Considering Management Tools to Limit Trawl Sablefish Overages

June 2021[1]

1 Introduction

In December 2020 the North Pacific Fishery Management Council (Council) passed a motion requesting that staff prepare a discussion paper to examine management tools that the Council may consider to limit or prevent overages of trawl sablefish area- and sector-specific allocations. The Council specified that the discussion paper should provide relevant data and consider management measures to address sector allocation overages that may include:

1. Time/Area closures
2. Reduced allocations to target species with high sablefish bycatch
3. Inter-cooperative agreements and incentive programs
4. Lower maximum retainable amounts (MRA) or extended MRA status (i.e., no trawl sablefish directed fishing)
5. Other actions taken by other Councils to manage to sector allocations.

The Council also directed that the discussion paper should include a discussion of management implications of restraining catch to regional, area and sector allocations, any benefits to the sablefish stock of reducing juvenile sablefish fishing mortality, and projected impacts to the trawl and fixed gear sectors.

The Council initiated this discussion paper in response to public comment and a letter submitted to the Assistant Administrator for NOAA Fisheries in October 2020, identifying a number of complaints about the trawl sector exceeding its sablefish allocation, concerns about exceeding established annual catch limits (ACLs), a perceived lack of accountability measures (AMs) to prevent exceedances, and how sablefish is apportioned between management areas and the setting of a statewide overfishing level (OFL). In addition to the management measure discussion requested by the Council, the paper also provides context for understanding sablefish ACLs and how they are managed, and sablefish catch in the

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trawl fisheries. This paper draws heavily from the 2020 Sablefish Assessment (Goethel et al., 2020) and several other Council analyses and discussion papers. Those papers are incorporated by reference.

2 Sablefish stock assessment and fishery management

2.1 Alaska sablefish stock and annual catch limits

The Magnuson Stevens Fishery Conservation and Management Act (MSA) National Standards (NS) require regional fishery management Councils to, among other things, make management decisions based on the best available scientific information (NS 2). In the case of sablefish management in Alaska, the best available science suggests that a single stock occupies the Bering Sea, Aleutian Islands, and Gulf of Alaska (Goethel et al. 2020). In December 2019 the SSC considered the appropriateness of continuing to specify sablefish overfishing limits (OFLs) at the separate BS, AI, and GOA management area levels, and decided the best scientific information available regarding stock structure for sablefish supports an Alaska-wide OFL specification. Therefore, based on biological considerations, the SSC recommended and the Council adopted the specification of a single Alaska -wide sablefish OFL beginning in 2020, which applies to the Bering Sea, Aleutian Islands and the GOA combined. Acceptable biological catches (ABCs) for sablefish continue to be specified by management areas, and the SSC and Council agreed with the Plan Team that a substantial reduction in the 2020 and 2021 ABCs from the maximum permissible ABCs was warranted.

The abundance of sablefish in Alaska has cycled between a number of peaks and valleys since at least the 1960s (Goethel et al. 2020). Low levels of abundance in the 1970s that were likely due to heavy fishing were followed by peaks in the mid 1980s associated with the exceptionally large year classes in the 1970s. Abundance was relatively stable from the late 1980s through 2000, but all indices showed a strong decline from the mid 2000s until about 2015 (Figure 1 in this paper, and Figures 3.3-3.4, 3.8b, 3.9, and 3.10a in Goethel et al. 2020). Since 2015, the abundance indices have shown considerable rebound, especially in the longline survey where 2020 catch represented the highest relative population numbers (RPNs) in the time series. The recovery has been dominated by several large year classes in 2014, 2016, and 2017 (Figure 2, Goethel et al. 2020).

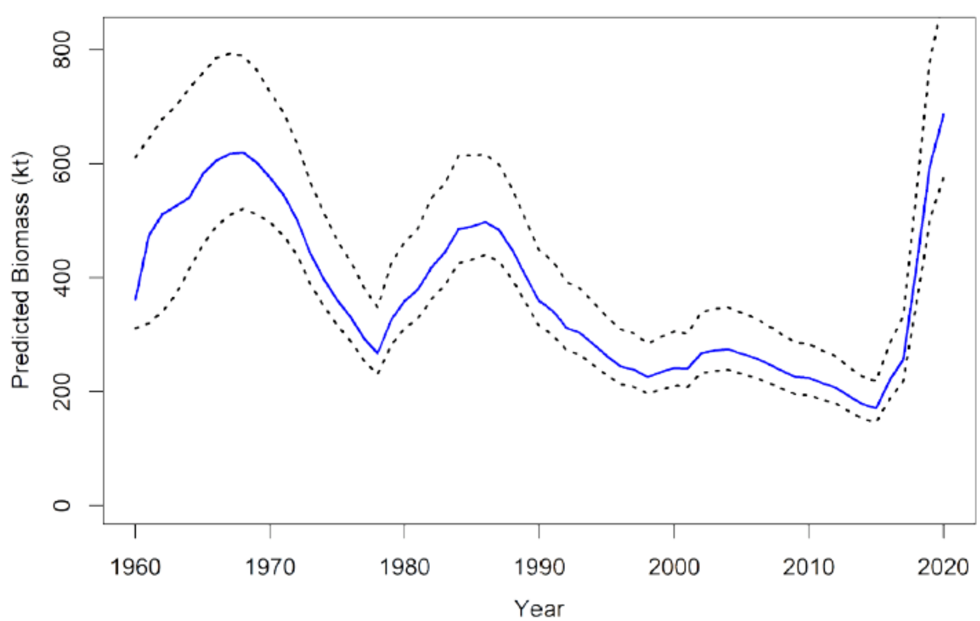

Figure 1. Estimated sablefish total biomass with 95% MCMC credible intervals. From Goethel et al. 2020.

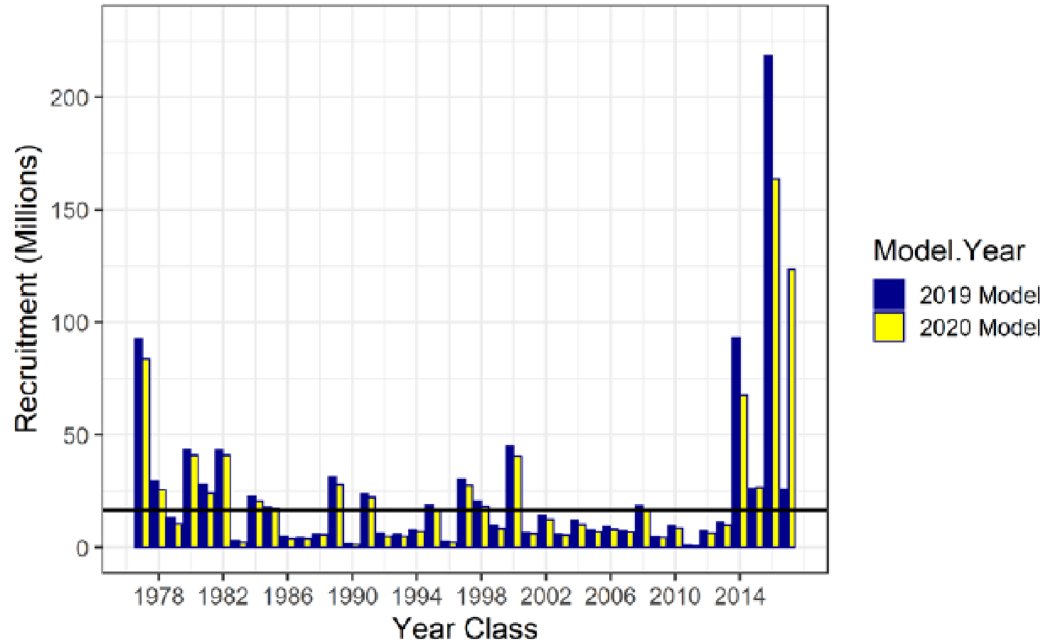

Figure 2. Estimated recruitment by year class (1977-2017) in number of age-2 fish (millions) for the 2019 and 2020 stock assessment models. Black line is mean recruitment. From Goethel et al. 2020.

Despite similar trends, spawning stock biomass (SSB) of sablefish has lagged recent increases in survey biomass because recent increases have consisted primarily of young, immature fish (Goethel et al. 2020). Spawning stock biomass reached a time series low in 2018, but was higher in 2019 (Figure 3). Terminal spawning biomass in 2020 is estimated to be 30% of unfished spawning biomass, and is expected to increase rapidly to around 42% of unfished spawning biomass in 2021.

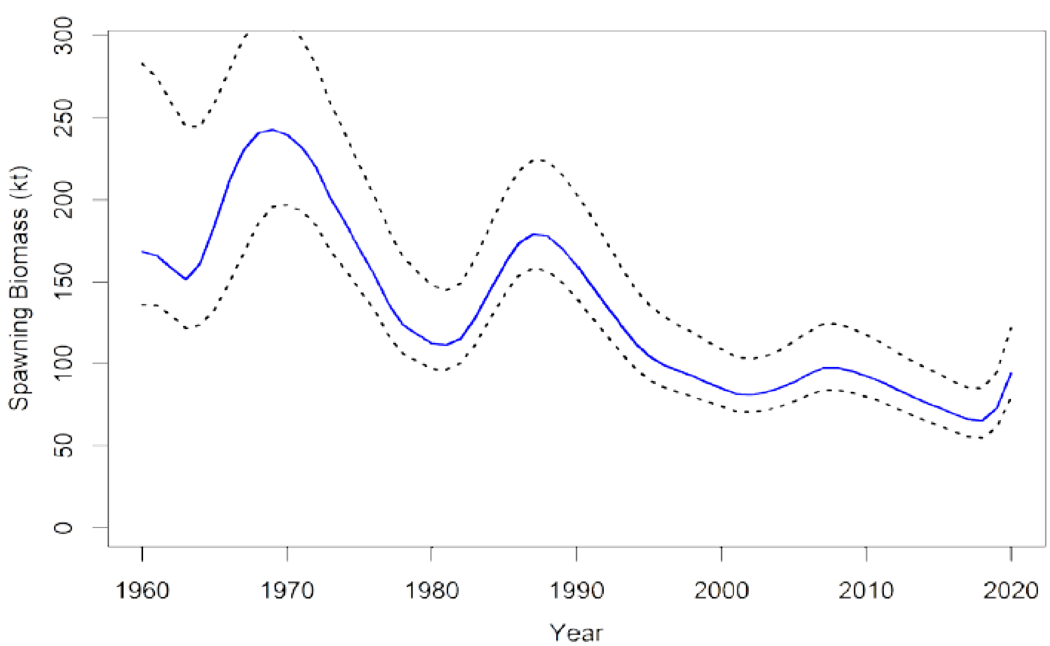

Figure 3. Estimated spawning stock biomass with 95% MCMC credible intervals. From Goethel et al. 2020.

Sablefish are managed under Tier 3 of NPFMC harvest rules. The biomass-based reference points in the 2020 assessment increased by 20% from 2019 (Goethel et al. 2020), primarily from incorporation of the strong 2016 year class in the calculation of reference points for 2020. Because the 2017 year class is estimated to also be large, a similar pattern for the 2021 assessment is likely. Current model projections indicate that this stock is not subject to overfishing, not overfished, and not approaching an overfished condition.

As a result of the strong recent year classes and the lag in increases in spawning stock biomass, the age composition of sablefish in Alaska is skewed toward younger fish (Figure 4). Coincident with the large increase in the numbers of immature sablefish, large catches of small, low-value sablefish occurred in both the sablefish Individual Fishing Quota (IFQ) longline and pot fisheries[2] and pelagic and non-pelagic trawl fisheries (Goethel et al. 2020). Sablefish IFQ participants are currently required to retain all sablefish, but the Council has initiated analysis of an FMP amendment to remove the regulatory requirement and to allow IFQ fishermen to discard small, low-value sablefish. In general (except for the Central GOA Rockfish Program), trawl fisheries target other species and may retain sablefish up to the maximum retainable amount (MRA) for their target species (see Section 2.3 for further detail), until the trawl sablefish allocation is reached. Once their allocation is reached, NMFS prohibits retention and trawl fisheries are required to discard any sablefish caught incidentally during their target fishing for other species. Other than the requirement to discard sablefish once the allocation is reached, there are no other requirements to further avoid sablefish for the trawl sector. If total catch of sablefish for all gear types combined nears the statewide OFL, all retention by any gear type, directed and incidental, may be prohibited. However, there are several factors to consider when issuing an overfishing closure, §679.20(d)(3). Because the ABC in 2020 and 2021 has been substantially reduced from ABC_{max}, there is little likelihood that total catch will approach the OFL.

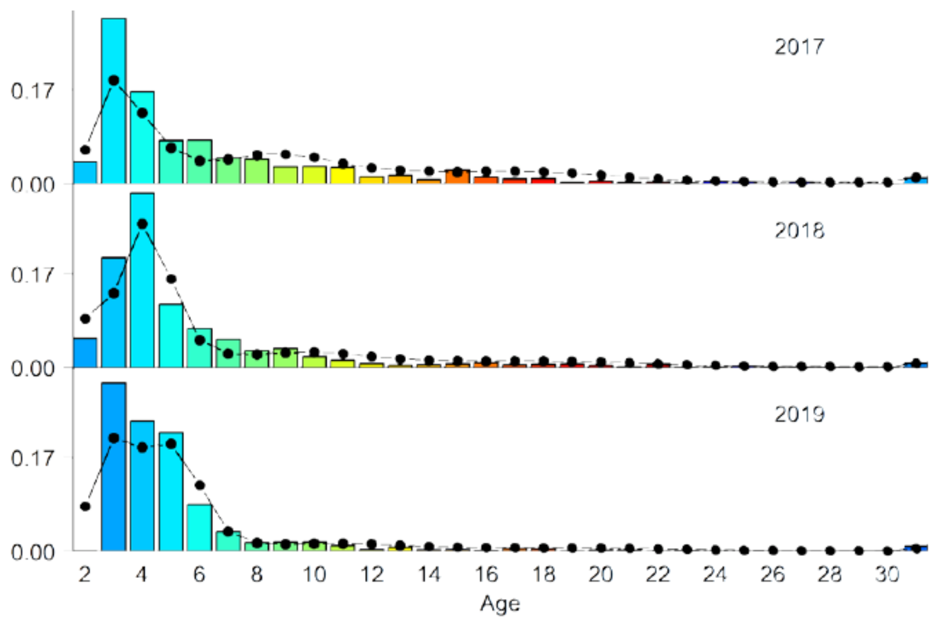

Figure 4. Domestic longline survey sablefish age composition. Y axis is proportion of population. Select years from Figure 3.24 in Goethel et al. 2020.

[2] Initial Review Draft EA/RIR for Proposed Amendments to the Fishery Management Plans for BSAI and GOA Groundfish. IFQ Sablefish Release Allowance. February 2021.

The NPFMC stock assessment process allows for the ABC to be set below the maximum permissible ABC (ABC_{max}) if the author provides the rationale, and the SSC concurs, that there is sufficient justification and assessment uncertainty. A risk table approach has been developed to qualitatively determine the perceived level of risk associated with the assessed stock. Goethel et al., 2020 applied the risk table to the sablefish stock assessment, and concluded that there was "substantially increased concern" to "major concern" for sablefish in 2020 (Table 1).

Table 1. Risk table summary for the 2020 Sablefish assessment. From Goethel et al., 2020.

Assessment Related Considerations	Population Dynamics Considerations	Environmental and Ecosystem Considerations	Fishery Performance Considerations
Level 3: Major concern	Level 3: Major concern	Level 2: Substantially increased concern	Level 3: Major concern

Goethel et al., 2020 noted that although there are positive signs of strong incoming recruitment, concerns exist regarding the lack of older fish contributing to the spawning biomass, the uncertainty surrounding the estimates of strength of the 2014, 2016, and 2017 year classes, and ambiguity related to how existing environmental conditions may affect the success of these year classes in the future. Goethel et al., 2020 felt that these concerns warranted additional caution when recommending the 2021 and 2022 ABCs. The SSC and Council concurred that an adjustment from ABC_{max} was warranted, but recommended a different ABC reduction than suggested by the assessment authors. The SSC recommended, and the Council approved, a stairstep approach by increasing 25% of the range from the 2020 ABC to ABC_{max}, resulting in a whale-adjusted (Goethel et al., 2020) ABC of 29,588 t, compared to ABC_{max} of 52,427 t and a statewide OFL of 60,426 t. Therefore, because of the precaution shown in establishing ABC, the increase in biomass, particularly in young, small fish has greatly outpaced the increase in ABC and the associated TACs.

Overall, Alaska-wide sablefish Annual Catch Limits and total catch are well below the biomass estimates from the annual stock assessments, as shown in Table 2 and Figure 5. In recent years, the sablefish ABCs have been set at a precautionary level relative to maxABC, and TACs have also been set at a precautionary level relative to the ABC. In 2020 and 2021, the Council recommended sablefish TACs lower than the ABCs to accommodate their concerns about the amount of harvest in the trawl and fixed gear fisheries, and to address economic and market considerations, primarily in the fixed gear IFQ fisheries. The TAC is then further allocated between gear sectors (Figure 6), and then in the BSAI, also to CDQ and non-CDQ sectors. As shown in Figure 6, the trawl sector has exceeded its sablefish allocation for the last three years as encounters with small sablefish have increased. A consequence of setting TACs low relative to the maximum permissible ABC is that it becomes more difficult to avoid encounters when strong recruitment is driving a greater abundance of fish in the water. This is also true for the fixed gear sector, but the different IFQ management program largely prevents the possibility of overages in that program.

Table 2 2013 to 2020 Alaska wide Sablefish Biomass, Annual Catch Limits (OFL, ABC, TAC) and Total Catch

YEAR	Catch	TAC	ABC	MAX ABC[1]	OFL	Biomass
2013	13,781	16,230	16,230	16,230	19,180	192,000
2014	11,597	13,772	13,772	13,722	16,225	178,000
2015	11,013	13,657	13,657	13,657	16,128	171,000
2016	10,252	11,795	11,795	11,795	13,396	221,000
2017	12,330	13,083	13,083	13,509	15,428	256,000
2018	14,402	14,957	14,957	25,583	29,507	421,000
2019	16,695	15,068	15,068	28,171	32,798	597,000
2020	19,165	18,293	22,009	44,065	50,481	687,000

[1] Maximum permissible ABC, as determined in the sablefish stock assessment
Source: NOAA AKR Sustainable Fisheries Catch Accounting

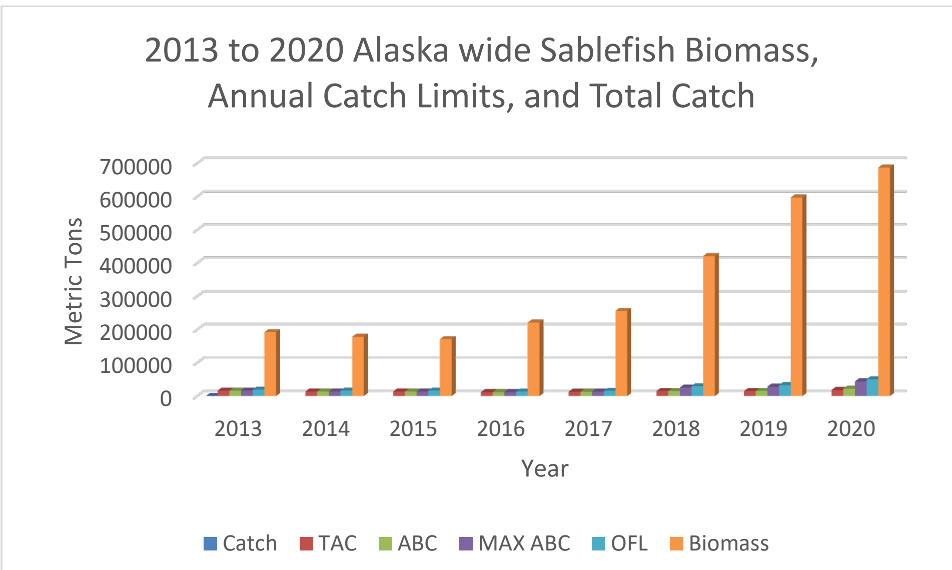

Figure 5 2013 to 2020 Alaska-wide sablefish biomass, annual catch limits, and total catch. Source: NOAA AKR Sustainable Fisheries Catch Accounting.

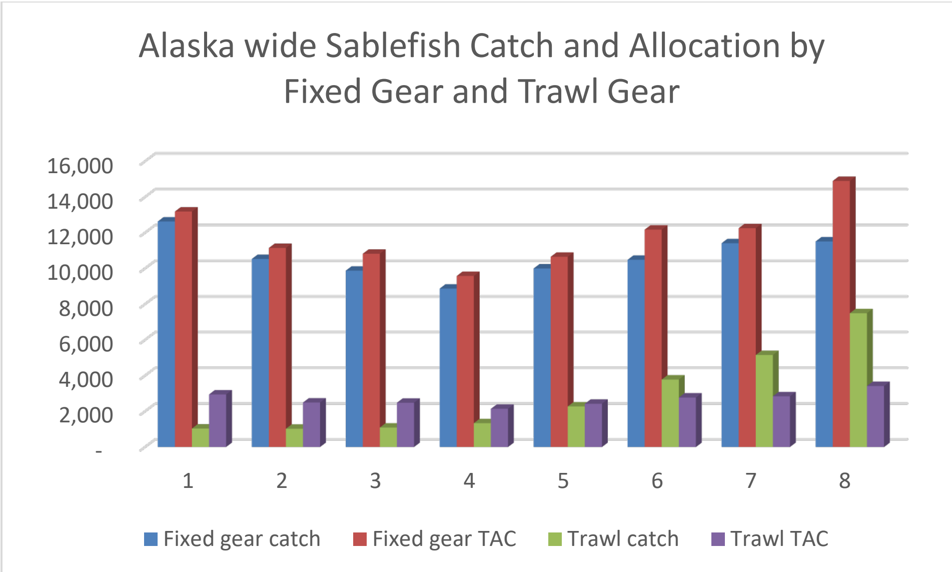

Figure 6 **Alaska-wide sablefish catch and allocation, by fixed gear and trawl gear. Source: NOAA AKR Sustainable Fisheries Catch Accounting**

2.2 Quota Allocation

In 1985, Amendment 14 to the GOA FMP allocated sablefish TAC by gear type: 80% to fixed gear (including pots) and 20% to trawl in the western and central GOA, and 95% to fixed gear and 5% to trawl in the Eastern GOA. In the Central GOA, 6.78% for trawl CVs and 3.51% for trawl CPs of the Central GOA total TAC is allocated to the Rockfish Program cooperatives and is deducted from the Central GOA trawl gear allocation of the TAC. Amendment 15 to the BSAI FMP allocated sablefish quota by gear type: 50% to fixed gear and 50% to trawl in the eastern Bering Sea (EBS) and 75% to fixed gear and 25% to trawl gear in the AI, effective in 1990. In the BSAI, the gear allocations are further allocated between CDQ and non-CDQ. Section 679.20(b)(1)(ii)(B) requires 20 percent of the fixed gear allocation to the CDQ reserve for each subarea. Also, § 679.20(b)(1)(ii)(D)(1) requires that in the Bering Sea and Aleutian Islands, 7.5 percent of the trawl gear allocation of sablefish TAC from the non-specified reserve be assigned to the CDQ reserve. In the BSAI and the GOA, the fixed gear allocations (non-CDQ in the BSAI) are fully allocated to the IFQ program and no fixed gear sablefish is set aside for incidental catch by vessels without IFQ.

2.3 Maximum Retainable Amounts

Maximum Retainable Amounts (MRAs) are the maximum amount of a species closed to directed fishing that may be retain onboard a vessel. MRAs are calculated as a percentage of the weight of catch of each species or species group open to directed fishing (basis species) that is retained onboard the vessel. The percentage of a species or species group closed to directed fishing retained in relation to the basis species must not exceed the MRA. MRAs are the primary management tool for trawl-caught sablefish and sablefish can be retained if caught incidentally, up to the specified amounts. The MRAs for sablefish vary by basis species. In the GOA (Table 10 to 50 CFR part 679) the MRAs are: 1% for pollock, Pacific cod, Atka mackerel, arrowtooth flounder, “other species”, and aggregated amounts of non-groundfish species, 7% for deep flatfish, rex sole, flathead sole, shallow flatfish, Pacific ocean perch, northern rockfish, dusky rockfish, and demersel shelf rockfish in the Southeast Outside district, and thornyhead rockfish. In the BSAI (Table 11 to 50 CFR part 679), they are: 1% for pollock, Pacific cod, Atka mackerel, arrowtooth flounder, Kamchatka flounder, rock sole, yellowfin sole, Alaska plaice, other flatfish, and aggregated amounts of non-groundfish species, 15% for flathead sole, Greenland turbot, Pacific ocean perch, northern rockfish, blackspotted/rougheye rockfish, shortraker rockfish, and other rockfish, and 3% for "other species". All sablefish catch above the MRA must be discarded.

2.4 Area Allocation of Harvests

Sablefish is spatially apportioned among the Bering Sea, Aleutian Islands, Western GOA, Central GOA, Western Yakutat, and Southeast Outside management areas. For other groundfish stocks, the spatial apportionment is based on the abundance of the species in each area as determined in the survey. In December 1999, the Council apportioned the 2000 ABC and OFL based on a 5-year exponential weighting of the survey abundance index and fishery catch-per-unit-effort data. This apportionment strategy was used for over a decade. However, in 2011 assessment authors determined that the objective to reduce variability in apportionment was not being achieved using the 5-year exponential weighting method. Because of high annual variability in apportionment, the SSC fixed the apportionment at the proportions from the 2013 assessment until the apportionment scheme was reevaluated and reviewed. The fixed apportionment scheme has been used since 2013. Research on alternative apportionment methods is underway and is summarized in Appendix 3D of the 2020 Sablefish Assessment (Goethel, et al., 2020). A 2016 CIE review concluded that there was no immediate biological concern with the fixed apportionment, given the high mixing rates of the stock.

Regional ABC apportionment to management areas can result in different impacts on the population, depending on assumptions present in the apportionment scheme. Historically, young fish have been observed first in the western areas (BS, AI, Western GOA), and older mature fish are more prevalent in eastern areas (Central and Eastern GOA). The location of catches in periods of high abundance can have an impact on different portions of the sablefish population-at-age: high catches in the western areas may lead to higher mortality on younger fish when above average year classes dominate, and high catches in eastern areas may have higher impact on SSB. Recent high recruitment events have shifted the age structure of the population to younger fish (Figure 4), and resulted in higher directed and incidental catch of those younger fish. However, there is not sufficient information to determine what impact that may have on population rebuilding, but given the magnitude of recent large year classes, it is unlikely that moderate increases in catch of young fish will harm the stock (Goethel et al. 2020). Conversely, purposefully avoiding young fish may inadvertently lead to increased mortality on larger, mature fish (Goethel et al., 2020), which could result in further truncation and reductions in the spawning stock. Impacts could be exacerbated further if recent year classes do not materialize at the strength estimated by the assessment.

Recent modeling work has suggested that different apportionment methods could have different impacts on the sablefish population. However, there is not currently enough information on spatial processes to adequately determine whether specific apportionment methods create a conservation concern (e.g., localized depletion, age truncation, or year class reduction) for the sablefish population. The results of simulation work indicate that an apportionment of ABC to the six management regions can be conducted in numerous ways with little variability in the average implications for the population. This is primarily due to the high movement rates exhibited by sablefish and the existing harvest control rule and management framework. Spawning fish and juvenile fish are found in all management areas, but there are not sufficient data to understand if the Alaska sablefish population is dependent on one or more productive spawning locations or juvenile habitats to sustain the population. Without this information, Goethel et al. (2020) suggest it is important to protect spawning biomass in all management areas and maintain fishing mortality on immature fish at reasonable levels.

Several recent above average year classes are entering the population following a period of low recruitment. The period of low recruitment had led to increased pressure on the mature spawning biomass (SSB) because of their predominance in the harvestable population and higher value than smaller fish. The influx of high recruitment year classes has raised concerns about removing too many young fish before they mature and contribute to the spawning population. Public comment at several Council meetings has suggested that alternative apportionment methods should be considered and implemented. The Council, SSC, and Plan Teams continue to discuss apportionment methods, but that discussion is beyond the scope of this discussion paper. Research into different apportionment methods is currently being conducted, but a full summary of that research is beyond the scope of this discussion paper. Readers are directed to Appendix 3D in the 2020 Sablefish Assessment (Goethel et al., 2020) and the report[3] of the December 2020 SSC meeting for more information.

3 Trawl sablefish catch

Trawl fisheries have exceeded several area-based trawl sablefish allocations in recent years (Table 3). Catch data suggest that this is a recent occurrence coincident with incoming large year classes (Figure 1, Figure 2), and occurs primarily in the Bering Sea and Central GOATable 3. Figure 7 and Figure 8 show the distribution of sablefish trawl catch in the BSAI and GOA from 2018 through 2020 in the pollock and other target fisheries. The figures show that there are some areas of higher sablefish catch that could be considered "hot spots". However, those areas are also areas of high target species catch and effort. Rather than showing areas where more sablefish are present, it is likely that the figures reflect higher target effort, and resultant higher incidental sablefish catch.

Before 2016 total sablefish catch in the trawl fisheries was less than 5% of the trawl allocation of the TAC in the BS, AI, and Western GOA, and less than 60% of the TAC in the Central GOA (Table 3. The Amendment 80 trawl fleet retains sablefish up to the maximum retainable amount when sablefish is encountered, to comply with Council direction to increase groundfish retention in the Amendment 80 program. In most, but not all, years since 2013 the Amendment 80 trawl sablefish catch has been higher than the AFA pollock trawl catch (Table 4). However, since 2018 the AFA CV sector sablefish catch has increased markedly over their catch from 2013 through 2017 (Table 4). Again, this is coincident with the large increase in young sablefish observed in the surveys. Table 5 shows the total trawl sablefish catch by sector in the GOA. Table 6 shows the temporal distribution of sablefish catch in the BSAI and GOA trawl fisheries, in recent years the vast majority of catch has occurred after June 10.

[3] https://meetings.npfmc.org/CommentReview/DownloadFile?p=83259122-e0fc-4412-9cac-73f3ea722dad.pdf&fileName=SSC%20Report%20Dec%202020%20FINAL%20.pdf

Table 3 **Total trawl sablefish catch in the Bering Sea, Aleutian Islands, Western Gulf of Alaska, and Central Gulf of Alaska from 2013 – 2020. The Bering Sea and Aleutian Islands includes CDQ Trawl, pollock, and Amendment 80 fisheries. From National Marine Fisheries Service Alaska Region, Sustainable Fisheries Catch Accounting.**

Bering Sea	Catch (t)	Quota (t)	Remaining Quota (t)	% Taken
2020	4468	931	-3537	479.91
2019	2506	745	-1761	336.38
2018	1017	732	-285	138.93
2017	679	637	-42	106.59
2016	257	532	275	51.69
2015	17	617	600	2.76
2014	34	619	585	5.49
2013	134	731	597	18.33

Aleutian Islands	Catch (t)	Quota (t)	Remaining Quota (t)	% Taken
2020	695	509	-186	136.54
2019	241	502	261	48.01
2018	178	459	281	38.78
2017	129	402	273	32.09
2016	30	360	330	8.33
2015	16	417	401	3.84
2014	26	419	393	6.21
2013	58	495	437	11.72

Western GOA	Catch (t)	Quota (t)	Remaining Quota (t)	% Taken
2020	183	388	205	47.16
2019	320	316	-4	101.27
2018	224	309	85	72.49
2017	66	270	204	24.44
2016	47	255	208	18.43
2015	43	295	252	14.58
2014	61	296	235	20.61
2013	13	350	337	3.71

Central GOA	Catch (t)	Quota (t)	Remaining Quota (t)	% Taken
2020	2064	1289	-775	160.12
2019	1960	1036	-924	189.19
2018	2124	1032	-1092	205.81
2017	1192	903	-289	132.00
2016	826	805	-21	102.61
2015	802	932	130	86.05
2014	752	936	184	80.34
2013	660	1108	448	59.57

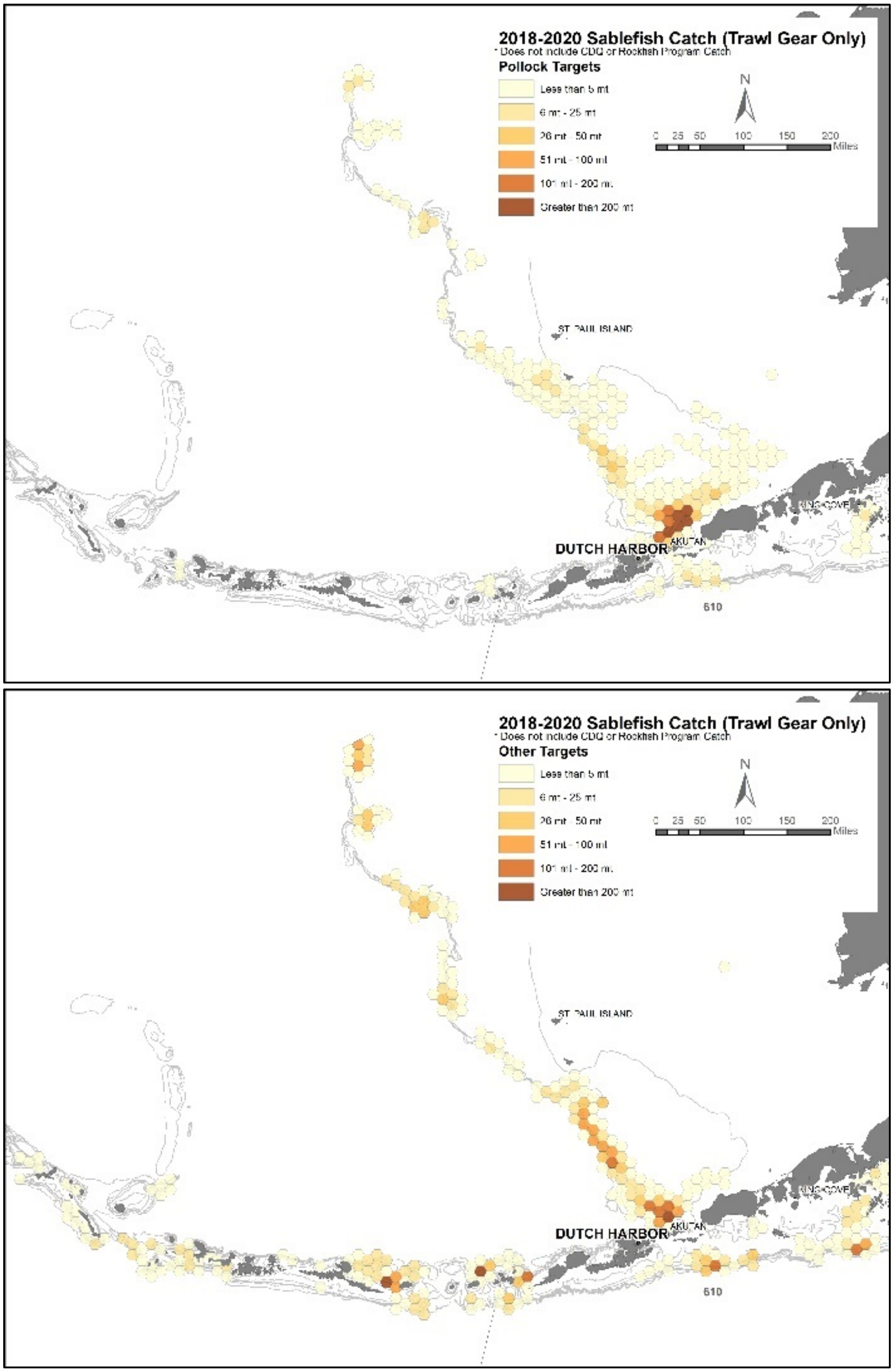

Figure 7. **Distribution of sablefish catch by pollock (top) and other target (bottom) trawl fisheries in the BSAI from 2018-2020. Does not include CDQ catch. Source: NOAA AKR Sustainable Fisheries Catch Accounting.**

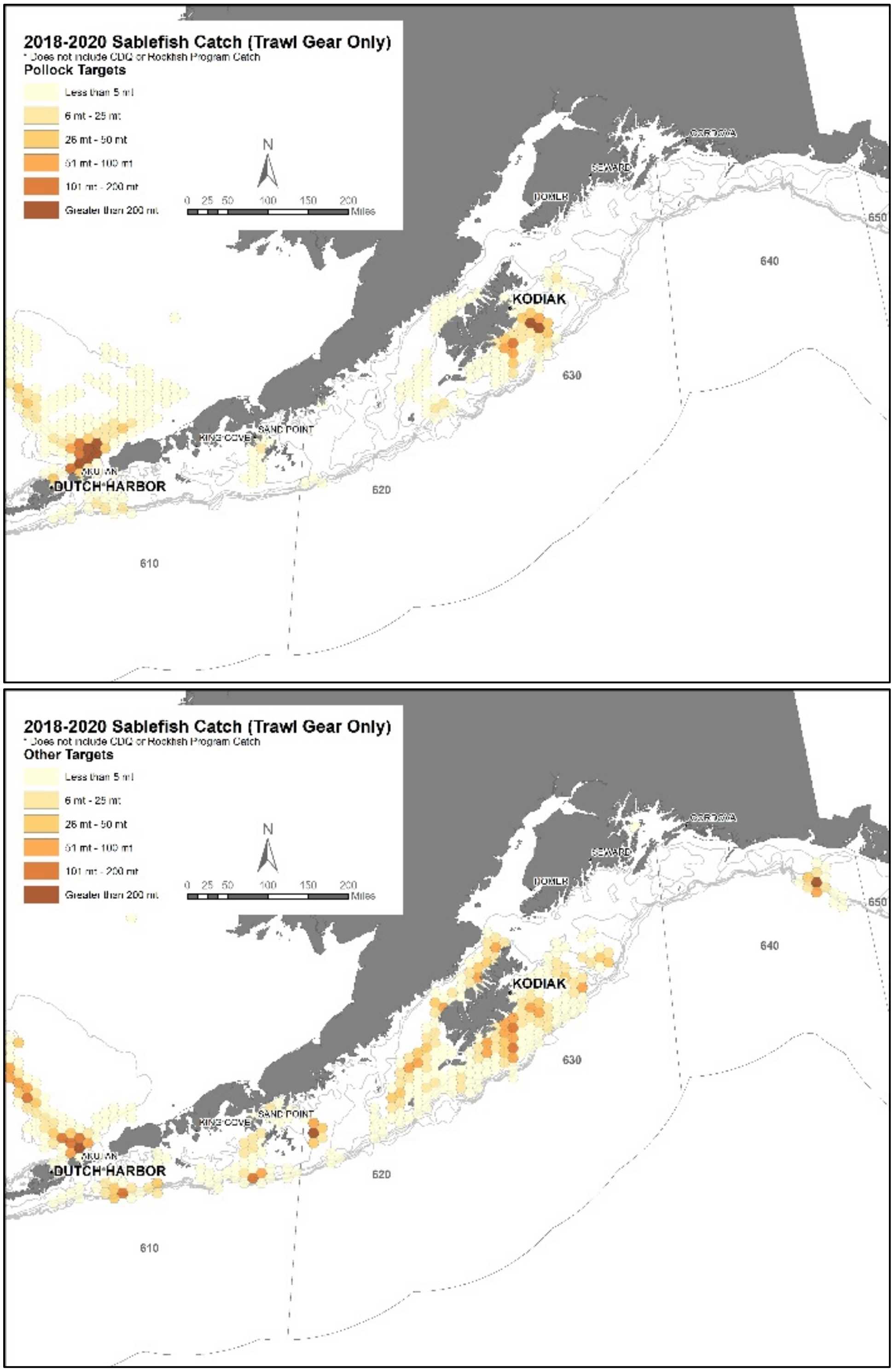

Figure 8. Distribution of sablefish catch by pollock (top) and other target (bottom) trawl fisheries in the GOA from 2018-2020. Does not include Rockfish Program catch. Source: NOAA AKR Sustainable Fisheries Catch Accounting.

Table 4. Bering Sea trawl sablefish total catch by sector. Source: NOAA AKR Sustainable Fisheries Catch Accounting.

YEAR	Amendment 80	AFA pollock	CDQ	Open Access
2020	1,057	3,393	15	3
2019	1,272	1,186	45	3
2018	596	385	32	4
2017	561	86	30	1
2016	226	16	15	0
2015	17	0	0	0
2014	33	0	1	0
2013	129	0	5	0

Table 5. Gulf of Alaska trawl sablefish total catch by sector. Source; NOAA AKR Sustainable Fisheries Catch Accounting.

YEAR	Open Access	Central GOA Rockfish Program
2020	1,698	633
2019	1,893	514
2018	2,073	510
2017	1,039	426
2016	650	399
2015	601	456
2014	484	481
2013	303	543

Table 6. Bering Sea (left) and GOA (right) trawl sablefish catch in the first half and second half of the calendar year. Source: NOAA AKR Sustainable Fisheries Catch Accounting.

	Bering Sea Trawl		GOA Trawl	
Year	Jan 1 – Jun 10	Jun 10 – Dec 31	Jan 1 – Jun 10	Jun 10 – Dec 31
2020	557	3,895	298	1,400
2019	257	2,204	356	1,537
2018	457	528	599	1,474
2017	385	263	173	866
2016	109	133	160	491
2015	12	4	58	544
2014	6	27	105	379
2013	24	105	31	272

3.1 Operational factors

The trawl fisheries in the BSAI and GOA operate under a number of sector- or cooperative-level hard caps and PSC limits which influence their ability to respond to emerging incidental catch encounters. In the MSA, the term "bycatch" means “fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards.” Sablefish are considered bycatch in the trawl fisheries when the MRA limit has been reached and they are required by regulation to be discarded.

Amendment 80

The Amendment 80 sector works with the most varied portfolio of allocated target species in a catch share program as well as profitable groundfish species that are not allocated to the Amendment 80 Program, such as sablefish. Vessel operators must make complicated decisions that consider allocated and non-allocated target species, PSC limits for species such as halibut, and “choke species” such as Pacific cod to decide when and where their vessels operate. Amendment 80 companies and vessel operators must also work within constraints of area closures and exclusions areas (e.g., crab protection zones) and may be preempted by fixed-gear vessels in Federal- or state-water fisheries. Further, vessel operators must consider temporal patterns of target catch and PSC: an Amendment 80 vessel that experiences intolerable Pacific cod bycatch or halibut PSC rates in an early-season flatfish target might switch focus to another target to set aside Pacific cod TAC or halibut PSC limits to support fisheries that occur later in the year. Vessel operators may not be able to move to the AI or GOA fisheries if unacceptable conditions are encountered in the BS early season. A simple data report on annual harvest volume and gross revenue does not reflect how species are physically comingled, or the decisions that vessel operators make to derive value from trawl tows.

The allocation of BSAI non-pollock species to Amendment 80 CPs has allowed companies to plan for groundfish fisheries that span most of the calendar year. Many vessels strive to stay working from January 20 to November, and participants report that most Amendment 80 companies rely on a full and varied season to remain profitable. When constraints such as high bycatch rates emerge, vessel operators do not have the option to cease fishing completely because cost accrual on such large platforms would be unsustainable. As a result, Amendment 80 operators generally do not follow a uniform progression from one target to the next over the course of a season, rather annual fishing plans are designed with contingencies in mind to stay active and look for areas with the right species combinations in place, even if it is a time or area where history would not have predicted. Vessel operators communicate information about bycatch rates to keep potentially limiting bycatch as low as possible. Furthermore, there is a large difference in quota allocations between the five Amendment 80 companies. For those companies more dependent upon flatfish and without Aleutian Islands fisheries, incidental catches of other species such as Pacific cod and halibut become limiting at times. This can move vessels into arrowtooth flounder to avoid Pacific cod and halibut.

More detail on the operations of Amendment 80 vessels can be found in other Council analyses, such as the BSAI Halibut ABM PSC Limits Analysis[4], and readers are directed to that publication for more details of the existing program.

<u>AFA and CDQ pollock</u>

The pelagic pollock trawl fisheries in the BSAI operate within a number of bycatch and PSC hardcaps that are monitored closely by the cooperatives. The most recent and significant Council action includes the development of measures to minimize the incidental catch of Chinook and chum salmon. These measures have focused primarily on closure areas and PSC limits. Experience over time has shown that the industry, working cooperatively, can more effectively avoid salmon bycatch by sharing data and using a system of short-term closures in areas where higher rates of salmon bycatch occur, and by using salmon bycatch excluders in pollock trawl nets.

In 2011, Amendment 91 to the BSAI Groundfish FMP established two Chinook salmon PSC annual limits for the pollock fishery; 60,000 total, and a 47,591 performance standard. Under Amendment 91, the 60,000 Chinook salmon PSC limit is for the entire pollock fishery fleet participating in an industry-develop contractual arrangement, known as an incentive plan agreement (IPA). An IPA establishes a program to minimize bycatch of Chinook salmon at all levels of Chinook abundance. The 47,500 Chinook performance standard ensures that the IPA is effective and that all sectors cannot fully harvest the total 60,000 limit under most years. Each sector is annually issued an annual threshold amount that represents the sectors' portion of the 47,591 Chinook salmon performance standard. Each sector is expected to remain under its performance standard threshold in most years, with provisions to allow overages no more than twice in any consecutive seven years. The program provides pollock fishery

[4] https://meetings.npfmc.org/CommentReview/DownloadFile?p=d824f6a2-6077-4687-815e-c08742d7c1ed.pdf&fileName=C2%20BSAI%20Halibut%20ABM%20PSC%20Limits%20Analysis.pdf

participants with incentives to limit Chinook salmon bycatch to the performance standard, but provides the fleet with flexibility to adapt to unanticipated changes in the fishery due to weather, operating conditions, or the status of target or bycatch species stocks.

In 2016, Amendment 110 to the BSAI Groundfish FMP modified the IPAs to add Chum salmon bycatch avoidance measures into the existing IPAs, and to reduce allowable Chinook salmon bycatch in years of low Chinook salmon abundance. The amendment added provisions to provide incentives to avoid Chinook and chum salmon under any condition of pollock and Chinook salmon abundance, rewards for avoiding Chinook salmon, penalties for failing to avoid Chinook salmon at the vessel level, and a new lower performance standard (33,318) and total limit (45,000) for the pollock fishery in years following low Chinook salmon abundance in western Alaska, as determined by a three-river system index based on post-season in-river Chinook salmon run sizes on the Kuskokwim, Unalakleet, and Upper Yukon aggregate stock grouping.

The CDQ, CV, CP, and mothership sectors have developed methods to track rates of bycatch for multiple species, including Chinook and chum salmon, herring, and sablefish. Bycatch data are used to identify “hotspots” where bycatch rates are higher. If rates are unacceptably high, the cooperatives can enact temporary closures for some or all of their cooperative members in areas with high bycatch rates. The assumption is that moving the fleet away from areas of higher bycatch rates will, overall, reduce the cooperative’s annual bycatch for important species. Readers are directed to the cooperative reports from the April 2021 Council meeting[5] for additional details.

4 Potential management measures to prevent trawl sablefish overages

In the December 2020 motion, the Council requested that staff consider management measures to address sector allocation overages such as:

1. Time/Area closures;
2. Reduced allocations to target species with high sablefish bycatch;
3. Inter-cooperative agreements and incentive programs;
4. Lower MRAs or extended MRA status;
5. Other actions taken by other Councils.

The following sections address each of these, but do not attempt to predict the effect that implementing each of these may have on total sablefish catch, or quantitatively predict the impact on trawl or fixed gear sectors. When possible, staff have included qualitative summaries of potential impacts to each sector, with the caveat that predicting the behavior of the fleet under hypothetical management measures is difficult.

4.1 Time/Area closures

The Council and NMFS have enacted time/area closures to address issues including bycatch reduction, rebuilding stocks at low abundance, habitat protection, and protection for species on the U.S. Endangered Species List. The effectiveness of these closures has been debated for many years and is again beyond the scope of this discussion paper.

Time and area closures may be more effective when the target of concern (bycatch species, habitat area, etc.) is defined in either area or time. An example of effective closures could be the “coral garden” protected areas that were closed to all bottom-contact fishing gear in 2005. These six Habitat Conservation zones total 110 nm^2 with exceptionally high density coral and sponge habitat. Because these

[5] https://meetings.npfmc.org/Meeting/Details/1945

are discrete areas designed to protect habitat for immobile, benthic species a closure is an effective method to reduce the potential impacts to the habitat or species. Sablefish are not bound by either time or space, and with the remarkable recruitment of recent year classes, appear to be ubiquitous on the BS and GOA fishing grounds (Table 6, Figure 7, Figure 8). It may, therefore, not be possible to identify locations or times when targeted closures could affect the overall rates of sablefish catch in trawl fisheries. It is possible that any closures would shift fishing effort to areas where the rates of bycatch are as high or higher than in the closed areas. If bycatch rates are lower where the fleet redeploys, then overall bycatch rates of sablefish could be reduced. However, if the fleet is moved from areas of high target CPUE to lower CPUE, but bycatch rates are unchanged or higher, it is possible that overall sablefish bycatch could be increased by a closure. Also, closures to reduce the catch of one species can often result in moving vessels into areas that have increased catch of another species like halibut or salmon. Both the AFA pollock and Amendment 80 sectors have examples of moving to avoid one species and increasing the incidental catch of another species. The Bering Sea pollock and Amendment 80 cooperative management is more effective and efficient than NMFS management to implement time and area closures. The cooperatives may receive information through direct communication with their vessels and close an area or move their members fishing locations to avoid a high incidental or bycatch species sooner than NMFS can issue a closure. NMFS must publish closures in the Federal Register to be effective and areas with high incidental or bycatch may have changed before a closure is effective.

With any time/area closure, it is likely that affected operators will redeploy their fishing effort to adjacent areas where they may expect to make up catch, and gross revenue, put at risk by the closure. Some of the vessels that participate in the potentially affected fisheries operate within fishing cooperatives, and these cooperative arrangements may assist them in locating adjacent fishing areas with comparable CPUE and lower bycatch rates. Past catch reprojection analyses have attempted to identify where catch may be made up for fisheries where time/area closures have been considered. Such analyses have shown that there are cases where widespread dispersal of the catch reprojection may lead to increased operating costs due to the need to make additional sets, lifts, or tows, as well as increased searching and running time (NMFS 2014). Those analyses have not, however, found that catch may actually be foregone. Rather it is more likely that operational costs may increase due to the relative production inefficiency imposed by the constraint.

Ontogenetic changes in sablefish distribution may also affect the efficacy of time/area closures. Because young sablefish appear to first appear in western areas (BS,AI, Western GOA), and older mature fish appear most prevalent in eastern areas (Central and Eastern GOA), the location of catch as year classes mature can change (Goethel et al., 2020). Therefore, static time/area closures may affect bycatch of some age classes of sablefish, but may be less effective as year classes mature and move to different areas.

Goethel et al. (2020) examine the patterns of sablefish bycatch in the eastern Bering Sea. Although there are increases in the bycatch of smaller sablefish in the EBS, there are not currently sufficient data to determine what impact that may have on population rebuilding. Goethel et al. (2020) state that given the magnitude of recent large year classes, it is unlikely that moderate increases of catch of young fish will harm the stock.

Sablefish recruitment varies greatly from year to year (Figure 2), but shows some relationship to environmental conditions (Shotwell et al., 2014). Previous strong year classes occurred when abundance was near historic low, and were associated with phase changes in the Pacific Decadal Oscillation (PDO) (Hollowed and Wooster 1992 *in* Goethel et al., 2020). Those large year classes indicate that the population was able to take advantage of favorable environmental conditions and produce large year classes. If recent large year classes continue to mature and contribute to SSB, the ABC in future years may not be reduced relative to ABC_{max} as much as in recent years, and fisheries may benefit. However, because we lack data to determine the impact of modest fishing mortality on recent year classes, it is not possible to determine how reductions in fishing mortality may affect future SSB and the value of directed fisheries on those larger fish.

4.2 Inter-cooperative agreements and incentive programs

As described in Section 3.1, above, cooperatives exist for trawl fisheries in the BS. Some of the cooperatives have inter-cooperative agreements and incentive plan agreements (IPAs) to help the cooperatives manage bycatch for Chinook and chum salmon. They also track data for in-season catch rates for other bycatch or prohibited species like halibut, herring, and have recently begun tracking sablefish bycatch rates (J. Gruver, Pers. Comm.). The inter-cooperative agreements and incentive programs were carefully crafted to meet specific objectives, and are adjusted as conservation goals change. Readers are directed to the IPA reports[6] from the April 2021 Council meeting for more detailed information on the development and activities of the salmon IPA groups.

If the Council were to consider inter-cooperative agreements and incentive programs to manage the bycatch of sablefish in trawl fisheries, it is likely that a specific set of objectives would be necessary in order to identify mechanisms that the cooperatives could employ. Importantly, the current salmon IPAs contain incentives to offset the potentially increased costs of avoiding species that the Council wishes to protect. Some of the species for which inter-cooperative agreements or incentive programs exist have conservation concerns. That is in contrast with sablefish, for which Goethel et al. (2020) suggest, despite concerns with the assessment that warrant a reduction in ABC from ABC_{max}, is not subject to significant conservation concern.

4.3 Maximum Retainable Amounts

Maximum retainable amounts, as described in Section 2.3, are the maximum amount of a species closed to directed fishing that may be retained onboard a vessel. MRAs are calculated as a percentage of the weight of catch of each species or species group open to directed fishing (basis species) that is retained onboard the vessel. The percentage of a species or species group closed to directed fishing retained in relation to the basis species must not exceed the MRA.

Maximum retainable amounts are the primary tool used by NMFS to reduce or slow the catch of groundfish species when directed fishing for that species is closed. Previous analysis[7] has evaluated the effects of lower MRAs on catch of species for which directed fishing is closed. That analysis identified the “intrinsic catch rate” as the rate that would occur if there were no market for the closed species, or if there is no value to be obtained from catching the closed species. If the intrinsic rate of catch is less than the MRA, then lowering the MRA may reduce the rate of catch. If the intrinsic rate of catch is equal to or greater than the MRA, then there would be little effect of lowing the MRA, other than increasing the amount of regulatory discards.

Maximum retainable amounts can provide opportunity for the prosecution of low value fish by allowing higher value fish to be retained up to the MRA. In the GOA, fisheries for arrowtooth flounder may be subsidized by a 7% MRA for sablefish, based on the arrowtooth flounder basis species. The intrinsic rate of sablefish catch in the arrowtooth flounder fishery is not known. If the intrinsic rate is lower than the 7% MRA, reducing the MRA may result in lower overall sablefish catch, but at some cost to the arrowtooth fishery participants. If the intrinsic rate is higher than the 7% MRA, lowering the MRA would have little effect on the overall sablefish catch, but a greater proportion of the catch would be subject to regulatory discards, again at a cost to the arrowtooth fishery participants.

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[6] https://meetings.npfmc.org/Meeting/Details/1945
[7] https://meetings.npfmc.org/CommentReview/DownloadFile?p=ec5bca06-dc24-47e4-bcf0-c9918837a450.pdf&fileName=C3%20GOA%20Skate%20MRA.pdf

The MRA for sablefish for most basis species is 1%, the minimum that allows for some retention before all catch is required to be discarded. Lowering the MRA from 1% is equivalent to prohibiting retention at the beginning of the season and would result in increased regulatory discards without having any appreciable effect on the rate of sablefish catch for those fisheries.

4.4 Reduced allocations to target species with high sablefish bycatch

The Council annually sets TACs for all species in the BSAI and GOA FMPs during the harvest specifications process. During the TAC setting process, the Council must consider the MSA National Standard Guidelines to balance conservation of resources and optimal yield. In the Bering Sea and Aleutian Islands, the Council will generally set the total TAC at the two million ton cap, to achieve optimal yield. Pollock is the most abundant fish species in the Bering Sea, and the Bering Sea pollock TAC has averaged 1.3 million tons from 2011 to 2020. The Bering Sea pollock TAC has been set well below its ABC during that time, ranging from 18,000 mt below the ABC in 2011 to 1,455,000 mt below the ABC in 2017. Sector allocations in the Bering Sea pollock fishery are set by the American Fisheries Act and CDQ program, and any decrease in the Bering Sea pollock TAC will also decrease the TAC for sectors that have lower sablefish incidental catch. The TAC for more valuable species, such as Pacific ocean perch, Atka mackerel, and Pacific cod (after accounting for State's Guideline Harvest Level fisheries), is generally set equal to the ABC, and these fisheries have lower incidental catch of sablefish. The TACs for flatfish species are generally set below their ABC. The Amendment 80 allocated flatfish species (yellowfin sole is also allocated to the BSAI trawl limited access sector) have relatively low incidental catch of sablefish even in the recent high recruitment years (rock sole and yellowfin sole) or have relatively low targeted catch (flathead sole). Other species that are targeted and have higher incidental catch of sablefish are Greenland turbot and arrowtooth flounder. The Greenland turbot TAC is generally set below the ABC and is a relative low TAC compared to other TACs. The hook-and-line CPs also participate in the Greenland turbot fishery and reducing the TAC may impact this sector as well. The arrowtooth flounder TAC supports directed fishing and is also necessary to support directed fishing of other species. If the Council were to reduce arrowtooth flounder TAC, there is a possibility that the CDQ pollock fishery could be constrained by the incidental catch of arrowtooth flounder. The CDQ groups are hard capped by all of their CDQ allocated species which includes arrowtooth flounder. The Council cannot increase the percentage of the arrowtooth flounder TAC allocated to the CDQ program because the MSA sets the CDQ allocation of BSAI arrowtooth flounder at 10.7% of the TAC. If the Bering Sea pollock TAC were reduced and the Council continued to set the BSAI total TAC at 2 million tons, TACs could increase for the flatfish species with low incidental catch of sablefish. However, the flatfish species are generally constrained by Pacific cod and halibut PSC limits so increasing flatfish to balance the decrease of pollock would likely decrease the total catch in the BSAI groundfish fisheries. Also, pollock is taken as incidental catch in other fisheries and a decrease in pollock TAC and increases in other species TACs may increase the percent of the pollock TAC necessary to support incidental catch therefore decreasing the pollock allocated to the AFA sectors.

In the GOA, most of the groundfish TACs are set equal to the ABC, except for species that contribute to the State's Guideline Harvest Level fisheries (Pacific cod and pollock), species for which the TAC is set only to support incidental catch (Atka mackerel), or species that have higher ABCs but for which catch is limited because halibut and salmon PSC limits prevent increased catch (most flatfish species).

4.5 Other actions taken by other Councils to manage sector allocations

As requested, staff contacted staff from other Councils around the country to investigate whether other Councils have enacted programs to limit incidental mortality in their managed fisheries. In general, other Councils have considered or implemented some of the tools considered in this paper and other methods that the NPFMC has enacted for other issues, including time/area closures, set-asides for some species, cooperative agreements, and moving species from managed species status to ecosystem component status.

None of the other Council staff indicated that they were facing similar circumstances, although the Pacific Fishery Management Council staff were interested in the issue because they are also anticipating large year classes of sablefish affecting their fisheries. Although none of the responses from other Councils' staff provided other methods to consider, this may provide opportunity to collaborate with other Councils if similar challenges or issues are affecting management around the country.

5 References

Goethel D.R., D.H. Hanselman, C.J Rodgveller, K.H. Fenske, S. K. Shotwell, K.B. Echave, P.W. Malecha, K.A. Sewicke, and C.R. Lunsford. 2020. Assessment of the Sablefish Stock in Alaska. https://www.fisheries.noaa.gov/alaska/population-assessments/2020-north-pacific-groundfish-stock-assessments#bering-sea-and-aleutian-islands-stock-assessments

Hollowed, A.B., and W.S. Wooster. 1992. Variability of winter ocean conditions and strong year classes of Northeast pacific groundfish. ICES Mar. Sci. Syp. 195, 433-444.

NMFS. 2014. Secretarial Review Draft Regulatory Impact Review/Initial Regulatory Flexibility Analysis for Proposed Amendment to the Fishery Management Plan for Bering Sea/Aleutian Islands Management Area and the BSAI Crab FMP to revise the Pribilof Islands Blue King Crab Rebuilding Plan. National Marine Fisheries Service, Juneau Alaska. https://alaskafisheries.noaa.gov/sites/default/files/analyses/43_103draftririrfa.pdf

Shotwell, S.K., D.H. Hanselman, I.M. Belkin. 2014. Toward biophysical synergy: Investigating advection along the Polar Front to identify factors influencing Alaska sablefish recruitment. Deep-Sea Research II. http://dx.doi.org/10.1016.j.dsr2.2012.08.024.