Discussion Paper:
Sablefish Discard Allowance

December 2019[1]

1 Background

A discussion paper[2] presented to the North Pacific Fishery Management Council (Council) at its October 2018 meeting[3] explored the potential to allow discarding of small sablefish in the sablefish Individual Fishing Quota (IFQ) fishery. The discarding allowance was suggested by stakeholders in April 2018[4] 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 in 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).

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[1] Prepared by: Jim Armstrong, Council staff, and Joseph Krieger, PhD, NOAA Fisheries Alaska Region.
[2] http://meetings.npfmc.org/CommentReview/DownloadFile?p=b6b509dd-a14c-442b-867b-3f88fa9f8d98.pdf&fileName=D2%20Sablefish%20Discard%20Allowance.pdf
[3] http://meetings.npfmc.org/Meeting/Details/142
[4] http://npfmc.legistar.com/gateway.aspx?M=F&ID=f7e25c7f-12e1-4fc1-9b92-eb99b965b4be.pdf

A second discussion paper[5] related to this issue was presented to the Council at its April 2019 meeting[6]. In that paper, staff identified for the Council a range of decision points that would likely require development through a future analysis if the Council chose to move forward with action on this issue. The nine areas of concern that were identified by the Council in the October 2018 discussion paper were addressed directly in the April 2019 discussion paper. In particular, an emphasis was placed on exploring options for estimating and accounting for discard mortalities in the sablefish IFQ fishery and the resource investments associated with those options. A summary of the nine areas of concern identified in the April 2019 paper are provided in the corresponding Action Memo[7].

There is a broad set of options to consider in potentially modifying regulations to allow discarding in the sablefish IFQ fishery off Alaska. Some of these options require the initiation of significant data collection efforts and an investment of resources. Less resource-demanding operational solutions do exist, such as the discarding requirement in the halibut IFQ fishery, but these are associated with increased uncertainty and reliance on assumptions, and an appropriate level of precaution would need to be taken.

In reviewing the April 2019 discussion paper, the Council was particularly interested in learning more about the potential for discarding to result in shifting harvest to more vulnerable portions of the stock biomass, such as the older, reproductively mature fish. Related to this is the potential for discarding to affect Acceptable Biological Catch (ABC) and Total Allowable Catch (TAC) and, therefore, create situations in which the allocation of sablefish between the target IFQ component of the fleet and the non-target trawl component need to be re-considered.

The Council's April 2019 motion reads as follows:

> The Council moves to initiate an expanded discussion paper to gather more information on the possible implications of modifying the requirement to retain small sized sablefish in the Alaska IFQ longline and pot fisheries (GOA and BSAI).
>
> The discussion paper should include an evaluation of the following:
>
> - Voluntary versus mandatory release of sablefish
> - Single size limits versus area specific size limits
>   - Areas to be explored:
>   - GOA, BSAI
>   - EGOA, CGOA, WGOA, BSAI
> - Options for discard accounting relative to ABC and TAC
> - The use of proxy DMR options at the initiation of sablefish discarding
>   - 12% (Stachura et al)
>   - 16% (State of Alaska)
>   - 20% (PFMC)
> - Use of gear specific DMRs for IFQ fisheries
> - Address concerns related to monitoring and enforcement options from:
>   - Discards estimated from the survey
>   - Discards estimated based on observer and EM data
>   - Discards estimated based on logbook reporting

[5] https://meetings.npfmc.org/CommentReview/DownloadFile?p=547e97ee-897a-4d4d-8811-71fba0d56de3.pdf&fileName=D8%20Sablefish%20Discard%20Allowance%20DiscPaper.pdf
[6] https://meetings.npfmc.org/Meeting/Details/583
[7] https://meetings.npfmc.org/CommentReview/DownloadFile?p=b40b8eb3-a783-421c-9c3a-4497b1432159.pdf&fileName=D8%20Action%20Memo.pdf

This discussion paper should also explore the implications of these changes on overall stock abundance and allocations to trawl and IFQ fisheries.

1.1 Organization of the document

This discussion paper is structured around the major bullets in the Council motion from April 2019 and attempts to characterize some of the issues that may need to be addressed for each of those bullets if the Council proceeds to development of an analytical document. As a convenient reference, Table 1 below provides summary conclusions for each of the elements in the Council motion. Subsequent document sections address each issue in greater detail. Acronyms are used extensively in the document text and translation of acronyms and abbreviations are given in Section 10. Finally, a brief conclusory section with considerations for potential next steps is provided.

Table 1. Issues identified by the Council in its April 2019 motion, as well as brief summary statements from the sections of the discussion paper that address each issue.

Council-identified Issue	Summary conclusion
1. Voluntary versus mandatory release of sablefish ***(Section 2)***	Voluntary discarding maximizes flexibility and is almost universally appealing to fishing operations where encounters with small, marginally valuable fish are not predictable. Financially punitive conditions may be more frequent for size-based mandatory discards than under no discarding. Voluntary discarding adds to the uncertainty in discard estimates. Significant observer monitoring would be necessary to ensure accuracy in discard inputs for the sablefish stock assessment.
2. Single size limits versus area specific size limits **(*Section* 3)**	Because of high movement rates by sablefish, there are no known differences in demographics of sablefish in different areas. Because of the Alaska-wide similarities in sablefish demographics, area-specific size limits may not be necessary, or appropriate, to achieve the Council's objectives.
3. Options for discard accounting relative to ABC and TAC **(*Section* 4)**	No set-aside was ever established for sablefish discards in the IFQ fishery when the IFQ Program was established. An allowance for IFQ discards will necessitate reductions in TAC allocations to either trawl and IFQ vessels or IFQ vessels only. Complete use of the trawl TAC recently suggests that overall TAC reductions would affect trawl vessels. For IFQ vessels, the discard reduction would have to change? proportional to IFQ. Landings reporting and discard estimation do not occur at the same time, so precaution would be needed to avoid exceeding IFQ using discards.

Council-identified Issue	Summary conclusion
4. The use of proxy DMR options at the initiation of sablefish discarding. **(*Section* 5)**	The selection of any of the DMRs presented here would yield similar sablefish "savings". This being the case, the Council may wish to choose the initial DMR which it feels has the best scientific justification.
5. Use of gear specific DMRs for IFQ fisheries. **(*Section* 6)**	Proportionally, sablefish savings from the pot fishery far exceed those from the hook-and-line fishery. The Council may choose to consider how this could influence participation in the pot fishery, as this relatively large increase in savings could provide an incentive for increased participation in the IFQ pot fishery.
6. Address concerns related to monitoring and enforcement options for survey, observer, and logbook discard reporting. **(*Section* 7)**	Survey based discard estimates present challenges related to introduction of uncertainty, timeliness, consistency across years, and calibration to pot selectivity. Observer based estimates introduce potential bias from an observer effect, accuracy issues for EM-based estimates, and significant increases in investment and changes to onboard protocols. Logbook reporting is not a timely source for in-season management against ABC/TAC. Aside from issues related to size limits, an inherent enforcement problem for observer or survey estimates has to do with liability - the IFQ is assigned to an individual, but the discard estimate would come from a third party and would be applied fleet-wide.
7. Implications of these changes on overall stock abundance. **(*Section* 8)**	Population effects of discarding on the current Alaska stock of sablefish produced a set of hypothetical forecasts. In the forecasts, future ABC declines very rapidly initially, especially for a larger size limit. SSB declines as well, and fishing mortality on older fish is greater than under current conditions. The forecasts allowed ABC to be caught each year and did not include discards is achieving that. As such, the impacts on the population under well accounted for discards would be less than in the forecasts. However, discarding small sablefish would necessarily increase fishing pressure on larger older fish.

2 Voluntary versus mandatory release of sablefish

Stakeholder input. Starting in 2017, unprecedented numbers of small sablefish began showing up in Gulf of Alaska (GOA) and Bering Sea (BS) fixed gear catches (Figure 1). This phenomenon initiated the ongoing stakeholder appeal for management action to provide relief from the ban on sablefish discarding that is in place for the IFQ fleet. Public testimony consistently addresses the need for regulatory changes to provide *flexibility* in contending with uncertain but potentially overwhelming catches of small, low value fish. One approach that explicitly addresses the issue of flexibility is to make discarding of small sablefish voluntary, rather than framing it as a regulatory requirement associated with a minimum size limit.

In April 2019, the Council's IFQ Committee addressed the issue of discarding as part of their agenda[8]. The Committee agreed that any discard action should provide for voluntary participation. Additionally, Committee members were concerned about how a mandatory and size-based discard requirement would be enforced, and how difficult it could be for fishermen to comply with a minimum size while rapidly handling fish at the rail that are near the size threshold. A mandatory, size-based discard requirement might require that fishermen substantially alter their fish-handling practices to avoid risking an accidental violation. A minimum size was also seen as problematic for areas where small fish can sometimes dominate the landings, for example Western GOA and Bering Sea and Aleutian Islands (BSAI) as compared to Eastern GOA (Figure 2).

Mandating discards of fish that might otherwise be sold for a profit, albeit a smaller one, could adversely impact crew pay and thus the ability to attract and retain a crew. Note that, as provided in the first discussion paper, Lowe and Fujioka (1991) found minimum size limits to be ineffective for increasing net value, although they did not consider very large influxes of small fish. Finally, requiring fish to be discarded when depredating whales are around the boat could be counterproductive to the goal of returning fish to the sea so that they survive, grow, and reproduce.

The comments of the IFQ Committee capture many of the issues related to a discarding option - voluntary discarding maximizes flexibility and is almost universally appealing to fishing operations where conditions that favor retention of small, marginally valuable fish are likely to be variable and possibly not easily predictable. In fact, the reasons for not discarding that are reflected in the Committee comments suggest that financially punitive conditions may actually occur more frequently for a discard requirement than under the current prohibition.

[8] https://meetings.npfmc.org/CommentReview/DownloadFile?p=6943f395-a6a0-4886-bf98-90e4a3a85f34.pdf&fileName=IFQ%20Committee%20Minutes.pdf

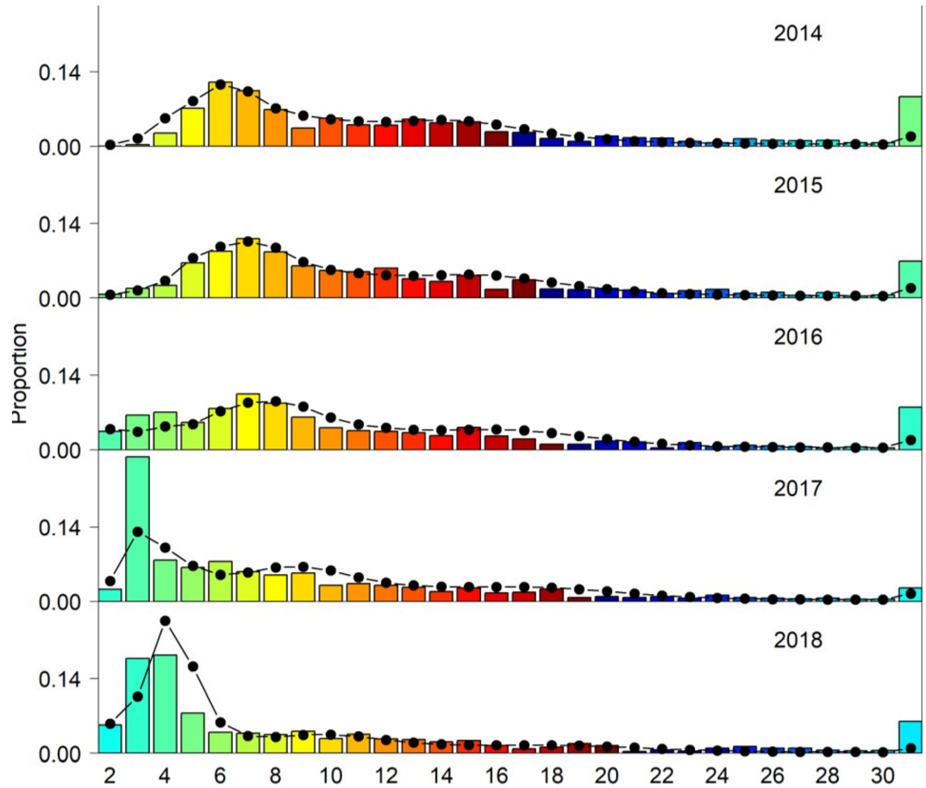

Figure 1. Domestic fishery age compositions. Bars are observed frequencies and lines are predicted frequencies. Source: 2019 draft sablefish SAFE chapter.

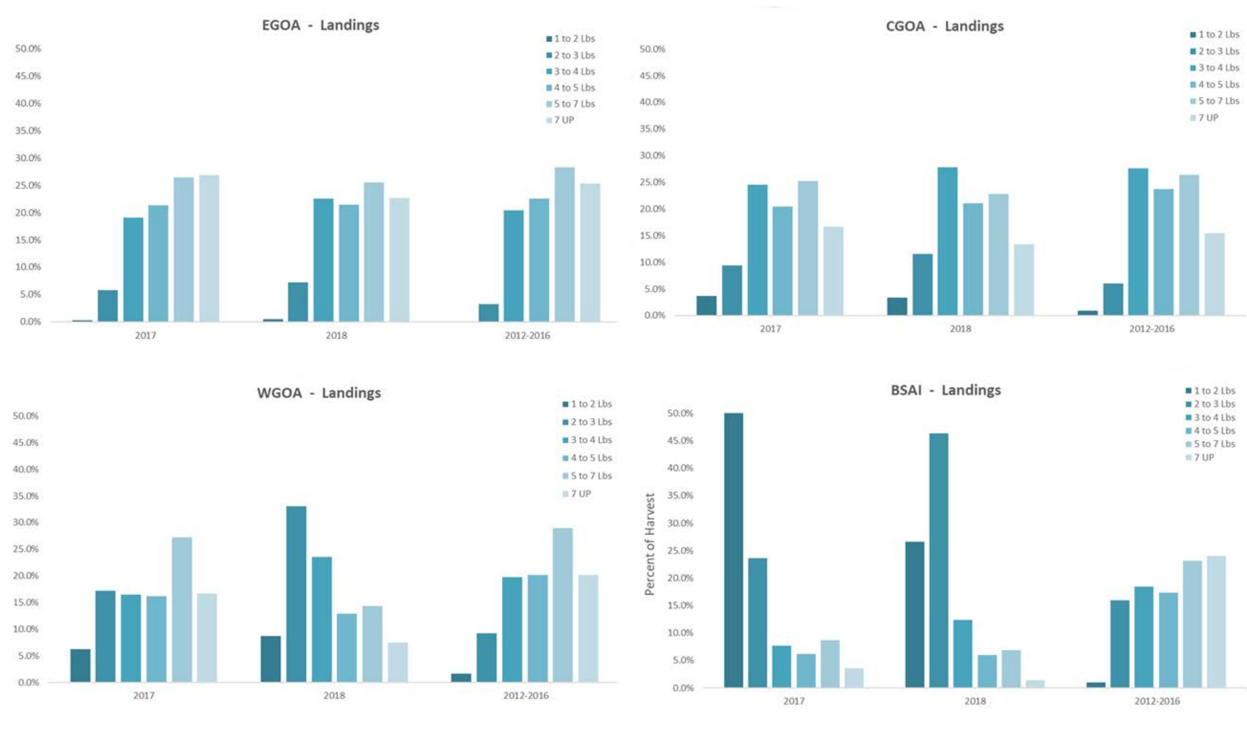

Figure 2. Relative landings of sablefish in 2017-2018 by market category and management subarea. Source: ADFG Fish Ticket data provided by AKFIN.

In the first discussion paper on this subject[9], presented to the Council in October 2018, a range of harvesting and processing issues supported increasing flexibility to address shifting size composition in the catch. The paper notes that individual vessel operators would be expected to evaluate the benefits of discarding small fish based on their unique situation. The events leading to any size fish being caught require investments, so mandating discards of small fish with no certain replacement by large fish could be a revenue sink. Issues like variation in hold capacity, trip length, the presence of whales, and catch rates of larger fish in the area, contribute to the discard-or-retain calculus. In short, a mandatory discard requirement based on a minimum size limit does not allow operators to decide whether discarding is a net benefit based on their particular situation.

Analyst perspective. In September 2019[10], sablefish discarding options were presented to the Joint Groundfish Plan Teams whose members work with and prepare data for stock assessments and in-season management. The analysts' prevailing concern with voluntary discarding was the introduction of an unknown amount of uncertainty into the sablefish stock assessment. Any discarding regulation will introduce uncertainty into estimates of removals, including the quantity, size and age composition, and mortality of the discarded catch. Allowing discarding to be *voluntary* in regulation contributes additional uncertainty in terms of the *probability* of discarding by fishery participants.

Observer estimates are typically used to estimate discard rates by observing a subset of hauls and if discarding practices vary greatly across the fleet, obtaining accurate discard rates will be a challenge. Under a voluntary program, the probability of discarding will be influenced by the full range of

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[9] https://meetings.npfmc.org/Meeting/Details/142

conditions that affect decisions to retain or discard at the rail. Work would have to be done to identify contributing factors in addition to area, vessel, trip, and haul variables for extrapolation to the fleet.

On the other hand, “voluntary” could be defined as participating in a funded, 100% observed, permit option that would allow discarding. Under this arrangement, the subset of observed vessels could be reduced to a level that does not strain traditional observer funding resources. Additionally, a special allowance for a small number of vessels could help develop solutions to logistical challenges that would need to be addressed before making the discarding allowance available on a fleetwide basis. The EFP process could be used encourage industry proponents of this management initiative to develop realistic on-board procedures and monitoring mechanisms. The universe of participating vessels would reflect a commitment to identifying solutions to logistical challenges considered in Council discussion heretofore, as well as numerous others that would likely arise in practice.

Underreporting, overreporting and other types of error in catch data can lead to inaccurate characterizations of population dynamics and inappropriate exploitation strategies (Pitcher et al. 2002). In contrast, discard quantities provided by the Alaska Region’s Catch Accounting System (CAS) are considered to be accurate and representative due to the expenditure of substantial effort and resources to ensure data quality. The sources and related issues with catch estimates in the sablefish stock assessment[11] are thoroughly addressed in the Groundfish SAFE. This includes historical catches from periods when all catch reporting was voluntary, and as a result? some of those catches are estimated.

Although methodological changes to the sablefish stock assessment could hypothetically be explored that would account for the introduction of sablefish discards, the preferred approach would be to achieve accuracy within the discard accounting process itself through monitoring standards. Inaccuracy in discard quantities could contribute to precautionary analytical options, such as further reductions from max ABC under the process documented in the sablefish assessment.

A voluntary sablefish discarding program currently exists in Alaska for the Chatham Strait longline fishery managed by the State of Alaska (SOA). Under SOA regulations (5AAC 28.170), fishermen are able to release sablefish not visibly injured or dead. This occurs in the absence of at-sea monitoring and relies instead on vessel logbooks for records of releases, which are considered to reflect discard estimates, not reliable discard numbers. Size compositions from the SOA longline survey include small fish that are not reflected in fishery landings, which has been suggested to reflect discarding in the fishery that increases during periods of strong recruitment (Figure 3) and do not corroborate logbook reports.

[11] https://www.fisheries.noaa.gov/alaska/population-assessments/north-pacific-groundfish-stock-assessment-and-fishery-evaluation

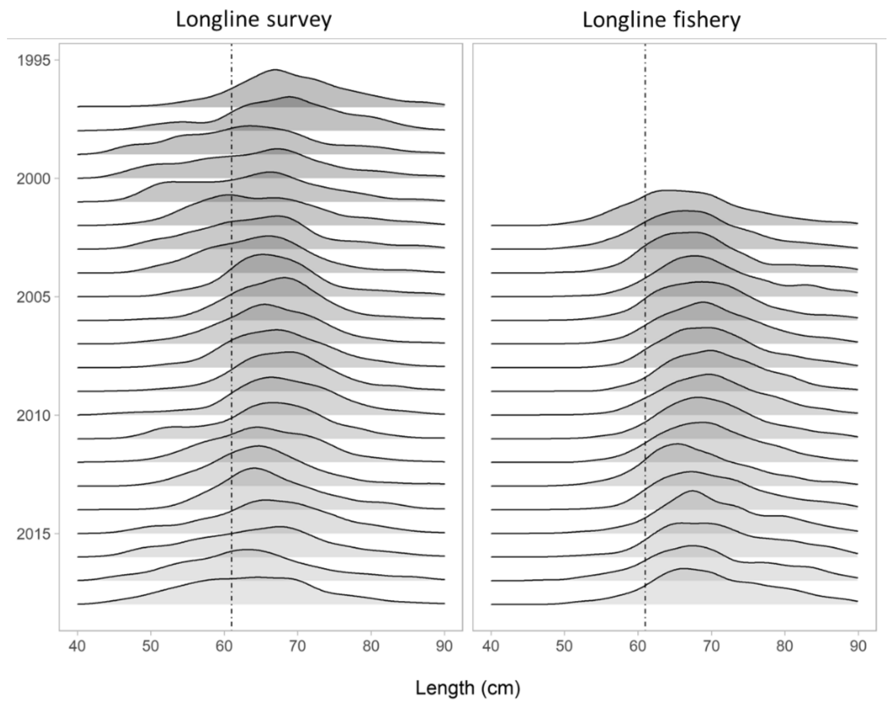

Figure 3. Longline survey (1997-2018) and fishery (2002-2019) length distributions, sexes combined. The dashed vertical line at 61 cm represents the length at 50% maturity (Sullivan et al. 2019).

In the SOA Chatham Strait sablefish assessment, a retention curve is used to describe the probability of fish being kept based on size, age, or sex. Currently, to estimate discards retention curve parameters are interpolated from landings categorized by processor grade and price per pound (Figure 4), but this approach is assumption-laden. The stock assessment author (2019) is exploring creative methods to estimate retention probabilities by attempting to learn about likely operator sorting choices in response to simulated visual cues about fish size in a digital "game". (pers. comm. J. Sullivan). Although the promise for this specific approach remains to be proven, a model-based approach could be explored on the larger offshore fisheries if a range of appropriate predictor variables can be identified.

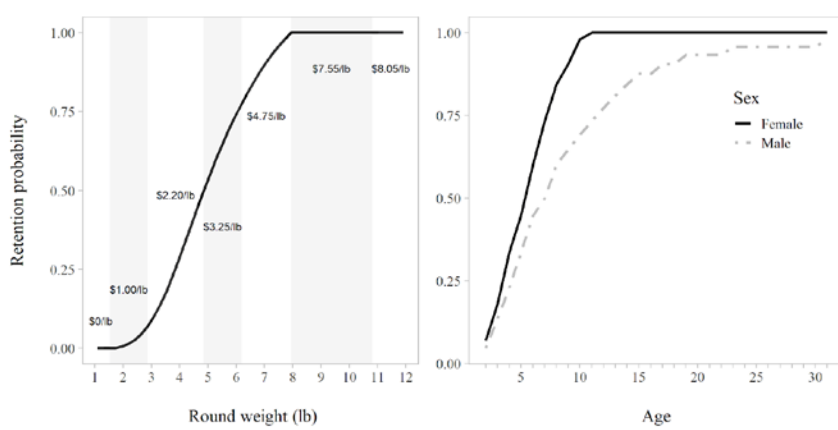

Figure 4. The probability of retaining a fish as a function of weight (left panel), sex, and age (right panel) (Sullivan et al. 2019).

Enforcement Perspective: In the second discussion paper on this subject, presented to the Council in April 2019[12], extensive consideration was provided on enforcement concerns. Central to these concerns is the question of voluntary vs. mandatory discarding. Federal law requires that discarded fish must be returned to the sea immediately, with a minimum of injury (50 CFR 679.21(a)(2)(ii)). If voluntary release of sablefish is allowed, the only change in on-water enforcement would be an extension of that requirement to sablefish. For at-sea enforcement, this would involve observing fishery operations and ensuring that sablefish not retained by IFQ vessels are returned to the sea immediately, with minimal injury.

An additional layer of enforcement would be involved if discarding, based on a size specification, is made mandatory. In this case, at-sea enforcement would continue to address careful release standards but would also need to involve verification of compliance with length standards. Dockside enforcement of the minimum size would also need to occur, which would be achieved by examination of landings by enforcement officials

If minimum size is associated with a discard requirement, then careful release and interception of discard violations are necessary. In addition, enforcement of the minimum size for retention would be accomplished by enforcement officials examining retained or landed catch. Enforcement of the minimum size (32 inches) for the halibut IFQ fishery does occur, and the vessels involved often participate in sablefish IFQ fishing, the differentiation of halibut relative to minimum size has been characterized as being much easier than for sablefish.

3 Single size limits versus area specific size limits

Areas to be explored:

- GOA, BSAI
- EGOA, CGOA, WGOA, BSAI

Sablefish have traditionally been thought to form two populations based on differences in growth rate, size at maturity, and tagging studies (McDevitt 1990, Saunders et al. 1996, Kimura et al. 1998). The northern population inhabits Alaska and northern British Columbia waters and the southern population inhabits southern British Columbia, Washington, Oregon, and California waters, with mixing of the two populations occurring off southwest Vancouver Island and northwest Washington. However, recent genetic work by Jasonowicz et al. (2017) found no population sub-structure throughout their range along the US West Coast to Alaska and suggested that observed differences in growth and maturation rates may be due to phenotypic plasticity or are environmentally driven. Significant stock structure among the federal Alaska population is unlikely given extremely high movement rates throughout their lives (Hanselman et al. 2015, Heifetz and Fujioka 1991, Maloney and Heifetz 1997, Kimura et al. 1998).

At present, sablefish are assessed as an Alaska-wide stock and the ABC is apportioned by management area after the TAC is estimated. As described above, the rationale for the Alaska-wide model is that there are high movement rates across all areas off Alaska. Because of these high movement rates, there are no known differences in demographics of sablefish in different areas. Figure 5 depicts demographic information collected from tagged and recaptured sablefish throughout Alaska. While catch rates appear much higher throughout the GOA compared to the BS and AI (signified by larger sized bars), the proportional contribution by size class (different colors in bars; see figure legend) remains relatively uniform between management areas.

[12] https://meetings.npfmc.org/Meeting/Details/583

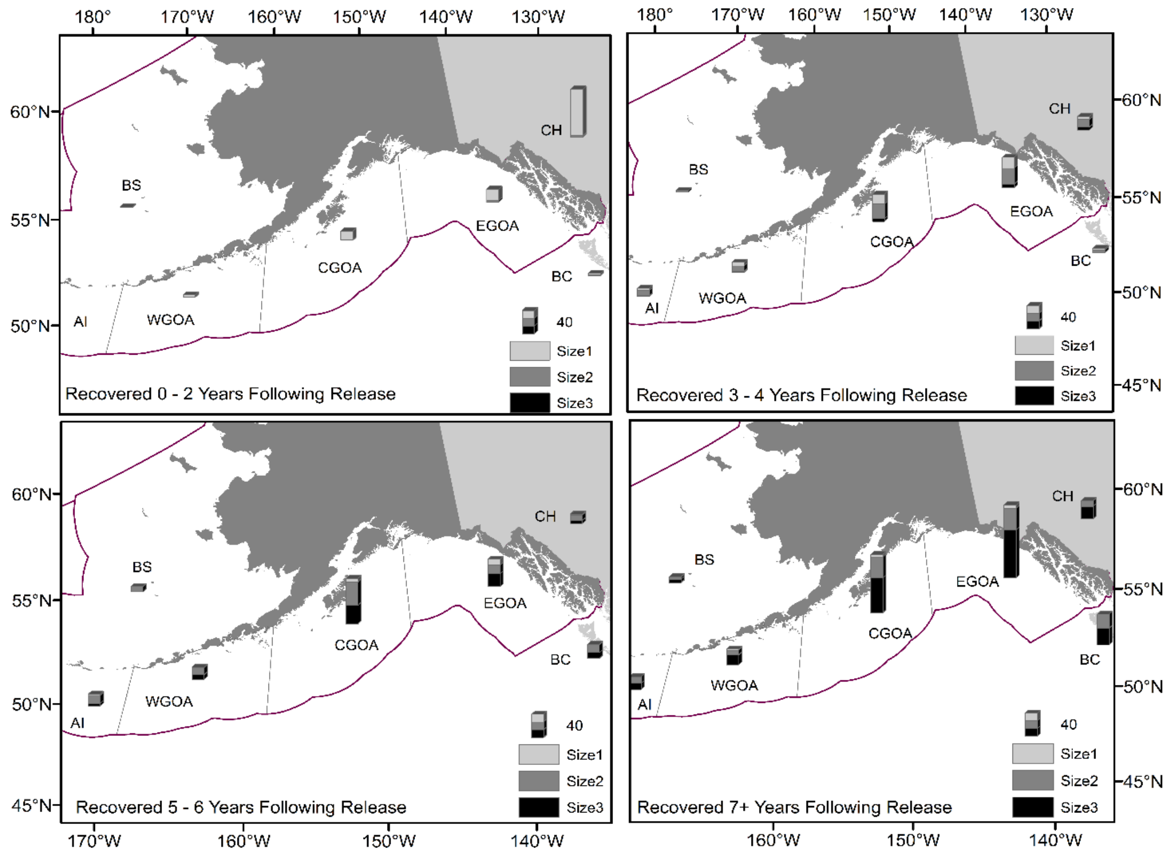

Figure 5. Recoveries of known-age tagged juveniles by recovery size and recovery area, recovered 0-2 years following release (top left panel), recovered 3-4 years following release (top right panel), recovered 5-6 years following release (bottom left panel), and recovered 7+ years following release (bottom right panel). BC = British Columbia, EG = Eastern Gulf of Alaska (GOA), CG = Central GOA, WG = Western GOA, AI = Aleutian Islands, and BS = Bering Sea. Size 1 = 41-56 cm, size 2 = 57-66 cm, and size 3 > 66 cm. Image taken from Echave et al., 2013.

Figure 6 shows the mean length of sablefish collected from the sablefish IFQ fishery (both hook-and-line and pot gear) throughout the federal waters off Alaska from 1999-2018 (Data from D. Hanselman). This figure shows almost no discernible difference between the mean length of sablefish caught in the Bering Sea (64 cm) and those caught in the GOA (67 cm; difference of 4.5%). In addition, there is minimal difference in mean length between sablefish caught in different areas of the GOA (range of 64.6 – 69.1 cm).

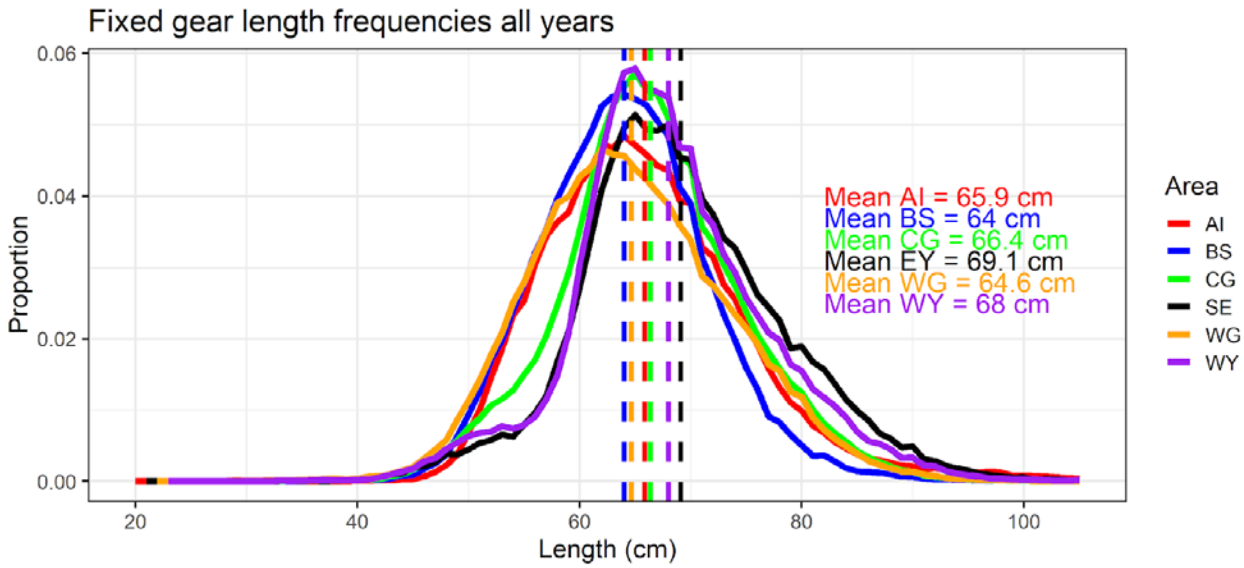

Figure 6. Length frequencies of sablefish collected from sablefish IFQ fishery (hook-and-line and pot gear) from 1999-2018. (Data from D. Hanselman). Dashed lines represent mean lengths by area.

Because of the Alaska-wide similarities in sablefish demographics, area-specific size limits may not be necessary, or appropriate, to achieve the Council's objectives. From staff understanding of this topic, the intent of this discard motion is to be able to release small fish when they are abundant due to unusually large year class events. These year classes would be of similar length range throughout Alaska. Area-specific limits would not be needed to achieve the goal of discarding fish from abundant year classes. Creating area-specific size limits implies demographic differences between stocks, where in reality there is considerable overlap among them. Area-specific size limits also creates monitoring issues and increases our uncertainty about the impacts that discards may have on Alaska-wide stock characteristics and abundance.

As previously mentioned, there are a number of enforcement issues related to the institution of a regulatory size limit. Implementing an area-specific size limit could compound these issues by adding increased monitoring and enforcement measures. Items for the Council to consider in this regard may include:

- What are the geographic boundaries distinguishing size limits?

- Does a vessel have to off-load its catch in the same "size-area" it was collected?

- Can sablefish IFQ vessels directed fishing for sablefish across multiple "size-areas" on the same trip? If so, what are the ramifications for catch-accounting?

- Mixed hauls of different sized fish from different areas with different size limits?

4 Options for discard accounting relative to ABC and TAC

TAC

The Alaska sablefish fishery is primarily made up of fixed gear (pot and hook-and-line) operations that meet qualifying criteria (possession of quota shares) to participate in the sablefish IFQ program. Allocative formulas from the Groundfish fishery management plans (FMPs) are applied each year to distribute the GOA and BSAI sablefish TACs among areas within the two FMP regions. In the GOA, the

TAC is apportioned among four areas: Western, Central, West Yakutat, and Southeast, and in the BSAI, the TAC is apportioned among the BS and AI. Trawl TAC is also distributed to each of these areas, with the exception of Southeast GOA where the gear is prohibited.

Among the areas, fixed gear is allocated 95 % of the TAC in the Eastern GOA and 80% of the TAC in the Central and Western GOA. In the BSAI FMP region, gear allocations are 25 % for trawl and 75 % fixed gear for the AI, and 50%:50% in the BS. Also within the BSAI, 20 % of the hook-and-line or pot gear allocation of sablefish is apportioned to the community development quota (CDQ) reserve for each subarea, and 7.5 % of the trawl gear allocation of sablefish to the non-specified reserves is assigned to the CDQ reserve.

No set-aside was ever established for sablefish discards in the IFQ fishery when the IFQ Program was established (NPFMC 1995). At the time, the Council thought unused trawl TAC would be sufficient to absorb the low levels of sablefish discard mortalities by IFQ vessels that had used all their IFQ and by non-IFQ fixed gear vessels. The prohibition on discarding that was implemented in order to discourage high-grading was also anticipated to continue indefinitely.

While catches by the fixed gear fishery have been more dynamic, historically, compared to catches by trawl gear, pronounced increases in trawl catches have occurred recently (Figure 7). Similarly the proportion of sablefish that are were discarded in 2018 (38.4%) is greater by an order of magnitude than in 2010 (Table 2). Retained sablefish by trawl gear is permitted through a maximum retainable amount of 1% or 15% depending on the basis species in the BSAI[13] and, likewise, 1% or 7% in the GOA[14]. Although the large increases in trawl catches of sablefish in 2019 are not expected to continue indefinitely, complete or near complete use of the trawl TAC by the trawl fleet makes it increasingly unlikely that it can continue to function as a reserve for removals by fixed gear vessels. This means that under IFQ discarding, additional removals in the form of discard mortalities will necessitate the creation of specific allowances in the either the entire TAC or the IFQ TAC only.

To sub-set the IFQ and/or trawl TACs to include discarding, appropriate discard amounts by gear and area would need to be calculated for regulations each year, and this could come from an apportionment-like exercise based on the stock assessment, or a static formula, as in the current TAC allocation. In either case, a decision point for action is created as to how to respond, in-season, to deviations from allocated percentages. For example, if observer data suggest that overuse of the IFQ discard TAC is likely, the overage could be taken from the remaining trawl TAC, which could potentially close trawl fisheries and also vessels with any remaining unused IFQ. Alternatively, the discard TAC could be static so that no borrowing from other TAC categories is allowed. Under this approach, once the discard TAC is used, discarding would be prohibited. Ironically, unless the discard TAC is distributed among quota share (QS) holders, this could create a “race to discard” within the IFQ fishery that may effectively contribute to increased high grading. Any of these considerations would also apply to a division of the overall GOA and BSAI TACs between landings and discards.

One of the IFQ program’s central principles is to provide participating vessel operators with the option to choose when to fish, based on a range of considerations, including the probability that unwanted catch will be minimized. By instituting a discard assumption into the allocation of TAC among QS holders, this principle is recast so that the minimization of discards is considered to be achievable, but only up to a point. In order to incorporate a discard percentage into individual QS holder’s IFQs, the reduction would assign an “average” propensity to discard among the participants, accounting for vessel characteristics,

[13] Table 11 in 50 CFR 679
[14] Table 10 in 50 CFR 679

area, and a range of other issues. Additionally, reporting sablefish catches against IFQ would require harvest and discards reporting. The IFQ program currently only applies landing data to the IFQ accounts. Creating an IFQ discard allowance under the IFQ program would require that accounts be able to have landings and discards charged separately. This presumes that the information would be collected and/or reported at the same time. However, estimates of at-sea discards are calculated after the landings data and observer/EM data enter the CAS. This means that the estimate of at-sea discards is not known at the time of landing to inform the IFQ holder of their remaining sablefish IFQ balance. The only system that would allow for contemporaneous discard and landings reporting would be industry-reported discards, which is not preferred.

A sufficiently complicated regulatory system (50 CFR 679.41) is in place to address procedures, eligibility, accounts, restrictions, etc. that allow QS and IFQ to be transferred within the sablefish IFQ program. Amendment of the Groundfish FMPs and sablefish IFQ regulations would be necessary for transfer provisions to also apply to discards and would require significant analytical treatment. Because transfer opportunities are an integral part of the IFQ program, if the Council were to indicate a preference to prohibit transfer of discards, it may be necessary to address reductions for IFQ discards at a more synthetic level such as the management area or sub-area.

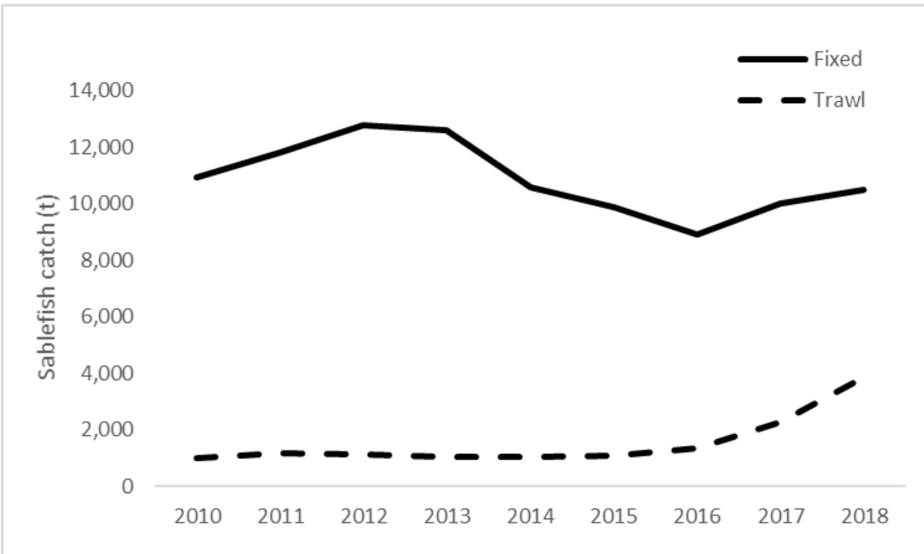

Figure 7. Alaska sablefish catches (t) by fixed and trawl gear since 2010. Source (www.akfin.org).

Table 2. Discarded catches of sablefish (amount [t], percent of total catch, total catch [t]) by gear (H&L=hook & line, Other = Pot, trawl, and jig, combined for confidentiality) by FMP area for 2010-2019. Source: 2019 Sablefish SAFE Chapter; NMFS Alaska Regional Office via AKFIN, October 1, 2019.

		BSAI			GOA			Combined		
Year	Gear	Discard	%Discard	Catch	Discard	%Discard	Catch	Discard	%Discard	Catch
2010	H&L	37	3.1%	1,187	371	4.0%	9,231	408	3.9%	10,418
	Other	5	0.9%	613	47	5.3%	900	53	3.5%	1,514
	Total	42	2.3%	1,800	419	4.1%	10,131	461	3.9%	11,931
2011	H&L	21	1.9%	1,096	396	3.9%	10,148	417	3.7%	11,243
	Other	8	1.3%	638	179	16.3%	1,097	187	10.8%	1,735
	Total	29	1.7%	1,733	575	5.1%	11,245	604	4.7%	12,978
2012	H&L	13	1.1%	1,197	253	2.3%	11,060	266	2.2%	12,257
	Other	13	1.7%	751	65	7.5%	861	77	4.8%	1,612
	Total	26	1.3%	1,948	318	2.7%	11,921	344	2.5%	13,869
2013	H&L	28	2.6%	1,067	598	5.4%	11,101	626	5.1%	12,168
	Other	4	0.6%	630	48	5.6%	846	51	3.5%	1,476
	Total	32	1.9%	1,697	646	5.4%	11,947	678	5.0%	13,645
2014	H&L	40	5.3%	750	441	4.6%	9,486	480	4.7%	10,236
	Other	1	0.3%	385	78	8.1%	967	80	5.9%	1,351
	Total	41	3.6%	1,135	519	5.0%	10,453	560	4.8%	11,588
2015	H&L	14	2.9%	489	593	6.4%	9,277	608	6.2%	9,766
	Other	5	3.5%	153	184	17.4%	1,054	189	15.7%	1,207
	Total	20	3.1%	642	777	7.5%	10,331	797	7.3%	10,972
2016	H&L	77	18.5%	415	653	7.8%	8,316	730	8.4%	8,731
	Other	9	1.9%	466	191	18.0%	1,060	199	13.1%	1,526
	Total	86	9.7%	881	843	9.0%	9,376	929	9.1%	10,257
2017	H&L	47	17.2%	273	431	6.0%	7,215	478	6.4%	7,488
	Other	173	13.2%	1,307	335	17.9%	1,875	508	16.0%	3,183
	Total	220	13.9%	1,580	766	8.4%	9,090	986	9.2%	10,670
2018	H&L	73	21.1%	348	600	7.2%	8,371	673	7.7%	8,718
	Other	396	20.7%	1,911	1,648	44.4%	3,713	2,044	36.3%	5,624
	Total	469	20.8%	2,258	2,249	18.6%	12,083	2,718	18.9%	14,342
2019	H&L	110	34.7%	318	528	8.4%	6,277	638	9.7%	6,594
	Other	1,479	46.7%	3,167	987	30.3%	3,251	2,465	38.4%	6,418
	Total	1,589	45.6%	3,485	1,514	15.9%	9,528	3,103	23.8%	13,012
2010-2018	H&L	39	5.1%	758	482	5.2%	9,356	521	5.1%	10,114
mean	Other	68	9.0%	762	308	22.4%	1,375	377	17.6%	2,136
	Total	107	7.0%	1,520	790	7.4%	10,731	897	7.3%	12,250

ABC

An upper limit on ABC for the Alaska stock of sablefish is calculated for each specification year based on a fishing mortality rate consistent with the tier determination from the stock assessment. The Council specifies final ABC and TAC, with ABC based on the Council's Science and Statistical Committee's (SSC) authoritative determination, while TAC can be set equal to or below ABC, as needed to account for management uncertainty ABC and TAC have been consistent since the mid-1990s, and the values of ABC/TAC correspond to total fishery removals of sablefish and do not address discarding.

The Council was presented with Groundfish Plan Team recommendations in 2018[15] for a suite of additional considerations and processes in their risk matrix. The Council was clear in its response to the max ABC discussion that due consideration to environmental, ecosystem, and other concerns should be given, and that these concerns should have well-documented biological relevance that the Science and Statistical Committee SSC could consider in determining ABC. The risk matrix that the Groundfish Plan Teams developed includes the following considerations:

[15] https://meetings.npfmc.org/Meeting/Details/313

1. Assessment-related considerations
    a. Data-inputs: biased ages, skipped surveys, lack of fishery-independent trend data
    b. Model fits: poor fits to fishery or survey data, inability to simultaneously fit multiple data inputs.
    c. Model performance: poor model convergence, multiple minima in the likelihood surface, parameters hitting bounds, retrospective bias.
    d. Estimation uncertainty: poorly-estimated but influential year classes.
2. Population dynamics considerations—decreasing biomass trend, poor recent recruitment, inability of the stock to rebuild, abrupt increase or decrease in stock abundance.
3. Environmental/ecosystem considerations—adverse trends in environmental/ecosystem indicators, ecosystem model results, decreases in ecosystem productivity, decreases in prey abundance or availability, increases or increases in predator abundance or productivity.

The Council may not intend to promote the max ABC risk matrix as a primary tool for adjusting ABC under sablefish discarding, however, as has been pointed out elsewhere in this document, a discard allowance could potentially introduce significant uncertainty in estimating total removals in a given year. That outcome could trigger consideration 1.a., in the above list, and the Council should be aware that accounting for sablefish discards in terms of uncertainty relative to ABC is quite different from accounting for discards relative to the distribution of TAC among areas and sectors. Additionally, there do not appear to be contingencies in the risk matrix approach for reducing ABC differently in the apportionment process, so presumably any reduction would be extended to all areas and gears sectors.

Further accounting for discarding in the sablefish ABC could occur in the treatment of inputs to the stock assessment. The sablefish stock assessment clearly describes how each catch component is addressed, including application of discard rates prior to the IFQ fishery to address underreported catches from the late 1980’s. It is very unlikely that an allowance for sablefish discards would be established that would result in this treatment of assessment inputs, however, significant uncertainty might arise for current year data if discarding is reported through logbook submissions. Logbooks often have issues with legibility and data are not available for incorporation in assessments until the following year, so a contingency would have to be made for addressing discards in the terminal assessment year.

Discard accounting under ABC might also take place through apportionment, a process of distributing ABC and overfishing limit (OFL) among biologically meaningful management subareas. Apportioning ABC to management areas began for sablefish in 1999. The method for apportioning between areas has varied over time. Currently, apportionment is fixed, i.e. the percentage of ABC and OFL apportioned to each area is the same annually. In previous years, ABC and OFL were apportioned variably between areas based on exponential weighting of survey and fishery abundances.

High interannual variability in apportioned ABC to management areas has led to initiation of work to develop a Management Strategy Evaluation-style analysis of apportionment. A potential for differential subarea discarding rates could be recommended for consideration in a synthetic analysis of apportionment scenarios. Additionally, protection of incoming year classes could be addressed through apportionment by limiting available subarea ABCs based on the spatial distribution of sablefish above an appropriate size limit. Additionally, assumptions would have to be made about the probability of discarding and the associated mortality, which would all have to fit within the calculation of ABC. Such an approach could greatly reduce ABCs for those areas where small fish are more abundant (BS and AI).

5 Use of proxy discard mortality rate options at the initiation of sablefish discarding (for fixed gear)

The last discussion paper outlined the discard mortality rate (DMR) process and discussed steps the Council could initiate to begin developing DMRs specific for the sablefish IFQ hook-and-line fishery. However, given that this was described as a time consuming process and that there is an apparent desire for this action to move quickly, the Council directed analysts to consider the use of the following proxy DMR options that could be utilized at the initiation of sablefish discarding:

> **-12 % -** 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 survey vs. fishery conditions and also because fishery gear may vary compared to survey gear.
>
> **-16 % -** State of Alaska. For 2019, the Alaska Department of Fish and Game (ADFG) used a new method to estimate the probability of a fish being discarded based on price/lb., weight, sex, and age (Sullivan et al. 2019). This information was incorporated into the assessment model and was reflected in the ABC in the stock assessment. This DMR value was chosen both because it is the DMR used for the Pacific halibut fishery (Gilroy and Stewart 2013) and because it is similar to the estimate for sablefish from Stachura et al. (2012) of 11.7%. The Stachura et al. (2012) estimate was based on the mortality rate of sablefish that were released carefully on a survey platform and so it was assumed that the DMR applied to commercial fishing should be higher than that estimate.
>
> **-20 % -** Pacific Fisheries Management Council – Somers et al. (2017) used a stratified multi-stage random sampling method to estimate discard mortalities for all the West Coast groundfish observed sectors of the groundfish fishery. A DMR of 20% was designated for sablefish caught in the "offshore" IFQ longline and pot gear fisheries by the Groundfish Management Team. See Somers et al. (2017) for a more detailed description of DMR estimation procedures.

The occurrence of a "savings" or discard-able portion of the fishery catch would allow fishing operations to redirect effort to harvest larger fish under their IFQ. To explore how the proxy DMRs provided by the Council would translate into realized sablefish "savings", we took into account; 1) the weight of landed sablefish by size category, and 2) the size at which a sablefish is considered "small" or under the size limit restriction if a size limit was put into regulation for the purposes of discarding. We then developed hypothetical scenarios that 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 sablefish IFQ harvest represents ~ 86% of total sablefish IFQ harvest in federal waters off Alaska 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. GOA (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 commercial fishers). At this weight, sablefish are approximately 40-45 cm (16-18 in) in length.

Tables 2 and 3 describe how sablefish landings in the GOA may be impacted by the four DMR values (including status quo) described in the preceding paragraphs. Table 4 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 sablefish IFQ 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 - 3 lbs. 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, 4) no reduction in IFQ to account for discard mortalities is addressed, which would decrease available harvest relative to status quo.

Table 4. Landings data for the GOA sablefish IFQ fishery under four 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
12% (Stachura et al.)	1-3 lbs	109.32	108.48	102.48	83.76	102.12	176.88	135.36
	> 3 lbs	15919	15624	12995	12134	10690	11386	6918
	Total	16028.3	15732.5	13097.5	12217.8	10792.1	11562.9	7053.36
16% (State of Alaska)	1-3 lbs	145.76	144.64	136.64	111.68	136.16	235.84	180.48
	> 3 lbs	15919	15624	12995	12134	10690	11386	6918
	Total	16064.8	15768.6	13131.6	12245.7	10826.2	11621.8	7098.48
20% (PFMC)	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 three hypothetical DMRs. From 2012 through 2016 we see only a modest reduction in overall landed weight of sablefish across all scenarios (range of 4.33 – 6.49 %). However, in 2017 and 2018, which corresponds to years when fishermen first began noticing large catches of small sablefish, a reduction in landed weight became much more apparent across all scenarios (range of 9.17 – 12.34%).

Table 5. Percent reduction in landed sablefish as a result of hypothetical DMRs. Landed sablefish data taken from Table 4.

Percent reduction in landed Sablefish as a result of DMRs.							
DMR	2012	2013	2014	2015	2016	2017	2018
12% (Stachura et al.)	-4.76	-4.81	-5.43	-4.79	-6.49	-10.09	-12.34
16% (State of Alaska)	-4.55	-4.59	-5.18	-4.57	-6.19	-9.63	-11.78
20% (PFMC)	-4.33	-4.38	-4.93	-4.35	-5.90	-9.17	-11.22

Table 6 shows how the percent reduction in landed "small" sablefish (shown in table 5) translates into weight of sablefish "savings" that would not be attributed to the overall TAC/ ABC but could instead be repurposed for high catches of larger, more profitable sablefish.

Table 6. Sablefish savings in sold weight under three DMR scenarios.

Sablefish savings in sold weight (1,000 lbs.)							
DMR	2012	2013	2014	2015	2016	2017	2018
12% (Stachura et al.)	801.68	795.52	751.52	614.24	748.88	1297.12	992.64
16% (State of Alaska)	765.24	759.36	717.36	586.32	714.84	1238.16	947.52
20% (PFMC)	728.80	723.20	683.20	558.40	680.80	1179.20	902.40

The difference in realized savings between 2012 – 2016 (pre-large recruitment event) and 2017-2018 (post-large recruitment event) is obvious, but it is uncertain if 2017 and 2018 represent a new trend in sablefish catch composition or if these years are simply anomalies that will not persist in the future.

One important aspect for the Council to consider is the relative difference in sablefish "savings" that is achieved between the three proxy DMRs analyzed in this document. Even when comparing the difference between the extremes of the proxy's analyzed (12 and 20%), we found only a ~9% difference in the relative amount of landed sablefish "savings". As such, if the Council decides to move forward with this action, the selection of any of the DMRs presented here would yield comparable sablefish "savings". This being the case, the Council may wish to choose the initial DMR which it feels has the best scientific justification and basis for its appropriateness for use in the Alaska sablefish IFQ fishery.

6 Use of gear specific DMRs for IFQ fisheries

If the Council decides to specify gear-specific DMRs for discards of sablefish, it could consider using the DMR for pot gear in the halibut IFQ fishery as a proxy for a DMR in the sablefish IFQ pot fishery, or it could decide to analyze a range of potential DMR values. In addition, the Council could consider requiring the use of escapement rings on pot gear, such as is required in the SOA sablefish directed fishery. Escapement rings have been used with great effect to "pre-sort" small sablefish from the catch prior to bringing fish onboard and could result in further reductions in DMR. The use of escapement rings and other possible equipment modifications to reduce the take of small sablefish is addressed in the second discussion paper on small sablefish retention.

Given that these mechanisms exist for reducing small sablefish mortality for pot gear, the Council could also consider using lower DMR values for sablefish as compared to DMRs for pot gear in the halibut IFQ fishery. Pot DMRs for halibut in the GOA are generally near 5%. A complicating factor is the apparent increase in pot DMRs for halibut in the BSAI which are currently estimated at approximately 27%.

Using methods similar to those described above, we developed a range of hypothetical scenarios to demonstrate the sablefish "savings" that may be achieved over a range of proxy DMR values for sablefish caught in the sablefish IFQ pot fishery. Landings data presented below show gear specific catches of sablefish from both pot and hook-and-line gear (Table 7). As with the analysis above, we have limited the scope of these scenarios to only include sablefish landed in the GOA. The use of pots in the GOA sablefish IFQ fishery began in 2017. As such, only two years of data are provided for sablefish landed with both hook-and-line and pot gear (2017 and 2018).

For hook-and-line landings, we developed scenarios using the same hypothetical DMR values described above. We also separated fish landings into 1-3 lbs. or > 3 lbs. For sablefish landings from pot gear in the GOA, we used the DMR applied to halibut in pots in 2018 (7%), 2019 (4%) and a hypothetical DMR of 2%. The hypothetical DMR assumed that sablefish are hardier and less stressed or injured during handling as compared to halibut.

Table 7. Gulf of Alaska (all sub areas) fixed gear sablefish landings by size category, 2017 - 2018. Source: ADFG Fish Ticket data provided by AKFIN.

HAL - Sold Weight (1,000 lbs.)				Pots - Sold Weight (1,000 lbs.)			
DMR	Size Category	2017	2018	DMR	Size Category	2017	2018
100% (Status Quo)	1-3 lbs	1039.3	1544.7	100% (Status Quo)	1-3 lbs	557.5	680.7
	> 3 lbs	10111.4	11153.8		> 3 lbs	855.2	1162.9
	Total	11150.8	12698.5		Total	1412.7	1843.6
12% (Stachura et al.)	1-3 lbs	124.7	185.4	2% (Hypothetical DMR)	1-3 lbs	11.2	13.6
	> 3 lbs	10111.4	11153.8		> 3 lbs	855.2	1162.9
	Total	10236.1	11339.2		Total	866.3	1176.5
16% (State of Alaska)	1-3 lbs	166.3	247.2	4% (2019 halibut)	1-3 lbs	22.3	27.2
	> 3 lbs	10111.4	11153.8		> 3 lbs	855.2	1162.9
	Total	10277.7	11400.9		Total	877.5	1190.1
20% (PFMC)	1-3 lbs	207.9	308.9	7% (2018 halibut)	1-3 lbs	39.0	47.6
	> 3 lbs	10111.4	11153.8		> 3 lbs	855.2	1162.9
	Total	10319.3	11462.7		Total	894.2	1210.6

Tables 8 and 9 describe how sablefish landings in the GOA may be impacted by the variable gear-specific DMR values described in the preceding paragraph. Landed sablefish weights are categorized similar to the analysis in the preceding section.

Table 8 shows the percent reduction in landed sablefish as a result of three hypothetical DMRs by each gear type. Percent reductions in landed sablefish are nearly 3 times higher for those landed by pot gear (34.34% - 38.68%) versus those landed by hook-and-line (7.46% - 10.7%). This disparity may be partially explained by the relatively high proportion of 1 - 3 lbs. sablefish caught in pot gear versus hook-and-line gear. In 2017 and 2018, approximately 39% and 37%, respectively, of total landed sablefish caught in pot gear weighted 1 – 3 lbs. In contrast, for hook-and-line gear in 2017 and 2018, only approximately 9% and 11%, respectively, of total landed sablefish weighed 1 - 3 lbs.

Table 8. Percent reduction in landed sablefish as a result of hypothetical DMRs.

HAL - Percent reduction in landed Sablefish		
DMR	2017	2018
12% (Stachura et al.)	-8.20	-10.70
16% (State of Alaska)	-7.83	-10.22
20% (PFMC)	-7.46	-9.73

Pots - Percent reduction in landed Sablefish		
DMR	2017	2018
2% (Hypothetical DMR)	-38.68	-36.18
4% (2019 halibut)	-37.89	-35.45
7% (2018 halibut)	-36.70	-34.34

Table 9 shows how the percent reduction in landed "small" sablefish translates into weight of sablefish "savings" that would not be attributed to the overall TAC/ ABC but could instead be repurposed for higher catches of larger, more profitable sablefish. While the total savings of sablefish caught with hook-and-line is nearly twice as much as the savings of sablefish caught in pots, landings from the sablefish IFQ pot fishery made up only 9% and 11% of the total GOA sablefish IFQ landings in 2017 and 2018, respectively.

Table 9. Sablefish savings in sold weight under three, gear-specific DMR scenarios.

HAL - Sablefish savings in sold weight (1,000 lbs.)		
DMR	2012	2013
12% (Stachura et al.)	914.6	1359.4
16% (State of Alaska)	873.0	1297.6
20% (PFMC)	831.5	1235.8

Pots - Sablefish savings in sold weight (1,000 lbs.)		
DMR	2012	2013
2% (Hypothetical DMR)	546.4	667.1
4% (2019 halibut)	535.2	653.5
7% (2018 halibut)	518.5	633.1

Similar to the discussion in the previous section, an important aspect for the Council to consider is the relative difference in sablefish "savings" that is achieved between the three proxies for each gear type analyzed in this document. The range of gear-specific DMR values analyzed in this discussion paper do not generate large gear-specific differences in sablefish savings. However, there is a substantial difference in relative savings that could be realized between the range of DMRs analyzed for pot gear and those analyzed for hook-and-line. Proportionally, sablefish savings from the pot fishery far exceed those from the hook-and-line fishery. The Council may choose to consider how this could influence participation in the pot fishery, as this relatively large increase in savings could provide an incentive for increased participation in the IFQ pot fishery.

7 Concerns related to monitoring and enforcement options

The Council tasked staff with exploring how estimates of small sablefish discards could be approximated for the directed fishery based off of several different sources. The first section addresses considerations for estimating discards of small sablefish from actual discards observed on the annual longline survey conducted by the Alaska Fisheries Science Center (AFSC). The second section describes consideration for estimating discards from observer and electronic monitoring (EM) data. The third section discusses considerations for estimating discards from vessel logbooks.

7.1 Discards estimated from the survey

A number of fishery independent surveys catch sablefish and could be used to inform estimates of sablefish discards for the sablefish IFQ fishery. However, the survey indices included in the stock assessment model include only the AFSC longline survey and the AFSC GOA bottom trawl survey. The use of these surveys in the stock assessment have been endorsed by the Council's Groundfish Plan Teams and the SSC. As such, we have limited our discussion of the survey discard estimates to the AFSC longline survey, as that survey utilizes the same gear as the sablefish IFQ longline fishery.

The longline survey samples all sablefish habitat in the GOA and BSAI. Surveyed depths range from approximately 200 – 1,000 m although at some station depths less than 200 m or more than 1,000 m are sampled. The intent of the longline survey is to sample the entire sablefish population structure (i.e. the entire size and age range of the population) Alaska-wide in order to estimate the relative abundance and size composition of the sablefish population.

When attempting to compare discard rates of sablefish caught by the longline survey to sablefish caught in the directed longline fishery, selectivity rates must be compared. In contrast to the survey, fishing effort for the directed fishery is largely driven by economics. Because of market price differentials in the size classes of sablefish, large fish are worth much more and are preferentially targeted. This results in fishing effort being focused on habitats and depths where large, valuable fish are more common, which skews selectivity towards larger fish. This also affects sexes differently due to sexually dimorphic growth (i.e. females attain a larger size at age compared to males). Since the survey samples all sablefish habitats and does not target larger/older fish it proportionally encounters more smaller/younger sablefish than the fishery, a disparity in selectivity exists between the survey and the fishery.

Figure 8 shows sablefish selectivity curves which show the proportion of sablefish of a given age and sex that are caught in the ASFC longline survey and in the sablefish IFQ fishery (data from D. Hanselman). Although at first glance they appear quite similar, there are comparatively large differences in the proportion of selected individuals at younger ages.

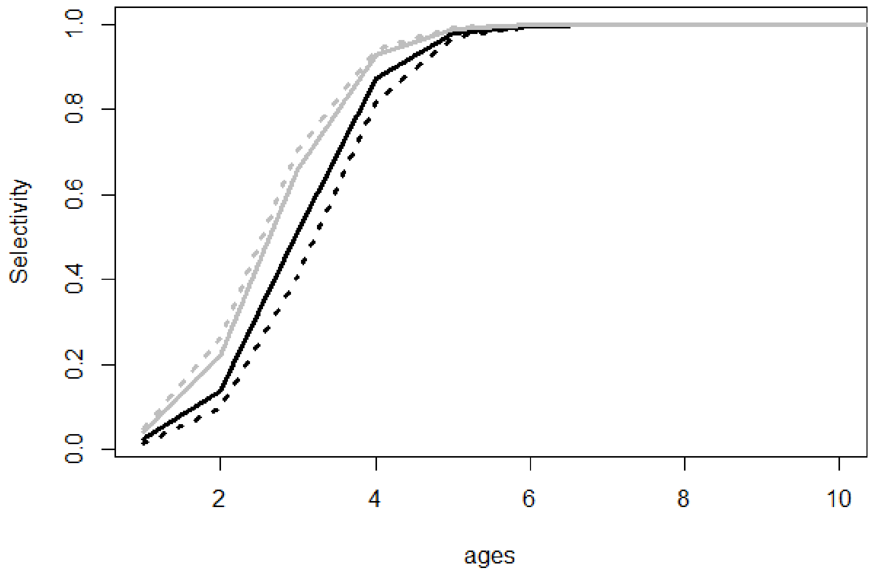

Figure 8. Sablefish selectivities for the sablefish IFQ longline fishery (grays) and the AFSC domestic longline survey (black) across all years indicated in the sablefish stock assessment (see Hanselman et al. 2018). Dotted lines represent male-specific selectivity and solid lines represent female-specific selectivity.

Table 10 lists the proportion of selected individuals of age 2 to 5 female sablefish caught in the ASFC longline survey and in the sablefish IFQ longline fishery. To demonstrate the magnitude of difference in selectivities, let us assume that there are 100,000 individuals of each class in the population. Using the selectivities provided in Table 10, the AFSC longline survey would conclude that 3,500 age 2, 19,600 age 3, 62,000 age 4, and 91,600 age 5 sablefish would be caught. A total of 176,700 sablefish. By comparison, selectivities from the sablefish IFQ fishery would conclude that 2,400 age 2, 13,900 age 3, 51,100 age 4, and 87,2000 age 5 sablefish would be caught. A total of 154,600 sablefish. The disparity in selectivity results in an ~ 13.5 percent difference in age 2 – 5 sablefish which is the age and size range where discards are most likely to occur.

Table 10. Proportion of selected individuals of age 2 to 5 female sablefish caught in the ASFC longline survey and in the sablefish IFQ longline fishery (data from D. Hanselman).

Female sablefish selectivities (proportion selected)		
Age	AFSC Longline	Sablefish IFQ
2	0.035	0.024
3	0.196	0.139
4	0.62	0.511
5	0.916	0.872

The end result is that directed fishery and longline survey selectivities are different. The survey, in theory, selects a more representative proportion of the population, whereas the directed fishery targets larger fish. However, even these disparities in fishery selectivity are not a static relationship. Since sablefish are assessed on an Alaska-wide basis, selectivities for both the survey and fishery are computed for the entire range in the assessment. Spatial differences exist in age/size composition, especially when large year classes move into the population (e.g. younger smaller fish are more prevalent in the western areas versus Eastern GOA). To properly account for this, separate selectivities for each management area should be considered. Additionally, selectivity differs by sex but since no sex information would be available from discarded fish in the fishery a proxy selectivity from the survey that combines sexes or assumed sex ratios would need to be used. In both the survey and fishery, selectivity likely changes due to emerging year classes or market based drivers, so estimating selectivity should not be considered static and may need to be updated annually.

The skewed relationship between the age and length composition of the sablefish collected from the longline survey compared to the composition of those caught in the directed fishery present challenges for generating accurate estimates of sablefish discards.

1) Because there are inherent differences between the catch composition of sablefish caught during the AFSC surveys compared to those caught in the directed fishery, attempts to estimate discards for the latter based on the former would add increased uncertainty into the stock assessment model. Catch (and inherently, discards) is not currently estimated or associated with the uncertainty that is factored into the stock assessment model, as there are no variance estimates included in the catch data. Catch is currently treated as a known value. Methods would have to be identified for introducing uncertainty associated with catch estimates.

2) In-season management and catch accounting will require “real-time” estimates of discards in order to manage the fishery as it is executed. The AFSC surveys are conducted annually during the summer months, which are partially concomitant with the directed fisheries. Discard estimates from the AFSC survey would not be available for use in estimating discards in the directed fishery until the following year. This raises an important issue. Given the high variability in size composition that has been observed over the past decade in both surveys and the directed fishery (including unprecedented large year class events), estimates of discards obtained from age and length compositions from one year may not accurately describe discards of the fishery in preceding years. Real time information is critical for management.

Aside from accurately accounting for the relationships between discards from the survey and those of the directed fishery, another consideration is how these survey-generated discards would be applied to vessels fishing with pots. Presently, no AFSC survey related to sablefish is conducted with the use of pot gear. Given the likely selectivity disparities between gear types, and differences in set times, sampling locations, bait, and other factors, estimating discards for the sablefish IFQ pot fishery from AFSC longline survey is not likely to provide an accurate representation of sablefish discards in the pot fishery.

7.2 Discards estimated based on observer and EM data

Catch accounting for sablefish discards in the pot and hook-and-line fisheries fundamentally relies on data collected by at-sea observers. This information provides critical information on the weight, numbers, and location of sablefish discarded. The Alaska Region’s CAS aggregates the available at-sea observer or EM data to estimate discards and combines the estimated discard with the total amount of retained sablefish. This estimate of total catch is required under National Standard 1 Guidelines and is used for inseason management of sablefish and during the annual harvest specification process. The data collection and estimation methods constitute the best available information from which to estimate total removals of sablefish in the hook-and-line and pot fisheries.

The change in accounting being considered in this discussion paper would allow operations to self-select the size of sablefish retained or be regulated with a size limit as is done with halibut. Regardless of whether sorting is based on a size limit or at the discretion of the operation, it presents a number of difficult estimation issues. This section provides a brief overview of data estimation and collection issues as they relate to both observer data and total catch estimation.

<u>Observer data collection</u>

The 2018 discussion paper provides detail on observer sampling protocols and implications on data collection. There have not been major changes in sampling protocol since that discussion was presented to the Council in October 2018. A brief overview is provided, and the reader is encouraged to reference the first discussion paper[16]. There are three key issues highlighted in this discussion that pose significant problems with data collection as currently configured:

- Use of the current at-sea observer sampling protocols in combination with current estimation routines would result in biased estimates of sablefish discards.
- Estimates of discard for vessels registered to fish in the EM strata would be reliant on available at-sea observer data for average weights, which are a key component of the estimation process.
- Biases in the estimation process identified above would be extrapolated to unobserved trips.

Bias –Observer Data

Current data collection processes and estimation methods for sablefish are designed to assess total catch and are not configured to evaluate size-selected discards. Observers collect representative samples to obtain data used for the estimation of the number of fish, disposition of the fish, and the average weight of sablefish caught on a set. The estimated weight of a set is the product of the total number of fish estimated to be caught and the species-specific average of weight of the unsorted catch, thus producing an estimate of the total catch. To obtain an estimate of discard, the proportion of fish discarded is applied to the estimated total catch weight of all sablefish estimated to be caught on a set.

Operations that are discarding small fish violate the assumption, under the current data collection and estimation model, that the weight distribution of discarded sablefish is similar to the weight distribution of retained sablefish. Operationalizing size-selective discard would likely result in an overestimate of total sablefish weight since the average weight per fish used to estimate discard will incorporate the weight of larger retained fish. This is currently an issue in the IFQ halibut fishery and recent work has shown that the amount of bias is not trivial (i.e., ~40% in terms of weight). An important difference between halibut and sablefish data collection, is that lengths are collected during viability sampling for discarded halibut. However, viability information is not collected for sablefish and weight information specific to sablefish discard is unavailable.

Estimation of discards for the EM portion of the fleet presents a unique situation in that average weight per fish from the observed portion of the fleet, subject to the previous described bias, would be used to estimate total sablefish weight for vessels with EM. This has added complexity since those vessels are likely to have operation-specific discarding behaviors that may depend on a number of factors related to the cost/benefit decisions associated with discarding (under a high grading scenario), such as size composition of sablefish, remaining IFQ, etc. This vessel-specific variability would be inherent in any proxy average weight used in the estimation of discards for the EM fleet. Careful consideration would be needed in establishing the estimation methods for the EM portion of the fishery.

Of the two options, size limit or voluntary discard, a program that allows voluntary discard without a size limit (i.e., high grading) would be more difficult to implement from a sampling perspective than one with a size limit. The primary issue is that at-sea sampling would require knowing the fisherman's *intent* regarding fish that are to be retained or discarded. Observers would need to sort these fish such that weights/lengths could be collected on fish that are intended to be discarded. Under a minimum size limit,

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[16] http://meetings.npfmc.org/CommentReview/DownloadFile?p=b6b509dd-a14c-442b-867b-3f88fa9f8d98.pdf&fileName=D2%20Sablefish%20Discard%20Allowance.pdf

this is obviously an easier task as all fish below a certain size must be discarded and species composition can be used to assess that information. Under either discard scenario (“voluntary” or minimum size limit), significant work on the sampling and estimation methods would be required and may involve a requirement for vessels to change their fishing operations relative to how they sort fish.

Discard Bias and CAS

The Alaska Region’s CAS uses available observer data to estimate catch on unobserved trips. The CAS uses a post-stratification process that prioritizes the data used to estimate catch on unobserved trips using information that is “most like” observed trips. Principally, in estimating unobserved trips, CAS prioritizes data from observed sablefish trips within a gear type, reporting area, and sampling strata over data aggregated across an entire FMP. This estimation process can result in biases being propagated differentially depending on operational differences that are tied to spatial location. For most federally managed areas, < 15% of the hook-and-line sablefish discard weight estimated by CAS relied on FMP-wide rates (NMFS 2019).

CAS also estimates sablefish discard based on a 5-week estimation window. This means data from observed trips are used to estimate discards for unobserved trips operating within the same 5-week period. This poses a unique complication under a scenario where operators choose when to sort. There can be periods where observer data is available on relatively few vessels, which may increase the risk of biased information if those operations are unique in their sorting behavior compared with unobserved vessels.

Account management

As is currently the situation, sablefish discard would accrue against GOA fixed gear and BSAI hook-in-line and pot gear accounts and be deducted against these allocations as specified in regulations. Accounting for discarded sablefish as part of an IFQ would not be possible given that discard is estimated using observer information that is not associated with the entity holding the IFQ. Doing so would create an enforcement issue since IFQ is assigned to an individual and enforced on the holder, but estimated discard would be originating from a fleet-wide rate. Further, discard would need to be assigned to the IFQ holder since IFQ is not tied to a vessel, which can have multiple IFQ holders onboard.

Conclusions

At-sea observation: Any proposal to allow sorting of sablefish will require changes to how observers collect at-sea information. Currently, length and weight information is collected to represent the entire catch and is not specific to discarded sablefish. The necessary changes to sampling and estimation methods are not trivial because they will require shifting observer tasks onboard the vessel, updating transmission software to accommodate disposition specific estimation for sablefish, and changing observer sampling and estimation methodology. The observer program is currently working towards changes to their ATLAS software system that would likely accommodate disposition-specific information (i.e., retained versus discarded). This change would allow the collection of weights or lengths specific to disposition; however, this work is in progress and is several years away. Finally, changes to observer workloads and sorting requirements would need further investigation; however, given that observers are already fully tasked, sampling priorities would likely need adjustment.

EM-Data: The current method of using the extrapolated FMP-wide average weight would need to be changed. However, given the current issues associated with the inconsistency between the estimation methods and the underlying observer data, it’s unlikely a satisfactory solution is available without either changing the methods used to collect observer data or using EM to collect length information specific to discard disposition and calculate weights based on length. This methodology would need to be developed and tested.

7.3 Discards estimated based on logbook reporting

Records of catch and effort from longline sets that target sablefish in the IFQ fishery are collected by observers and by vessel captains in voluntary and required logbooks. Logbooks have been required for vessels 60 feet and over since 1999 and are voluntary for vessels under 60 ft. Logbook sample sizes are substantially higher than observer samples sizes (see Table 3.9 in Hanselman et al. 2018). Logbook participation increased sharply in 2004 in all areas, primarily because the International Pacific Halibut Commission (IPHC) collected, edited, and entered logbook data electronically. This increasing trend is likely due to the strong working relationship the IPHC has with fishermen, their diligence in collecting logbooks dockside, and because many vessels under 60 feet are now participating in the program voluntarily.

Currently, information recorded in logbooks includes target of a set, location, date and time, and some measure of the amount or numbers of fish caught. However, logbooks do not require specific data on the weight or viability of retained catch nor do they collect any data on discarded sablefish (because it's illegal). Rather, the number of individual fish is recorded. In-season management and catch accounting use the weight of retained catch to track in-season apportionments and harvest limits. In order for discard estimates to be compatible with these practices, they too would need to reflect the actual weight of discarded sablefish, not just the number. In addition, information from logbooks is generally pooled and analyzed once on an annual basis, resulting in a one year lag between when any information from logbooks is available and when information on discard estimates would be required to be applied real-time. As described above, in-season management and catch accounting will require "real-time" estimations of discards in order to manage the fishery as it is executed. Logbooks as they are currently handled, do not allow for this.

8 Implications of these changes on overall stock abundance

In the first discussion paper, it was pointed out that Yield-per-Recruit (YPR) analyses do not show a biological benefit to the sablefish stock from discarding fish below a given age. Methods used in the cited YPR study (Lowe 1991) assume equilibrium recruitment and limit inference about the current stock given the highly variable year classes in recent years. An effort to explore population effects of discarding on the current Alaska stock of sablefish produced a set of hypothetical forecasts provided in the figures below (Figures 9-12). Note that these forecasts or scenarios are provided to facilitate discussion about the relative influence of assumed conditions and are not intended to predict the future status of the sablefish stock.

In these scenarios, discarding is presumed to be 100% accurate at returning fish to the water according to their age. Discards occur at two age cutoffs, specifically age 3 and below (roughly <65 cm; 26 in) and age 5 and below (<70 cm; 28 in). No projections were done that specifically considered a "voluntary" discard option that does not involve a size limit, however, assuming that discarding would be primarily small fish, these simulations should be useful for that as well.

All scenarios start at the stock assessment in 2018, which means that the 2014 year class is part of the 2019 ABC. Selectivity in the projections comes from the terminal (2018) assessment year and determines the catches of fish at age. In each year, the entire ABC is caught, but only consists of fish above the discard age 3 or 5 cutoffs. Hypothetical DMRs (12%, 20%, 50%, and 100%) are applied to fish below the discard age cutoffs, and these do not contribute to total catch at ABC. The effects of discarding are illustrated with regard to ABC (Figure 9), spawning stock biomass (SSB; Figure 10), abundance of older fish (Figure 11), and fishing mortality on older fish (Figure 12).

Although the 2019 ABC is caught in all of the conditions, future ABC declines very rapidly especially for scenarios where age 5 fish are discarded (Figure 9). The reason for this is that the achievement of ABC in the first year depletes the availability of older age classes for subsequent years, puts the stock lower on the control rule, and drops future ABCs. After several years, the large recent year classes not retained initially begin to contribute to the exploitable portion of the population and ABC increases in many cases. Note that the rapid declines in the age-5 discard scenarios are much greater than the effects of the assumed DMRs, however, within discard age groupings, the magnitude of the DMR affects the slope of the recovery (increases) in ABC over the longer term. This does not occur, of course when DMR is 100%.

The spawning stock biomass (SSB) scenarios are similar in shape to the ABC scenarios, except while ABC increases for low DMRs, none of the SSB trajectories are positive. Consistent with this, the abundance of older fish declines throughout the projected time frame. Fishing mortality increases most dramatically for the age 5 discard scenario but appears to level out as the control rule modulates ABC and would reach equilibrium in an extremely long time series.

A very important point in the configuration of the scenarios is that discard accounting did not contribute to the achievement of ABC. In other words, the effects would have been different if fishing in each year had stopped when the sum of discard mortalities and retained catch had achieved ABC. If that had been done, then the 100% mortality scenarios would likely have been very similar to the baseline, rather than the most divergent within each discard age grouping.

The simulation scenarios help illustrate several points: 1) Accounting for all sources of mortality for sablefish can reduce the potential for deleterious effects on ABC and SSB. 2) Shifting fishing mortality from abundant age classes to older age classes has potentially negative implications for the productivity of the stock. 3) The combined effects of assumed DMRs and the target age for discarding should be considered in establishing a discard allowance.

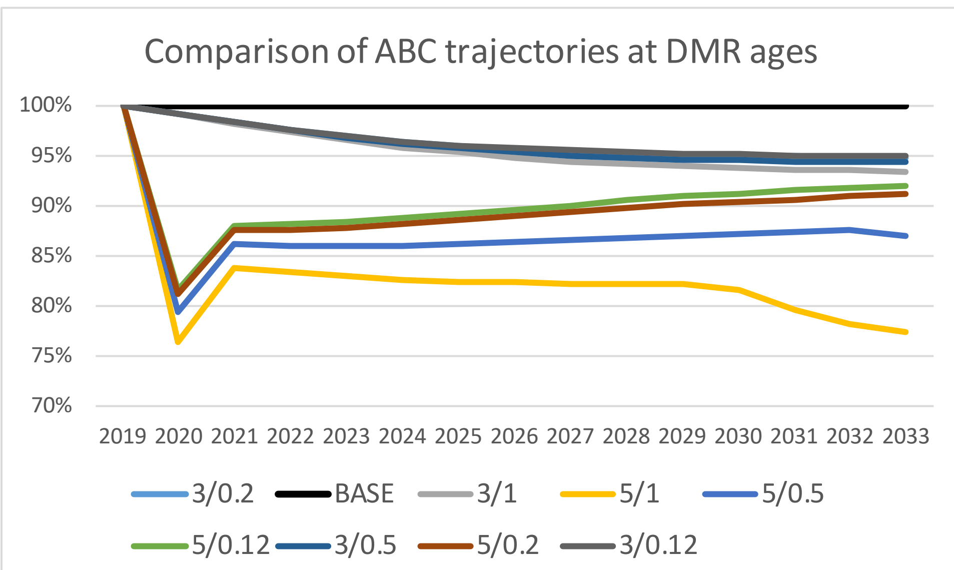

Figure 3. ABC trajectories for discarding scenarios. First number is the age of discarding and second number is the discard mortality rate (e.g. 5/0.12 means that all fish aged 5 and below are discarded with a DMR of 0.12).

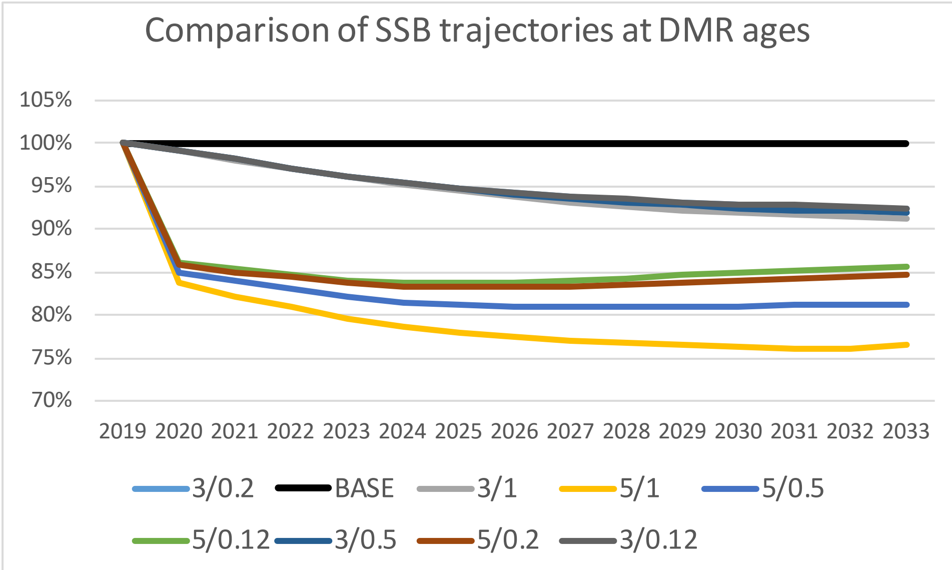

Figure 4. SSB trajectories for discarding scenarios. First number is age of discarding and second number is discard mortality rate (e.g. 5/0.12 means all ages 5 and below are discarded with a DMR of 0.12.

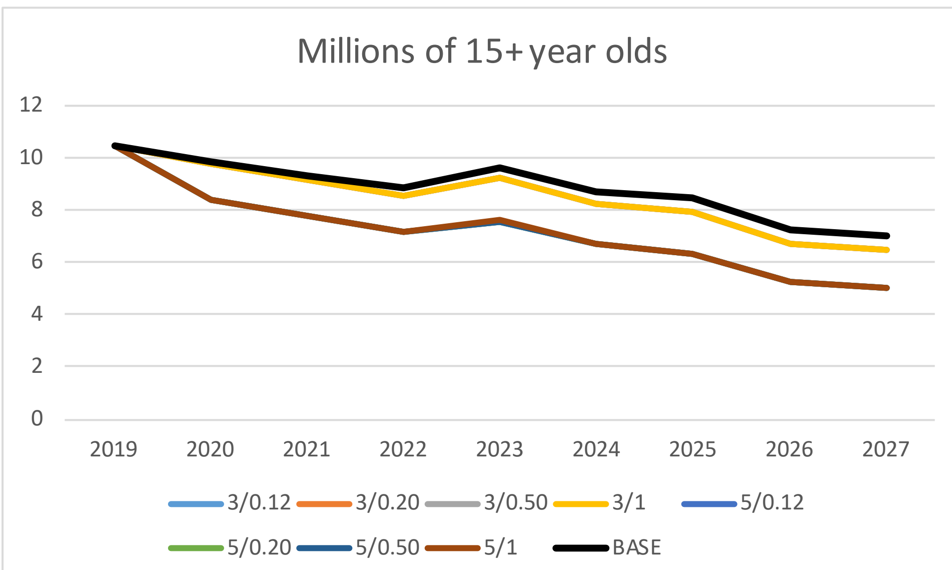

Figure 5. Age 15+ abundance trajectories for discarding scenarios. First number is age of discarding and second number is discard mortality rate (e.g. 5/0.12 means all ages 5 and below are discarded with a DMR of 0.12.

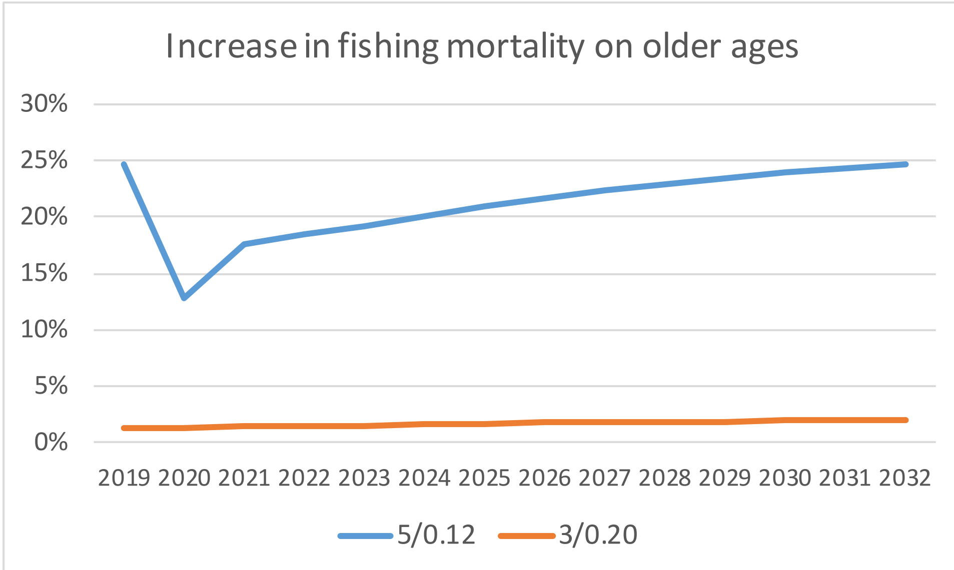

Figure 6. Fishing mortality trajectories for discarding scenarios. First number is age of discarding and second number is discard mortality rate (e.g. 5/0.12 means all ages 5 and below are discarded with a DMR of 0.12.

9 Conclusions

The Council will need to consider a wide range of offsetting issues if it wishes to pursue action to allow discarding in the IFQ sablefish fishery. The potential economic benefits to IFQ stakeholders from such an action have not been developed, however, trading in low value catch for potentially improved prospects has an appeal in its potential, at least, as does the possibility of operating under a regulatory structure that better accommodates adaptation to on-the-water conditions. Well-considered analyses of gains in catch value that would need to be achieved for individual operations to make up for catch that is discarded have probably been explored by stakeholders who support this action. Such analyses likely identify a price per pound in the retained catch for any hypothetical reduction in the total weight of that catch as well as a number of variables that would make discarding an unwise choice on a given day at the rail.

The major challenges with widespread adoption of a discarding allowance appear to be in the implementation of adequate monitoring and reporting mechanisms, so that an allowance for discarding does not result in an erosion of data quality for assessing the condition of the sablefish stock or for managing the fishery, both in-season, and through specifications. Additionally, an allowance for discarding within the structure of the IFQ program requires that discards be accounted for in real-time, which can only be done on a vessel-by-vessel basis.

If the Council wishes to further explore operational solutions to develop a discard option, a special provision may be needed that will allow investigative work to be done on a subset of IFQ vessels through an exempted fishing permit. This approach has been used in the past to develop gear modifications to reduce bycatch, to better account for bycatch, as well as to develop on deck procedures for reducing bycatch mortality. In this case, the need would be to develop for use, onboard methods that ensure that discarded sablefish are thoroughly accounted for with regard to quantity, weight, length, and release condition. Additional work could include a tagging program to improve DMR estimation. Any such project would need to occur for both hook-and-line and pot gear, and potentially in multiple areas and across vessel classes. If a viable approach is developed, the existing structure of the IFQ program would likely restrict its application to vessel operations that are able to support adequate vessel-level monitoring criteria. The costs of fulfilling any operational requirements identified from such a program would likely factor in variably across the IFQ fleet.

10 Acronyms

Acronym or Abbreviation	Meaning
ABC	Acceptable biological catch
ADFG	Alaska Department of Fish and Game
AI	Aleutian Islands
AFSC	Alaska Fisheries Science Center
AKFIN	Alaska Fisheries Information Network
BS	Bering Sea
BSAI	Bering Sea and Aleutian Islands
CAS	Catch Accounting System
CGOA	Central Gulf of Alaska
Council	North Pacific Fishery Management Council
CPUE	Catch per unit effort
DMR	Discard Mortality Rate
EGOA	Eastern Gulf of Alaska
EM	Electronic Monitoring
F	Fishing mortality rate

Acronym or Abbreviation	Meaning
FMP	Fishery management plan
GOA	Gulf of Alaska
IFQ	Individual Fish Quota
IPHC	International Pacific Halibut Commission
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fishery Service
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
Observer Program	North Pacific Groundfish and Halibut Observer Program
OY	Optimum yield
QS	Quota Share
SAFE	Stock Assessment and Fishery Evaluation
SOA	State of Alaska
SSB	Spawning Stock Biomass
SSC	Scientific and Statistical Committee
TAC	Total allowable catch
WGOA	Western Gulf of Alaska
YPR	Yield-per-recruit

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