by increasing the number of live sablefish returned to the water. Modifying these requirements could also increase the amount of sablefish accrued against the IFQ TAC/ABC if the discards of smaller sablefish significantly increases the landings of larger sablefish, thereby increasing total biomass of fish retained.

To explore how modifying small sablefish retention requirements would impact the potential or probability of approaching the overall TAC or exceeding the ABC, we took into account (1) the weight of landed sablefish by size category, (2) the size at which a sablefish is considered “small” for the purposes of discarding, and (3) a range of DMR scenarios, and developed hypothetical scenarios which describe how small sablefish discards could impact total landings data from 2012 - 2018.

Section 3 of the first discussion paper addressing small sablefish retention provides a detailed analysis on the age structure of landed sablefish in the IFQ fishery from 2012 - 2018. Since the GOA IFQ sablefish harvest represents ~ 90% of total statewide IFQ sablefish harvest during this time period, we will focus our analysis on this sector. Table 3 comes from the appendix of the first discussion paper and breaks out the comparison of total fixed gear catch across all GOA areas.

Table 3. Gulf of Alaska (all subareas) fixed-gear (hook-and-line and pot) sablefish landings, ex-vessel revenue, and prices by market category, 2012 - 2018. Source: ADFG Fish Ticket data provided by AKFIN.

Sold weight (1,000 lbs.)								% Total		
Market Category	2012	2013	2014	2015	2016	2017	2018 (Partial)	2012-16 Avg.	2017	2018 (Partial)
1 - 2 Lbs	116	74	58	59	156	334	203	1%	3%	3%
2 - 3 Lbs	795	830	796	639	695	1,140	925	5%	9%	11%
3 - 4 Lbs	3,867	3,700	3,529	3,167	2,707	2,738	2,027	24%	21%	25%
4 - 5 Lbs	3,628	3,725	3,235	3,117	2,620	2,611	1,656	23%	20%	21%
5 - 7 Lbs	4,756	4,639	3,605	3,508	3,184	3,346	1,872	28%	26%	23%
7 UP	3,668	3,560	2,626	2,342	2,179	2,691	1,363	20%	21%	17%
Total	**16,830**	**16,528**	**13,848**	**12,832**	**11,540**	**12,860**	**8,045**	**100%**	**100%**	**100%**

Ex-Vessel Value ($1,000)								% Total		
Market Category	2012	2013	2014	2015	2016	2017	2018 (Partial)	2012-16 Avg.	2017	2018 (Partial)
1 - 2 Lbs	451	221	242	210	605	1,627	260	0%	2%	1%
2 - 3 Lbs	3,181	2,728	3,296	2,307	2,982	6,032	2,366	4%	6%	6%
3 - 4 Lbs	17,914	14,025	16,488	14,330	13,641	17,351	7,529	19%	18%	18%
4 - 5 Lbs	20,855	15,387	16,314	16,325	15,075	18,955	7,711	21%	20%	18%
5 - 7 Lbs	31,737	21,094	20,563	22,751	22,758	27,776	13,514	30%	29%	32%
7 UP	28,649	17,943	17,297	17,259	18,847	25,174	10,556	25%	26%	25%
Total	**102,787**	**71,398**	**74,201**	**73,182**	**73,908**	**96,915**	**41,936**	**100%**	**100%**	**100%**

Price/LB.							
Market Category	2012	2013	2014	2015	2016	2017	2018 (Partial)
1 - 2 Lbs	3.89	3.00	4.19	3.55	3.89	4.88	1.28
2 - 3 Lbs	4.00	3.28	4.14	3.61	4.29	5.29	2.56
3 - 4 Lbs	4.63	3.79	4.67	4.52	5.04	6.34	3.71
4 - 5 Lbs	5.75	4.13	5.04	5.24	5.75	7.26	4.66
5 - 7 Lbs	6.67	4.55	5.70	6.49	7.15	8.30	7.22
7 UP	7.81	5.04	6.59	7.37	8.65	9.36	7.75

The Council would need to define what size limit designates a sablefish as “small”. For the purpose of the scenarios presented below, we have classified “small” as sablefish weighing 1-3 lbs. because this is the size class of sablefish that is first encountered in the fishery and represents the category with the lowest market value (and least value to fisherman).

In addition to knowing the number of small sablefish caught each year, the Council would also need to develop some estimation of the DMR for discarded sablefish. As mentioned above and discussed in detail in the first discussion paper, estimation procedures of DMR for sablefish caught in waters off Alaska have not yet been established. To provide some measure of how mortalities under full retention would compare to mortalities if this action were to move forward, we present scenarios below using DMR values of 100% (status quo), 85% (average rate from halibut fisheries in 2017-2018), and 20% (rate specified for sablefish caught on hook-and-line by the Pacific Fisheries Management Council). Please see section 2.4 for a more thorough overview of considerations needed for sablefish DMR estimation in Alaska waters.

Tables 3 and 4 describe how sablefish landings in the GOA may be impacted by the three DMR values described in the preceding paragraph. Table 3 categorizes the landings data into two categories, landed sablefish weighing 1-3 lbs. and those weighing greater than 3 lbs. We applied the DMR values to landed

sablefish weighing 1-3 lbs. and then added the resulting weights to the > 3 lbs. landings weight to demonstrate the possible savings in sablefish quota that may be realized if small sablefish discarding were to be allowed in the IFQ sablefish fishery. These hypothetical scenarios are based on the following assumptions: (1) the "Sold Weight" data in Table 4 represents the total caught and retained weight of sablefish in the GOA IFQ fishery, (2) in scenarios where a hypothetical DMR was applied, observers and other catch accounting procedures were hypothetically utilized to ensure that all discarded small sablefish were accurately accounted for, (3) all 1- to 3-lb. sablefish were discarded and the resulting "Sold Weight" for each DMR scenario corresponds to the weight of sablefish that would be counted against the IFQ TAC/ABC if that DMR was applied to the weight of discarded sablefish.

Table 4. Landings data for the GOA IFQ sablefish fishery under 3 DMR scenarios.

Sold Weight (1,000 lbs.)								
DMR	Size Category	2012	2013	2014	2015	2016	2017	2018
100% (Status Quo)	1-3 lbs	911	904	854	698	851	1474	1128
	> 3 lbs	15919	15624	12995	12134	10690	11386	6918
	Total	16830	16528	13849	12832	11541	12860	8046
85% (Halibut DMR)	1-3 lbs	774.35	768.4	725.9	593.3	723.35	1252.9	958.8
	> 3 lbs	15919	15624	12995	12134	10690	11386	6918
	Total	16693.4	16392.4	13720.9	12727.3	11413.4	12638.9	7876.8
20% (PFMC Sablefish DMR)	1-3 lbs	182.2	180.8	170.8	139.6	170.2	294.8	225.6
	> 3 lbs	15919	15624	12995	12134	10690	11386	6918
	Total	16101.2	15804.8	13165.8	12273.6	10860.2	11680.8	7143.6

Table 5 shows the percent reduction in landed sablefish as a result of the two hypothetical DMRs. A DMR of 85% provides only a very modest reduction in overall landed weight of sablefish (range of 0.8 - 2.1%). A DMR of 20% yields more apparent reductions in overall landed weight (range of 4.3 - 11.2%). This is especially true for 2017 and 2018 which corresponds to years when fisherman first began noticing large catches of small sablefish and likely represents individuals from the 2014 year class.

Table 5. Percent reduction in landed sablefish as a result of hypothetical DMRs.

DMR	2012	2013	2014	2015	2016	2017	2018
85% (Halibut DMR)	-0.8	-0.8	-0.9	-0.8	-1.1	-1.7	-2.1
20% (PFMC Sablefish DMR)	-4.3	-4.4	-4.9	-4.4	-5.9	-9.2	-11.2

The difference in realized savings between a DMR of 85% and 20%, is obvious but it is uncertain where an appropriate DMR for Alaska sablefish would fall. This again stresses the importance and necessity of establishing an accurate DMR which has been emphasized both in discussion papers and during the presentation made to the Council at the October 2019 meeting.

Linking back to the chief motivation of this motion item, depending on how it is addressed, allowing for discards of small sablefish could add to the potential of exceeding the overall ABC. Table 3 shows the

2014 to 2018 total catch (retained and discards) of sablefish for all sectors in the BSAI and GOA, annual TAC/ABC, and catch remaining. Total catch is approaching the TAC/ABC as all sectors are achieving their allocations of the TAC leaving less as a buffer for the discards by non-sablefish IFQ vessels.

Table 6. Sablefish total catch versus remaining TAC/ABC. Source: NMFS CAS.

Area	Catch in Tons	2014	2015	2016	2017	2018
Alaska-wide	Total Catch	11,610	11,012	10,290	12,333	14,467
	TAC/ABC	13,722	13,657	11,795	13,083	14,957
	Catch Remaining	2,112	2,645	1,505	750	490

Reductions in the amount of smaller sablefish landed by allowing discards could enable fisherman to harvest higher amounts of large sablefish, thus possibly accelerating the rate at which sablefish quota is accrued. This could have the unintended consequence of exceeding the TAC. However, there is no way of knowing for sure how the composition of the landed sablefish catch would change as a result of discarding small sablefish. Given the relatively small change a DMR of 85% has on the overall landings weight as compared to the greater relative change that a DMR of 20% has, the chances of exceeding the TAC would be highly contingent on the chosen DMR. The Council may choose to initiate a series of EFP trials whereby vessels are allowed to operate under a specified DMR separate from that of non-EFP participating vessels, such as is done for vessels participating in the trawl halibut deck sorting EFP. This could allow for a better understanding of how landings composition is affected by different DMR values, and subsequently, how likely is it that catching a greater number of large sized sablefish will affect the potential of reaching or exceeding the TAC/ABC in a given year.

3.7 Fishing Down the Spawning Stock

The spawning stock for sablefish has been below its target reference point since the mid-2000s, and there has been a precipitous decline in older fully mature and fully grown fish since 2011 (Figure 4). As a result, the age-diversity of sablefish has dropped rapidly, and both the fishery and population are now becoming dominated by the 2014 year class, and to a lesser extent the 2016 year class. These signs of high recruitment hold long-term promise for the recovery of the spawning stock biomass, but the stocks persistence below the target reference points is concerning. Since the magnitude of the 2014 year class estimate is so much higher than anything seen historically and the estimate's decline from 2017 to 2018, the authors' of the sablefish SAFE report advise that we should proceed with caution because the estimate may continue to decline. For example, there may be density dependence or other concerns that affect survival differently than previous year classes. Currently, much of the projected recovery of the spawning biomass is dependent on the maturation of the 2014 year class. The assessment model employs a static maturity curve, but visual estimates of maturity from the longline survey suggest that there may be significant variability (Figure 5). The 2014 year class will be 5 years old in 2019 and the annual longline survey data maturity curves indicate that these females could be between 9% to 38% mature. This range has a significant effect on our perception of stock status and ABC.

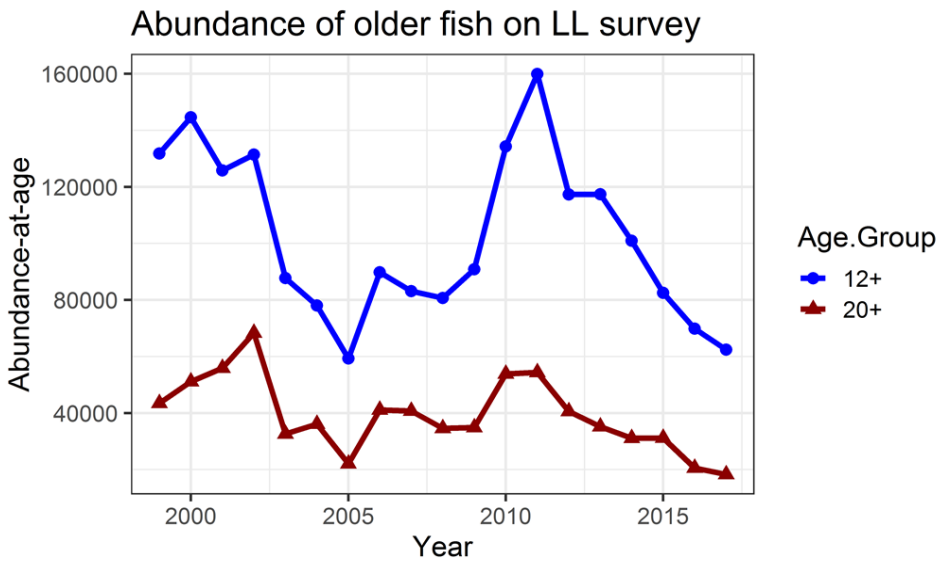

Figure 4. Relative population numbers of pooled fish 12 and greater (blue circles) and 20 and greater (red triangles) caught on the AFSC longline survey during 1999 – 2017.

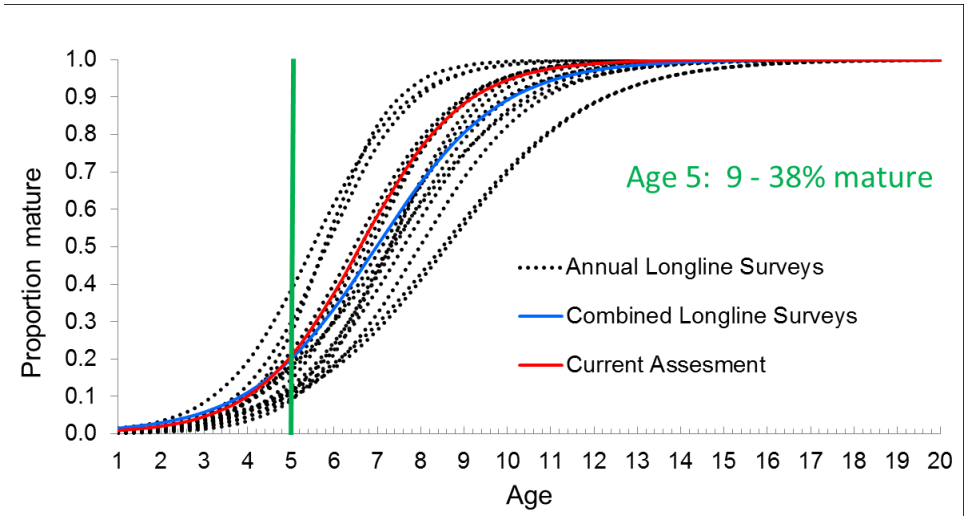

Figure 5. Logistic maturity curves estimated from annual longline survey macroscopic scans. Dashed lines illustrate the annual variability, the red solid line is the estimate from the pooled data which is similar to the static value used in the assessment. Age 5

While there are clearly positive signs of strong incoming recruitment, there are concerns regarding the lack of older fish and spawning biomass, the uncertainty surrounding the estimate of the strength of the 2014 year class, and the uncertainty about the environmental conditions that may affect the success of the 2014 year class in the future.

The 2018 sablefish SAFE report summarizes several conclusions reached in these SAFE sections: "Additional ABC/ACL Considerations" and the "Ecosystem and Socioeconomic Profile Appendix". We have bolded those conclusions in which particular emphasis should be given when considering the impact this action may have on spawning stock biomass:

1. The estimate of the 2014 year class strength declined 30% from 2017 to 2018.
2. **Despite projected increases in spawning biomass in 2017, the 2018 spawning biomass and stock status is lower than in 2017.**
3. Despite conservative fishing mortality rates the stock has been in Tier 3b for many years.
4. Fits to survey abundance indices are poor for recent years.
5. The AFSC longline survey Relative Population Weight index, though no longer used in the model, has strongly diverged from the Relative Population Number index, indicating few large fish in the population.
6. The retrospective bias has increased in the last two years, and the bias is positive (i.e., historical estimates of spawning biomass increase as data is removed).
7. **The amount of older fish comprising the spawning biomass has been declining rapidly since 2011.**
8. The very large estimated year class for 2014 is expected to comprise about 10% of the 2019 spawning biomass, despite being less than 20% mature.
9. **The projected increase in future spawning biomass is highly dependent on young fish maturing in the next few years; results are very sensitive to the assumed maturity rates.**
10. **The body condition of maturing sablefish in the recent years of high recruitment is lower than average, and much lower than during the last period of strong recruitments.**
11. Another potential marine heat wave is forming in 2018, which may have been beneficial for sablefish recruitment in 2014, but it is unknown how it will affect current fish in the population or future recruitments.
12. Small sablefish are being caught incidentally at unusually high levels shifting fishing mortality spatially and demographically, which requires more analysis to fully understand these effects.

These comments from the 2018 SAFE report paint a cautionary tale regarding how preferential selection of large sized sablefish, as a result of small sablefish discard, could result in negative consequences for the existing spawning stock, which has been in decline over the last decade. While the authors of the SAFE report point out that a large incoming year class will undoubtedly help increase spawning stock biomass, the relative impact appears to be minimal considering the size of the 2014 year class.

In an alternative scenario, allowing many small immature individuals the chance to mature and reproduce even once could have a dramatic positive impact on spawning stock biomass. One critical determination that the Council would need to consider is the longevity in which to allow small sablefish discarding to occur. If this action were to be implemented to allow small sablefish discards for only a short period of time (1 or 2 years) then it is likely that releasing small sablefish back into the water will result in a net positive impact on spawning stock biomass. However, if small sablefish discards were to be allowed indefinitely, we are more likely to experience the scenario in which a continued decline in spawning stock biomass is observed.

3.8 High Grading

Discarding the largest of what are generally considered to be "small sablefish" (~3 lbs.) could be viewed as high-grading. In practice, though, probably only the most capacity-limited vessel that is fishing in particularly good conditions would consider such discards. The net benefit of discarding those fish and replacing them with larger fish might be small as the additional effort increases costs. Catching and discarding small fish entails an operational cost in terms of time, labor, and bait. While small sablefish are less valuable, they probably generate a net positive return on the margin. The analysts use the word "probably" because each individual operator is facing a unique cost-profile in terms of where they fish (time/distance traveled), whale depredation in their fishing area, debt service obligations (particularly for non-initial QS recipients), and the amount of IFQ they possess. To the latter point, a QS holder with a larger annual IFQ allocation might be able to make a profit with 14% or even 70% small (1-3 lbs.) fish

(see Figure 11 and Figure 12 from the first discussion paper) because they can catch a sufficient number of larger, higher-value fish. By contrast, a smaller scale operation whose opportunity to generate gross revenue (IFQ pounds) is consumed largely by low-value fish could see his or her margins erode.

The first discussion paper presented an economic analysis of two scenarios in which the Council consider the contrast between a *requirement* to discard small sablefish and an *option* for discretionary release. Framing a discard regulation as a choice rather than a size limit regulation allows participants to optimize the value of their labor within their unique constraints and in the context of changing environmental and market conditions.

Requiring discards could result in vessels taking longer trips. Longer trips increase operating costs and could also require additional work dressing fish to preserve quality. If trip length is bounded by the processor's quality standards, a vessel might haul more sets or expend more on bait. When small fish predominate in an area, mandatory discarding might affect vessels in the same way that depredating whales do – reducing the productivity of labor, potentially to the point that crew retention becomes a challenge. Vessels that hand-bait might be less able to continue turning over gear to meet their production goals compared to those that auto-bait.

Vessels with relatively low hold-capacity might value the ability to discard a small fish more than a vessel that is not as limited by capacity within the bounds of their planned trip length. Vessels that are not constrained by capacity might prefer never to discard sablefish and thus would experience a minimum size limit as a loss (i.e., forgone revenue plus time and bait).

3.9 Enforcement Options

At sea and dockside enforcement operations are resource intensive, and establishing new regulations or modifying existing regulations must be carried out with due consideration of the challenges and efficiencies associated with enforcing those regulations. The Council's Enforcement Committee was established to review proposed FMP amendments, regulatory changes, and other management actions on matters related to enforcement and safety at sea. A set of enforcement precepts was developed by the Committee to assist the Council in any potential rulemaking project. These precepts, listed below, address enhancing enforceability of regulations and FMPs; understanding policy implications for enforcement; and potential statutory and regulatory amendments to address emerging areas such as seafood fraud and traceability.

Issues addressed by Enforcement Precepts:

1. Regulations Should Be as Simple and Straightforward as Possible
2. Where Feasible, Seek to Reduce the Number of Regulations
3. Clear Record of Council Intent
4. Accountable and Traceable Seafood Products
5. Electronic Monitoring and Technology
6. Observers
7. Resource Intensive Regulations

3.9.1 Vessel-Specific Enforcement Considerations

As addressed in the October 2018 discussion paper, an important consideration in modifying regulations associated with the IFQ sablefish fishery would be whether discarding is *allowed*, i.e., optional, or *required*. The discussion paper points out that discretionary release of sablefish by vessel operators would only require extension of careful release requirements (50 CFR 679.21(a)(2)(ii)) to sablefish. For at-sea enforcement operations, this would involve observing fishery operations and ensuring that sablefish not retained by IFQ vessels are returned to the sea immediately, with a minimum of injury.

An additional layer of consideration would be involved if a discretionary allowance for discarding sablefish were associated with a minimum size. In this case, vessel operators could either retain or discard sablefish, but would only be able to discard if the sablefish were below a given size. Vessel operations would continue to be held to careful release standards, but the observation of discarding by enforcement would also involve verification of compliance with length standards. This means that a violation would involve discarding fish above the minimum size and evidence for a violation would require that enforcement obtain a discarded fish or somehow record a discarding event that shows the violation. As long as discarding is discretionary, examination of the retained catch would not be necessary since retention of small fish would be allowed.

If a minimum size is associated with a discarding requirement, then the careful release and interception of discarding violations would still be necessary. In addition, at-sea or dockside enforcement of the minimum size for retention would be achieved by examination by enforcement officials of retained or landed catch.

If the Council intends to proceed to action on this issue, the above considerations and the exact regulatory language would need to be explored in an analytical document and be reviewed by the Council's Enforcement Committee in order to achieve consistency with various enforcement precepts. It is likely that a regulatory change allowing or requiring sablefish discarding would affect each of those enforcement precepts. It should be noted that the commercial IFQ fishery for Pacific halibut currently operates under a minimum size (28 inches) discard requirement. Many of the vessels that participate in that fishery also hold sablefish IFQ, and, as such, adaptation to a regulatory change extending size-based management to sablefish would be expected to be achievable for both fishery participants and enforcement personnel.

3.9.2 Fishery-wide Enforcement Considerations

Beyond enforcement of compliance with sablefish discarding regulations at the vessel level, the Council should consider, in a future analysis, the effects of a regulatory change on fishery-wide behavior. At the root of this concern is the issue of consistency between expected sablefish mortalities under discarding and actual sablefish mortalities reflected in the fishery's response to the regulatory change. Review by the Enforcement Committee would help craft a regulatory approach that would ensure that sablefish discards reported or otherwise attributed to the fishery reflect the level of discarding intended by the Council.

A risk will need to be addressed in a future analysis and review to ensure regulations or other management structures do not create unintended tensions between sablefish discard accounting and discard reporting and monitoring mechanisms. Potential issues to be addressed would include: (1) compliance with size-based regulations by unobserved vessels, (2) accuracy of trip-level discard reporting, (3) observer involvement in compliance.

An important and very fundamental consideration related to fishery-wide compliance is the way the Council intends sablefish discards by the IFQ fishery to be accounted for relative to the overall TAC that is divided up among IFQ holders. As addressed in section 3.6 above, the TAC only accommodates discards by the MRA fishery for which a 100% DMR is assigned. If significant discards of small sablefish are expected under a discarding allowance, then the Council will need to decide if those discards how those will be deducted or debited within the overall TAC and relative to vessel IFQs.

Options could include: (1) 100% observer coverage and vessel-specific debiting of IFQ, (2) partial observer coverage and vessel-specific debiting of estimated discards to unobserved vessel IFQs, or (3) creation of an "IFQ discards" category in pre-season apportioning of the TAC (similar to the IFQ halibut approach), among others. Each of these affects the importance of accuracy in vessel-specific discard reporting and would need to be evaluated in that regard.

4 Conclusions/Next Steps

The Council identified several issues for consideration in its request for this discussion paper. Summary remarks are provided in Table 1 in the Introduction section. General conclusions on further Council consideration of this potential action is provided below.

There is a broad set of options to consider in potentially modifying regulations to allow discarding in the IFQ sablefish fishery off Alaska. Some of these options require the initiation of significant data collection efforts and an investment of resources. Less resource-demanding options are also available but should be considered in the context of costs and benefits associated with underlying assumptions. An analysis of management options associated with this potential action would benefit from further clarity from the Council regarding its intended goals:

> Conservation: Discarding of small fish by the directed fishery has limited conservation benefit (see the October 2018 discussion paper), and concerns about declining sablefish spawning biomass may be better addressed through overall harvest strategies.
>
> Economic: Management options designed to provide operational and economic benefits could be evaluated in light of potential biological impacts and management resource demands in order to focus future Council decision-making on an optimal suite of regulatory changes that would balance these issues.

The existence of a discarding requirement in the IFQ halibut fishery, and requirement/allowances in sablefish fisheries outside of Alaska federal waters suggests that an operational solution does exist. The solutions reflected in those approaches are not as resource-demanding as many of the scenarios contemplated in this discussion paper, however, the Council would need to consider costs and unanticipated complications associated with a relatively simplistic management solution. Involvement of the Council's IFQ and Enforcement Committees would likely benefit the identification and development of analyses supporting further Council action.

5 References

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