INITIAL REVIEW DRAFT

Environmental Assessment/Regulatory Impact Review for Proposed Amendments to the Fishery Management Plans for Groundfish of the Bering Sea / Aleutian Islands Management Area Groundfish of the Gulf of Alaska

Small Sablefish Release

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Abstract: This Environmental Assessment / Regulatory Impact Review analyzes a proposed management measure that would apply exclusively to harvesters using fixed gear in the Alaska sablefish IFQ/CDQ fisheries. Current regulations require full retention of sablefish in these fisheries. Fishery encounters with large numbers of small sablefish have become more frequent because recent year classes of sablefish are more abundant than any previously recorded. The measures under consideration include allowing sablefish IFQ/CDQ harvesters using fixed gear to carefully release small (<22”) sablefish, which have low commercial value under current market conditions.

For definition of acronyms and abbreviations, see online list: https://www.npfmc.org/library/acronyms

Table of Contents

Executive Summary

This document analyzes an action under consideration by the Council that would adjust the regulatory prohibition on discarding sablefish that applies to participants using fixed gear in the Sablefish Individual Fishing Quota (IFQ) and Community Development Quota (CDQ) Programs in the Bering Sea (BS), Aleutian Islands (AI), and Gulf of Alaska (GOA). Current regulations require full retention of all sizes of sablefish encountered in the fixed gear sablefish IFQ/CDQ fisheries. The measures under consideration include allowing sablefish IFQ/CDQ harvesters to carefully release small sablefish (under 22" total length), which have low commercial value under current market conditions. Fishery encounters with large numbers of small sablefish have become more frequent because recent year classes of sablefish are more abundant than any previously recorded.

Purpose and Need

Beginning with the 2014 age class, a continuing series of large year classes of sablefish are resulting in significant catches of small sablefish in the IFQ fixed gear fisheries and current regulations require IFQ holders to retain all sablefish. Small sablefish have low commercial value under current market conditions. Although no scientific studies are available to estimate survival rates for Alaska sablefish, information from other areas suggests that survival rates for carefully released sablefish may be high enough to warrant consideration of relaxing full retention requirements. Limited operational flexibility to carefully release sablefish may increase the value of the commercial harvest and allow small fish to contribute to the overall biomass.

Alternatives

The Council adopted the following revised alternatives for analysis in June 2023.

Alternative 1: No Action, status quo

Under the No Action alternative, all regulations and FMP language related to a prohibition on discarding sablefish would remain intact. Those regulations include 50 CFR 679.7(d)(4)(ii) and 50 CFR 679.7(f)(11). Additionally, discarding is prohibited in both the BSAI and GOA Groundfish FMPs in the fourth provision under General Provisions section 3.7.1.7, prohibiting discarding of sablefish.

Alternative 2: Allow Release of Sablefish in the IFQ Fishery

This alternative would eliminate (Option 1) or modify (Option 2) the regulatory restrictions that prohibit release of sablefish caught by sablefish IFQ vessels as well as the FMP provision prohibiting discarding.

Option 1: Eliminate the regulatory restrictions that prohibit release of sablefish caught by sablefish IFQ vessels as well as the FMP provision prohibiting discarding.

Option 2: Require retention of sablefish 22 inches total body length or longer (provides for voluntary release of sablefish under 22 inches total body length).

The focus of this document is analysis of Alternative 2, Option 2, as compared to the status quo (Alternative 1). Alternative 2, Option 2, would provide limited flexibility for voluntary release of

For definition of acronyms and abbreviations, see online list: https://www.npfmc.org/library/acronyms sablefish under 22” total body length. Alternative 2, Option 1 has been the focus of previous documents, particularly NPFMC (2021). Focusing on analysis Alternative 2, Option 2 reflects the Council’s discussion in June 2023 that a path forward for Option 1 had yet to be identified that would provide the necessary data on the target fishery, and that the Council intended for a second initial review analysis to be completed within a reasonable timeframe. Section 1.2 describes the changes in the proposed action over time as the action has worked its way through the Council process.

Elements of the Alternatives

The Council’s motion also included three elements to be addressed in the analysis, which are not decision points but are important for understanding how the action would be implemented and associated impacts. Additionally, the Council included a fourth stand-alone element that the Council can consider at final action, regarding whether to require a review of the effects of adopting Alternative 2 after a given number of years, or a sunset date. The Council also included a final request for staff analysis on the effectiveness of escape mechanisms in sablefish pots.

Element 1: DMRs

Apply a DMR to released sablefish of:

1. *5%*
2. *12%*
3. *16%*
4. *20%*
5. *25%*
6. *SSC recommends the DMR through the stock assessment process.*

Sub-option: Select different DMRs for pot gear and hook and line gear.

Element 2: Catch and Release Mortality Accounting

Sablefish catch and release mortality associated with the IFQ fishery will be accounted for in the stock assessment. The analysis should describe the potential implications of voluntary discards on the sablefish stock assessment, specifications process and catch accounting in the context of other uncertainties.

Element 3: Monitoring and Enforcement

The analysis should describe potential monitoring and enforcement provisions that could improve estimates of voluntary and regulatory discards.

Element 4: Review

Option 1: The ability to release sablefish will be reviewed in a) 3 years b) 5 c) 7 years following implementation.

Option 2: The ability to release sablefish will sunset after 5 years following implementation.

The analysis should include a discussion of selectivity in sablefish pots and whether requiring escape mechanisms meets the objectives of this action.

Element 1 addresses a potential discard mortality rate (DMR) for released sablefish. In practice, if the Council were to adopt Alternative 2, the DMR would be set on an annual basis as part of the harvest specifications process. While the Council included various illustrative percentages in the original motion, a staff paper and input from the SSC in February 2024 has since narrowed the range, for analytical purposes and to signal what may be a more realistic range of DMRs, to 12%, 20%, and 35%. Section 2.2.1 summarizes how these values were arrived at. Appendix 5 describes the influence of DMRs when integrated into a simulation framework for projecting Acceptable Biological Catch (ABC) for Alaskan sablefish as described under Alternative 2, Option 2.

A description of some of the challenges of, and potential paths forward regarding **Elements 2 and 3** are included in Sections 2.2.2 and 2.2.3. These elements, specifically catch accounting and monitoring, are interrelated, as monitoring is essential to account for sablefish discards and total mortality. Consideration of **Element 4**, a review or sunset date for the proposed action, can be found in Section 2.2.4. Section 6 summarizes management considerations and includes NMFS' recommendations.

In addition to documents incorporated by reference that have previously analyzed past and present actions (Section 1.5), this document includes several appendices that provide supporting analysis, additional context, and further discussion as requested by the Council. These include:

- Sablefish size/age conversion table and equation (Appendix 1)
- Responses to prior SSC comments (Appendix 2)
- Discussion of Escape Rings and Selectivity (Appendix 3)
- Table of requirements applicable to sablefish discarding in other regions/ fisheries (Appendix 4)
- The simulation analysis and results for projecting ABC for Alaskan sablefish (Appendix 5)

Environmental Impacts

The potentially affected environment and the degree of the impacts of the alternatives on the various resource components, together with relevant past, present, and reasonably foreseeable actions, were analyzed in Section 4 and Appendix 5 of this document. Since the action alternative (specifically, Alternative 2, Option 2) would allow voluntary discarding of small sablefish, this environmental assessment primarily focuses on effects to the Alaskan sablefish stock.

A simulation framework for projecting ABC for sablefish was adapted to explore the potential implications of Alternative 2, Option 2 (Appendix 5). Projections were carried out for 50 years and performance metrics important to provide indication of resource status were calculated and compared across scenarios. Performance metrics indicative of fishery performance were also calculated but are not included in the discussion of environmental impacts. Sensitivity analyses were also conducted, considering alternate recruitment, retention, and future price scenarios.

Results indicated that Alternative 2, Option 2 would have negligible impacts on the sablefish stock (e.g., dead discards were minimal and SSB was reduced slightly compared to full retention). These results held for all recruitment scenarios explored. None of the scenarios demonstrated a strong risk of the stock entering an overfished state, and the probability of becoming overfished was independent of discard scenario (i.e., allowing discarding did not increase the probability of becoming overfished compared to full retention). Overall, the limited influence of discarding was due to natural mortality (i.e., resulting in 10% mortality of age-2 fish) being the primary driver of age-2 dynamics. Age-2 total mortality declined by less than 1% (i.e., 12% to 11%) when moving from full retention to age-3 retention ($\geq$22") with a 12% DMR (i.e., the highest discarding survival scenario).

A web-based interactive application was developed to better aid comparisons across model scenarios and to help managers and stakeholders better digest the implications of the results. The tool is available at: https://shinyfin.psmfc.org/small_sablefish/

The EA also analyzes potential impacts of associated changes in fishing effort and discarding of sablefish on non-target species, Prohibited Species Catch (PSC), marine mammals, seabirds, and habitat (Section 4). Any effects of Alternative 2 on these resource components are likely to be caused by changes in the amount of sablefish discarded and/or intensity of fishing effort in the BSAI and GOA sablefish IFQ/CDQ fisheries. Any increase in effort could increase catch of non-target or PSC species, the likelihood of interactions with marine mammals and seabirds, or gear impacts on habitat. Additionally, Alternative 2 could increase the potential for killer and sperm whales to be attracted to vessels that are discarding sablefish. However, impacts of Alternative 2 on these resource components are not expected to be significant because increases in fishing effort are expected to be minimal. This is due to the limited scope of the action, regulatory constraints such as the location and timing of the fishery, harvest limits (individual IFQs and TACs), and gear restrictions, and operational constraints in the IFQ/CDQ fisheries (costs that would eventually limit effort, such as fuel, bait, crew, etc.).

Economic and Social Impacts

Selecting Alternative 1 (no action) would leave in place the existing regulatory restrictions that prohibit release of any sablefish caught by sablefish IFQ vessels, either when directing on sablefish, or when anyone onboard has unused IFQ in their account. As a result, harvest participation and fishing behavior in the sablefish IFQ fishery are likely to be similar to the current participation and fishing practices given the numerous factors impacting the sablefish IFQ fishery. Therefore, the impacts of Alternative 1 on harvesters, crew, quota share owners, processors and communities that are directly engaged and dependent on the sablefish IFQ fishery could result in lower sablefish IFQ ex-vessel revenue and first wholesale revenue along with reduced direct, indirect, and induced expenditures in the communities from harvesting and processing sablefish IFQ. In addition, many harvesting and processors operations are dependent on sablefish IFQ revenue and thus these operations may have difficulty maintaining their credit and debt instruments and could be forced to refinance, which may not be possible for some entities and such a situation could lead to business sale and/or bankruptcy. The extent to which such impacts on business operations may be realized is impossible to evaluate given the proprietary nature of business finance information.

Under Alternative 2, allowing the release of smaller sablefish caught in the IFQ fishery would **likely be perceived as enhancing the flexibility by the individual vessel operators** to improve their gross ex-vessel revenue and to reduce waste of sablefish IFQ that has no economic value. As a result, harvest participation and fishing behavior in the sablefish IFQ fishery would likely change by some participants who perceive a benefit of discarding of sablefish IFQ that are less than 22' in length.

However, sablefish IFQ harvesters are likely to **face challenges in realizing the perceived benefits associated with discarding smaller sablefish** (1-2 lbs. grade) that are of less value with larger, in exchange for larger sablefish IFQ (2+ lbs. grade).

1) First, the large recruitment events have increased the encounter rates for smaller, less valuable, sablefish compared to the larger, more valuable, sablefish. It will likely be necessary to increase fishing effort to highgrade more valuable sablefish IFQ which will increase costs associated with fishing for sablefish IFQ to include higher fuel costs, bait costs, observer costs, vessel maintenance costs, and higher crew labor costs.

2) Second, the downturn in the sablefish market is putting downward pressure on prices for all processor grades, thus even larger sablefish are not generating high prices relative to historical prices.
3) Third, the relative percentage of sablefish IFQ that could be highgraded is very small and does not cover the range of sizes that currently are of little value to process. Having a cut-off point of <22'' means that a small amount of highgrading could result in required retention of slightly larger but still less valuable sablefish.
4) Finally, the use of ICAs to accommodate discards of sablefish IFQ will reduce allocations of sablefish IFQ for all sablefish IFQ holders.

Collectively, **these factors could make it difficult for harvesters to increase their gross and net ex-vessel revenue from highgrading their sablefish IFQ less than 22" for larger more valuable sablefish IFQ under Alternative 2, relative to Alternative 1**. These factors may limit the extent of benefits or may even result in a net loss for some sablefish IFQ harvesters. For instance, if the cost and effort expended to discard small sablefish, in exchange for larger sablefish exceeds the additional value generated from a slightly higher prices, an individual harvester may not benefit in this season. This may be the case if for example, they are discarding a 20" sablefish, but catching a 23" sablefish that is required to be retained but of little added value at the processor. In addition, if a sablefish IFQ harvester chooses not to discard, but has their allocation reduced to accommodate an ICA for expected fleet discards, they may not benefit from the action.

Nevertheless, **there is potential for some harvesters to increase their net gross ex-vessel revenue under Alternative 2**, by discarding small sablefish and using their IFQ to land larger, more valuable sablefish. In particular, given the current pressures on the markets and harvester stability, any level of additional revenue could be important in maintaining their credit and debt instruments and could prevent forced refinance or business sale and/or bankruptcy.

Sablefish processors and the communities that are directly engaged and dependent on the sablefish fishery would also likely face challenges in benefiting under Alternative 2 for many of the same reasons that could impact harvesters. For processors, the continued downward pressure on sablefish prices for all processor grades combined with the relatively small percentage of sablefish IFQ that harvesters could highgrade and delivered to the processors could result in less than expected gross first wholesale revenue under Alternative 2 for some processors. From the perspective of the communities that are directly engaged and dependent on the sablefish fishery, those sablefish IFQ harvesters and processors that can increase their net first wholesale revenue and ex-vessel revenue under Alternative 2, it is likely these processors and harvesters would increase their direct expenditures in the communities which in turn would increase indirect and induced expenditures in these same communities. Communities most reliant on the sablefish IFQ fishery are Sitka, Seward, Kodiak, Petersburg, and Juneau.

Management Considerations

The action alternative would require regulatory changes to 50 CFR 679. Both options under Alternative 2 allow for voluntary discarding of sablefish at any size (Option 1) or below 22 inches total body length while requiring full retention of all sablefish greater than or equal to this size (Option 2). Allowing for discarding of sablefish would require adjustments for at-sea sampling and catch accounting methods to accurately estimate discards, impacting management. Operationalizing size-selective discards necessitates new monitoring and catch accounting methods to be implemented to minimize biases associated with data collection and estimation of discard mortality rates (DMRs).

To account for mortality of discarded sablefish, an incidental catch allowance (ICA) for the sablefish IFQ catch share program would need to be implemented, which would vary between the GOA and BSAI due to CDQ reserve requirements in the BSAI. Gear modification such as escape rings could mitigate concerns with the proposed action by improving size-selectivity and reducing bycatch. Therefore, NMFS recommends consideration of an alternative or element requiring gear modifications to enhance size-selectivity, facilitating comprehensive analysis and potential regulatory amendments.

The proposed action would create additional enforcement concerns pertaining to the limited compliance monitoring tools that would be available to enforce a size limit and detect prohibited species violations. These enforcement concerns prompt consideration of careful release requirements to mitigate sablefish discard mortality.

Requests for Council Clarification

- Staff recommend the action alternative include reference to fixed gear CDQ as part of this action.[1]
- For the next iteration, staff recommend the Council eliminate Alternative 2, Option 1 if it is not a realistic option. This would avoid further analytical delays for an action that the Council has deemed time sensitive. The Council may also want to ensure that the purpose and need statement remains consistent with a revised set of alternatives.
- For the next iteration, staff recommend the motion be revised to focus on the options and decision points for the Council. For example, if the Council would like to provide its recommendations on specific monitoring and enforcement measures for the agency to consider, such as careful release requirements, this could be articulated in the Council's motion. Prior to final action, NMFS could then describe regulatory changes that will need to be made to implement this action.

Comparison of Alternatives for Decision-making

Table ES 1 shows a high-level comparison of the impacts of Alternative 1 and Alternative 2, Option 2. While Alternative 2, Option 1 is not analyzed in this document, it could be expected based on previous documents that environmental, social, and economic impacts of Alternative 2, Option 1 would be similar but greater in magnitude to the impacts described in this document for Alternative 2, Option 2. This is due to the additional flexibility that would be afforded to fishery participants to discard any size of sablefish under Option 1, rather than limiting sablefish discards to a narrow size range (<22").

[1] Required by MSA § 305 at 104-297 (i) ALASKA AND WESTERN PACIFIC COMMUNITY DEVELOPMENT PROGRAMS. — 109-241, 109-479 (1)(B)(iv) REGULATION OF HARVEST. — The harvest of allocations under the program for fisheries with individual quotas or fishing cooperatives shall be regulated by the Secretary in a manner no more restrictive than for other participants in the applicable sector, including with respect to the harvest of nontarget species.

Table ES 1 Comparison of Alternatives

	Alternative 1: No Action	Alternative 2: Option 2
Differences in Alternatives		
Discarding of sablefish	Prohibited in IFQ fishery	Voluntary release of sablefish under 22" total body length in fixed gear IFQ/CDQ fisheries. Retention of sablefish ≥ 22" required.
Environmental Impacts		
Sablefish	No changes	Simulation results for projecting ABC (Appendix 5) show negligible (not significant) impacts on the stock under current ABC utilization. • Minimal dead discards and spawning stock biomass was reduced slightly compared to full retention. • No strong risk of the stock entering an overfished state • Age-2 total mortality declined by less than 1% from full retention (Alt 1) to a 12% DMR (i.e., the highest discarding survival scenario).
Marine Mammals, PSC, non-target species, seabirds, habitat	No changes	Limited increase in fishing effort could result in minimal increases in interactions with or catch of these resource components. Release of sablefish could increase whale predation on discarded fish. Impacts are not expected to be significant.
Economic Impacts		
Harvesters	Status quo revenue costs associated with requirement to deliver less marketable fish	Simulation results from the sablefish model (Appendix 5) show slight improvements in total revenue for the sablefish IFQ fleet. Some perceived flexibility to improve ex-vessel revenue and reduce waste of sablefish IFQ that has little or no economic value. Harvesters could face challenges in realizing increased ex-vessel revenue.
Processors	Status quo conditions	Could see increased first wholesale revenue under Alternative 2. Processors will also face challenges in realizing increase first wholesale revenue for many of the same reasons as harvesters.
Communities	Status quo conditions	Those sablefish IFQ harvesters and processors that can realize ex-vessel and first wholesale returns under Alternative 2 will likely increase their directed expenditures in communities which would increase indirect and induced expenditures.

1 Introduction

This document analyzes an action under consideration by the Council that would remove the regulatory prohibition on discarding sablefish that applies to participants using fixed gear in the sablefish Individual Fishing Quota (IFQ) and Community Development Quota (CDQ) Programs. The action is intended to provide limited flexibility to fixed gear sablefish IFQ/CDQ participants who encounter catches of small, low-value fish as recent large year classes of sablefish recruit to the fishery. The approach analyzed in this document would provide limited flexibility for voluntary release of sablefish under 22” total body length while requiring retention of sablefish that are greater than or equal to 22” total length (Alternative 2, Option 2). The other approach the Council has considered in the past (Alternative 2, Option 1) has been the focus of previous documents and was analyzed in NPFMC (2021). Section 1.2 includes a detailed history of how the proposed action has changed over time.

This document is an Environmental Assessment/Regulatory Impact Review (EA/RIR). An EA/RIR provides assessments of the environmental impacts of a proposed action and its reasonable alternatives (the EA), the benefits and costs of the alternatives, the distribution of impacts, and identification of the small entities that may be affected by the alternatives (the RIR). This EA/RIR addresses the statutory requirements of the Magnuson Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act, 16 U.S.C. 1801, *et seq*.), the National Environmental Policy Act (NEPA), Presidential Executive Order 12866, and some of the requirements of the Regulatory Flexibility Act. An EA/RIR is a standard document produced by the North Pacific Fishery Management Council (Council) and the National Marine Fisheries Service (NMFS) Alaska Region to provide the analytical background for decision-making.

Under the Magnuson-Stevens Act, the United States has exclusive fishery management authority over all marine fishery resources found within the exclusive economic zone (EEZ). The management of these marine resources is vested in the Secretary of Commerce (Secretary) and in the regional fishery management councils. In the Alaska Region, the North Pacific Fishery Management Council (Council) has the responsibility for preparing fishery management plans (FMPs) and FMP amendments for the marine fisheries that require conservation and management, and for submitting its recommendations to the Secretary. Upon approval by the Secretary, NMFS is charged with carrying out the Federal mandates of the Department of Commerce with regard to marine and anadromous fish.

The sablefish fishery in the EEZ off Alaska is managed under the FMP for Groundfish of the Bering Sea / Aleutian Islands (BSAI) Management Area and the FMP for Groundfish of the Gulf of Alaska (GOA) Management Area. The proposed action under consideration would amend these FMPs and Federal regulations at 50 CFR 679. Actions taken to amend FMPs or implement regulations governing these fisheries must meet the requirements of applicable Federal laws, regulations, and Executive Orders.

1.1 Purpose and Need

Beginning with the 2014 age class, a continuing series of large year classes of sablefish are resulting in significant catches of small sablefish in the IFQ fixed gear fisheries and current regulations require IFQ holders to retain all sablefish. Small sablefish have low commercial value under current market conditions. Although no scientific studies are available to estimate survival rates for Alaska sablefish, information from other areas suggests that survival rates for carefully released sablefish may be high enough to warrant consideration of relaxing full retention requirements. Limited operational flexibility to carefully release sablefish may increase the value of the commercial harvest and allow small fish to contribute to the overall biomass.

1.2 History of this Action at the Council

At present, the IFQ sablefish longline and pot fisheries in the Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands (BS/AI) require full retention of sablefish. Beginning in 2017, unprecedented numbers of newly recruited sablefish began showing up in the GOA and BS fixed gear catches, initiating stakeholder appeal for management action to provide relief from the prohibition on sablefish discarding in the sablefish IFQ fleet. In April 2018, IFQ fishermen provided testimony to the Council that they were seeing a sudden influx of small, low-value sablefish in their catch. These fish were becoming an economic burden to fishermen because regulations prevent them from being discarded, even though, according to testimony, these fish were mostly uninjured by the fishing gear and appeared likely to survive if released. IFQ stakeholders at the meeting proposed that the Council explore an allowance to discard these fish, and the Council initiated the first of three discussion papers to explore issues related to this proposal.

In October 2018, the Council reviewed the first of three discussion papers (NPFMC, 2018) that evaluated:

- Effects of the exceptionally large 2014 and 2016 sablefish year classes.
- Sablefish discard mortality rate (DMR) estimates.
- Management considerations to the IFQ program.
- Changes to observer sampling protocols.
- Enforcement implications.

The paper also considered the contrast between a *requirement* to discard sablefish under a certain size (minimum size limit) and an *option* for discretionary release (voluntary discarding) in terms of both practical and economic impacts. A requirement to discard sablefish under a certain size would continue to require retention of all fish over that size limit. Voluntary discarding would allow for harvesters to choose what sizes of fish they would prefer to retain and could result in any size of fish being legally discarded.

In April 2019, the Council received a second discussion paper (NPFMC, 2019a) that evaluated:

- A process for establishing DMRs.
- An assessment of temporary proxy DMRs.
- Allowing discards during years of high abundance versus years of lower abundance.
- Whale depredation if discarding is allowed.
- Gear modifications that could aid in avoiding small sablefish.
- The implications of approaching the Total Allowable Catch (TAC) or exceeding the ABC.
- Fishing down the existing spawning stock.
- Impacts of highgrading.
- Enforcement options.

The Council then requested a third discussion paper (NPFMC, 2019b), reviewed in December 2019, that addressed:

- Mandatory vs. optional release.
- Varying size limits by area.
- Accounting for discards within ABC and TAC.
- Specific options for proxy DMRs.
- DMR variability by gear.
- Discard estimation methods and the associated monitoring and enforcement concerns.

- Impacts of discarding on sablefish abundance and how that affects allocations to IFQ and trawl sectors.

In December 2019, the Council adopted a purpose and need statement and developed alternatives to initiate analysis on this issue. The initial review analysis (NPFMC, 2021) was then considered at the January 2021 Enforcement Committee meeting (report) and February 2021 SSC, AP, and Council meetings.

The SSC recommended that additional analyses be conducted and included prior to any final action by the Council on this issue. Specifically, while the difficulties associated with the estimation of size or age distribution of discards were thoroughly considered in the analysis, the SSC concluded that there are two unresolved questions that are central to understanding the effects of the proposed amendment:

> 1. What is the impact on the age structure and overall productivity of the stock under different rates of discard mortality and for different gear and discard selectivity profiles?
>
> 2. What is the impact on the uncertainties in the stock assessment, and the required buffers in setting ABC, arising from knowledge gaps introduced by not knowing gear selectivity or discard selectivity and mortality in a mostly unobserved fishery?

The Council chose to postpone the action until it could consider recommendations from the IFQ Committee concerning the relative priority of this action. In April 2021, the IFQ Committee Report stated that "*the majority of the Committee thinks this action is a high priority that is worth the time to work through the stock assessment and catch accounting issues that were highlighted in the initial review draft.*"

In October 2021, the Council made the following motion under staff tasking: *"When time, resources, and staff allow, direct staff to prepare and schedule for Council consideration a small sablefish release Initial Review document to be scheduled for an upcoming meeting."*

The May 2022 IFQ Committee (see May 2022 IFQ Committee Report) received further public comment on small sablefish in response to additional large year classes occurring and the continued issue of mandatory retention of all sablefish caught.

In June 2022, the Council supported the IFQ Committee's recommendation to schedule the next initial review of action to allow small sablefish release, noting that the Council Chairman and Executive Director would schedule that review as Council agenda time and NPFMC/NMFS Alaska Regional Office (AKRO)/Alaska Fishery Science Center (AFSC) staff resources allow. At that time, the Council expressed interest for the updated analysis to include recent data on recruitment, growth rates, and market conditions and to revisit the discussion on assessment uncertainty. In keeping with the IFQ Committee recommendation, the Council noted that the discussion in the previous analysis about a minimum size limit for sablefish retention should not be considered in the revised analysis.

In June 2023, the Council received a staff update on the action, which identified the main concerns related to assessment uncertainty/complexity and what would be required to address the SSC's recommendations from the 2021 analysis (NPFMC, 2023). During that update, the analysts noted that many fisheries have adopted minimum size limits, whereby all fish under a certain size must be discarded, to reduce uncertainty introduced from at-sea discards. This would alleviate some of the challenges posed by not knowing the size of discarded fish (retention selectivity), and limit changes to the monitoring requirements for the IFQ Program, although additional monitoring would likely still be needed to provide information on the size distribution of retained fish separate from total catch. After the presentation from staff and hearing public testimony that *requiring* release of small sablefish would negatively impact some fishery participants, the Council revised the purpose and need statement to provide for "limited" operational flexibility, and revised the alternatives to include the option for a minimum size retention requirement of 22 inches total length (providing for *voluntary* release of sablefish under 22 inches, and a requirement that all fish ≥ 22 inches be retained). The Council also added to the elements a review of the management measures a certain number of years after implementation (see Section 2 for a description of the alternatives) and prioritized a second initial review of this action.

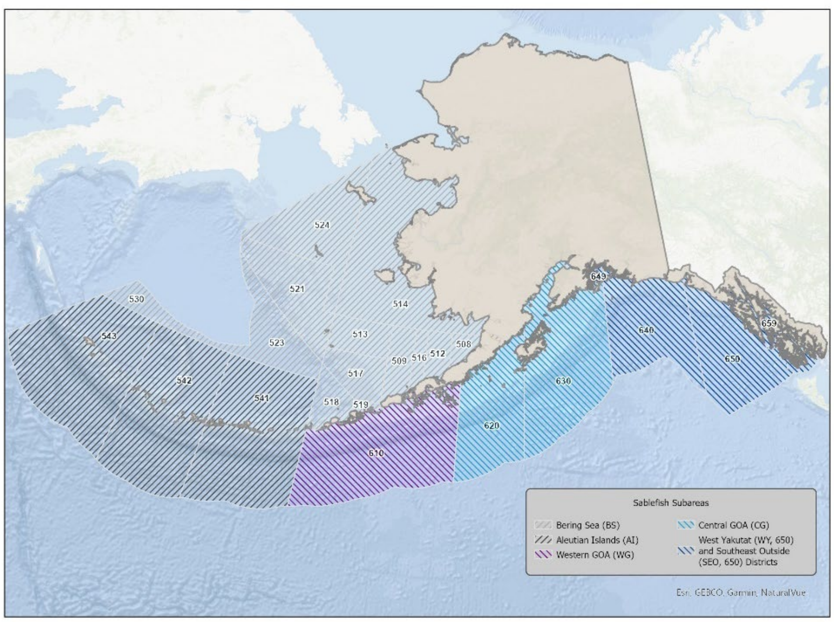
In February 2024, the SSC received a discussion paper and presentation on options for DMRs and the proposed analytical approach for Alternative 2, Option 2 (NPFMC, 2024), and provided new recommendations to consider in this analysis.

For clarity, this action has been referred to in several ways as it has evolved over time: IFQ sablefish release allowance, sablefish discard allowance, small sablefish discarding, small sablefish retention, small sablefish release, voluntary careful release of sablefish.

1.3 Description of Management Area

There are six sablefish regulatory areas in the IFQ Program (Figure 1-1). Throughout this document the sablefish regulatory areas (subareas) may be referred to as SE – Southeast Outside District, WY – Western Yakutat, CG – Central Gulf of Alaska, WG – Western Gulf of Alaska, AI – Aleutian Islands, and BS – Bering Sea.

Figure 1-1. Sablefish Regulatory Areas in Alaska. Map courtesy of Abby Jahn, AKRO.



1.4 EA and RIR requirements

Environmental Assessment

There are four required components for an environmental assessment. The need for the proposal is described in Section 1.1, and the alternatives in Section 2. The potential ecological impacts of the proposed action and alternatives are addressed in Section 4 and Appendix 5, economic and social impacts in Section 5. A list of agencies and persons consulted is included in Chapter 8.

Regulatory Impact Review

The preparation of an RIR is required under Presidential Executive Order (E.O.) 12866 (58 FR 51735, October 4, 1993) as amended through E.O. 14094, April 6, 2023 (88 FR 21879). The requirements for all regulatory actions specified in E.O. 12866 are summarized in the following Statement from the E.O.:

> *In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.*

E.O. 12866, as amended by E.O. 14094 requires that the Office of Management and Budget review proposed regulatory programs that are considered to be “significant.” A “significant regulatory action” is one that is likely to:

- Have an annual effect on the economy of $200 million or more (adjusted every 3 years by the Administrator of OIRA for changes in gross domestic product); or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, territorial, or tribal governments or communities;
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise legal or policy issues for which centralized review would meaningfully further the President’s priorities or the principles set forth in this Executive order, as specifically authorized in a timely manner by the Administrator of OIRA in each case.

1.5 Documents Incorporated by Reference in this Analysis

This impact assessment relies heavily on the information and evaluation contained in previous environmental analyses, and these documents are incorporated by reference. The documents listed below contain information about the fishery management areas, fisheries, marine resources, ecosystem, social, and economic elements of the groundfish fisheries. They also include comprehensive analysis of the effects of the fisheries on the human environment and are referenced in the analysis of impacts throughout this document.

Alaska Groundfish Harvest Specifications Final Environmental Impact Statement (NMFS 2007).

This EIS provides decision makers and the public an evaluation of the environmental, social, and economic effects of alternative harvest strategies for the federally managed groundfish fisheries in the GOA and the Bering Sea and Aleutian Islands management areas and is referenced here for an understanding of the groundfish fishery. The EIS examines alternative harvest strategies that comply with Federal regulations, the Fishery Management Plan (FMP) for Groundfish of the GOA, the Fishery Management Plan (FMP) for Groundfish of the BSAI Management Area, and the Magnuson-Stevens Fishery Conservation and Management Act. These strategies are applied using the best available scientific information to derive the total allowable catch (TAC) estimates for the groundfish fisheries. The EIS evaluates the effects of different alternatives on target species, non-specified species, forage species, prohibited species, marine mammals, seabirds, essential fish habitat, ecosystem relationships, and economic aspects of the groundfish fisheries. This document is available from https://alaskafisheries.noaa.gov/fisheries/groundfish-harvest-specs-eis.

Alaska Groundfish Harvest Specifications Supplemental Information Report (NMFS 2024)

Annual Alaska Groundfish Harvest Specifications Supplemental Information Reports (SIRs) evaluate the need to prepare a Supplemental EIS (SEIS) for groundfish harvest specifications (in relation to the above EIS). The 2024 supplementary information report provides information to determine whether an SEIS may be necessary for the 2024 and 2025 groundfish harvest specifications. NMFS determined that a supplemental EIS is not necessary to implement the 2024 and 2025 harvest specifications. This document is available from https://www.fisheries.noaa.gov/s3//2024-04/SIR-clean-copy-508.pdf.

Draft Alaska Marine Mammal Stock Assessments, 2023 (Young et al. DRAFT 2023 SAR), Alaska Marine Mammal Stock Assessments, 2022 (Young et al. 2023)

Marine mammal Stock Assessment Reports (SARs) are published annually under the authority of the MMPA for all stocks that occur in state and federal waters of the Alaska region. Individual SARs provide information on each stock's geographic distribution, population estimates, population trends, and estimates of the potential biological removal (PBR) levels for each stock. See additional information in Section 4.5. Draft 2023 document is available from https://www.govinfo.gov/content/pkg/FR-2024-01-29/pdf/2024-01653.pdf, or in the Federal register at 89 FR 5495. The 2022 document is available from https://repository.library.noaa.gov/view/noaa/52074/noaa_52074_DS1.pdf?download-document-submit=Download

Stock Assessment and Fishery Evaluation (SAFE) Reports for the Groundfish Resources of the BSAI and GOA (NPFMC 2023f)

Annual SAFE reports review recent research and provide estimates of the biomass of each species and other biological parameters. The SAFE report includes the acceptable biological catch (ABC) specifications used by NMFS in the annual harvest specifications. The SAFE report also summarizes available information on the ecosystems and the economic condition of the groundfish fisheries off Alaska. These documents are available from https://www.npfmc.org/library/safe-reports/.

Final Programmatic Supplemental Environmental Impact Statement (PSEIS) on the Alaska Groundfish Fisheries (NMFS 2004).

The PSEIS evaluates the Alaska groundfish fisheries management program as a whole and includes analysis of alternative management strategies for the GOA and Bering Sea/Aleutian Islands (BSAI) groundfish fisheries. The EIS is a comprehensive evaluation of the status of the environmental components and the effects of these components on target species, non-specified species, forage species, prohibited species, marine mammals, seabirds, essential fish habitat, ecosystem relationships, and economic aspects of the groundfish fisheries. A Supplemental Information Report (NPFMC and NMFS 2015) was prepared in 2015 which considers new information and affirms that new information does not indicate that there is now a significant impact from the groundfish fisheries where the 2004 PSEIS concluded that the impact was insignificant. The PSEIS document is available from https://alaskafisheries.noaa.gov/node/33552 and the 2015 SIR from https://www.npfmc.org/wp-content/PDFdocuments/fmp/Final_SIR_2015.pdf.

2 Description of Alternatives

NEPA requires that an EA analyze a reasonable range of alternatives consistent with the purpose and need for the proposed action. The action alternative was designed to accomplish the stated purpose and need for the action, to allow for careful release of sablefish captured in the IFQ/CDQ sablefish fishery.

The Council adopted the following revised alternatives for analysis in June 2023.

2.1 Alternative 1: No Action

Under the No Action alternative, all regulations and FMP language related to a prohibition on discarding sablefish would remain intact. Those regulations include 50 CFR 679.7(d)(4)(ii) and 50 CFR 679.7(f)(11), and a provision in both the BSAI and GOA Groundfish FMPs under General Provisions section 3.7.1.7, prohibiting discarding of sablefish. This is the status quo alternative.

50 CFR § 679.7 - Prohibitions.
In addition to the general prohibitions specified in § 600.725 of this chapter, it is unlawful for any person to do any of the following:

...

(d) CDQ.

(4) Catch Accounting –

(ii) Fixed gear sablefish. For any person on a vessel using fixed gear that is fishing for a CDQ group with an allocation of fixed gear sablefish CDQ, to discard sablefish harvested with fixed gear unless retention of sablefish is not authorized under § 679.23(e)(4)(ii) or, in waters within the State of Alaska, discard is required by laws of the State of Alaska.

...

(f) IFQ fisheries.
(11) Discard halibut ***or sablefish*** *caught with fixed gear from any catcher vessel when any IFQ permit holder aboard holds unused halibut* ***or sablefish*** *IFQ for that vessel category and the IFQ regulatory area in which the vessel is operating, unless:*
(i) Discard of halibut is required as prescribed in the annual management measures published in the Federal Register pursuant to § 300.62 of chapter III of this title;
(ii) ***Discard of sablefish is required under § 679.20 or, in waters within the State of Alaska, discard of sablefish is required under laws of the State of Alaska; or***
(iii) Discard of halibut ***or sablefish*** *is required under other provisions.*

GOA *and* BSAI Groundfish FMPs

3.7.1.7 General Provisions

4. Discarding of sablefish is prohibited by persons holding sablefish IFQs and those fishing under the CDQ program.

2.2 Alternative 2: Allow Release of Sablefish in the IFQ Fishery

This alternative would eliminate (Option 1) or modify (Option 2) the regulatory restrictions that prohibit release of sablefish caught by fixed gear sablefish IFQ/CDQ vessels as well as the FMP provision prohibiting discarding. While the Council did not specify that this action applies to vessels fishing for sablefish in the CDQ Program, the MSA requires “the harvest of allocations under the program for fisheries with individual quotas or fishing cooperatives shall be regulated by the Secretary in a manner no more restrictive than for other participants in the applicable sector, including with respect to the harvest of nontarget species”.[2] Throughout the next several sections, language directly from the Council motion is italicized.

> ***Option 1****: Eliminate the regulatory restrictions that prohibit release of sablefish caught by sablefish IFQ vessels as well as the FMP provision prohibiting discarding.*

Alternative 2, Option 1 would not meet the intent of the Council’s revised purpose and need statement which refers to “*limited operational flexibility*”. Option 1 has been the focus of previous documents, particularly NPFMC (2021). While not analyzed in this document, it is expected that in general, environmental, social, and economic impacts of Alternative 2, Option 1 would be similar but greater in magnitude than impacts of Option 2. This is due to the opportunity afforded to fishery participants to discard any size of sablefish under Option 1, rather than limiting sablefish discards to a narrow size range (<22”). A general statement on the direction and magnitude of impacts of Alternative 1, Option 1 as compared to Alternative 1 and Alternative 2, Option 2 is included in Section 4 for environmental impacts and Section 5 for economic and social impacts.

> ***Option 2:*** *Require retention of sablefish 22 inches total body length or longer (provides for voluntary release of sablefish under 22 inches total body length)*

Throughout the document, “small sablefish” refers to fish less than 22” total body length. For the purposes of the analysis, the analysts are assuming that a sablefish of 22” roughly corresponds to an age 3, 56-57 cm, 3.2-3.3lb round weight, 2lb dressed weight, Grade 2/3 sablefish using the age/length/weight formulas included in Appendix 1. Therefore, sablefish at or above these size metrics are required, and thus expected, to be retained. Fish below this size/weight/grade may be voluntarily discarded, under careful release requirements.

Staff have analyzed the influence of Element 1 (DMRs) on the sablefish stock in Appendix 5. Staff expect that at this stage, Elements 2-4 are intended as direction for the analysts and consideration of implementation issues rather than decision points for the Council. Therefore, staff did not pull Elements 2-4 through the entirety of the impact analyses (Sections 4 and 5). For example, staff did not intend to analyze environmental, social, and economic impacts of various monitoring options until staff have a better understanding of what potential monitoring changes may be considered by the Council. In lieu of a full NEPA analysis of these elements, in the description of the alternatives, staff have flagged at a high level the potential impacts of changes to monitoring. If staff become aware of new potential impacts as this action works its way through the Council process, these will be identified and brought forward.

For the next iteration, staff recommend the Council eliminate Alternative 2, Option 1 if it is not a realistic option. This would avoid further analytical delays for an action that the Council has deemed time sensitive. The Council may also want to ensure that the purpose and need statement remains consistent with a revised set of alternatives.

2.2.1 Element 1: DMRs

Apply a DMR to released sablefish of:

1. *5%*
2. *12%*
3. *16%*

[2] Required by MSA § 305 at 104-297 (i) ALASKA AND WESTERN PACIFIC COMMUNITY DEVELOPMENT PROGRAMS. — 109-241, 109-479 (1)(B)(iv) REGULATION OF HARVEST.

4. *20%*
5. *25%*
6. *SSC recommends the DMR through the stock assessment process.*

   Sub-option: *Select different DMRs for pot gear and hook and line gear.*

A discard mortality rate must be applied to released fish to calculate the number of fish that would die post capture or handling. There is limited information on these processes (number of fish discarded, size or age composition of discards, and the proportion of those that will die), and multiple factors to take into account when considering an appropriate DMR for sablefish in the IFQ fishery such as: gear type and soak times, depth of capture, fish size/age, handling practices, injury from gear during capture (e.g., from hooking on longlines or abrasion in pots), or unknown mortality following release due to long-term injury or predation.

Previous Council documents summarized available information relevant to development of DMRs and discussed steps that the Council could initiate to begin developing DMRs specific for the sablefish IFQ fishery (NPFMC 2018; NPFMC 2019a; NPFMC 2019b; NPFMC 2021; NPFMC 2023; NPFMC 2024). For brevity, that information is not repeated here. To date, no scientific studies have been conducted to estimate a DMR specific to the Alaska sablefish IFQ fishery. The Council directed analysts to consider the use of five proxy DMR options for analysis (i.e., 5%, 12%, 16%, 20%, 25%). **These DMRs were identified by the Council to demonstrate the influence of the chosen value on the impact analysis, acknowledging that the actual DMR will be recommended by the SSC through the groundfish harvest specifications process.** It is anticipated that any DMR chosen could be reevaluated annually as future observations or studies inform the realized impacts of sablefish discarding if the proposed action is implemented.

The first four values roughly correspond to existing proxy DMRs determined through research studies (Stachura et. al 2012, Somers et al., 2020) or used by other agencies in sablefish management. The fifth value (25%) was added as an option for analysis by the Council in June 2023, due to consideration that a higher DMR may be more appropriate given instances of whale predation on released sablefish. Appendix 4 includes sablefish discarding requirements and related DMRs, size limits, and monitoring requirements used in other regions and by other agencies.

With consideration of staff time, resources, and review time, the analysts analyzed three values to simulate potential impacts of reasonable maximum and minimum DMRs on resultant SSB and catch advice along with associated uncertainty. **The three DMRs used in the simulation analyses are 12%, 20%, and 35%** (Appendix 5**)**. The values chosen were based on input from the SSC in February 2024, and include two values from the Council's options in the motion, and one higher than any listed in the Council's motion to provide some contrast in the results, for comparability with historical studies, and to account for potential unknown future whale depredation.[3] This approach, using upper and lower bounds on DMR, is meant to demonstrate the range of potential impacts, as the DMR selected during the harvest specifications process will directly scale sablefish mortality estimates and the resulting reference points for the following year.

The Council's alternatives include a suboption to differentiate DMRs by gear type (e.g., sablefish caught in pots may have a different DMR than hook-and-line (H&L, or 'longline') caught sablefish) due to variables like hooking injuries and catch handling. Given the level of uncertainty in total DMR (i.e., handling mortality plus mortality from predation), there is not sufficient data to accurately parse out the relative difference in DMR among gears. In February, the SSC did not recommend using different DMRs for pot and H&L gear due to the lack of gear specific information and the practical consideration that the

[3] Scientific and Statistical Committee Final Report to the North Pacific Fishery Management Council February 5th – 7th, 2024.

gear types are not currently separated in the stock assessment. Therefore, this analysis uses the SSC's proposed DMRs as average fleet-wide DMRs, which would account for when sablefish are released with and without whales present, since there is no information on the frequency of post-release whale predation events.

A DMR is applied at the total catch/removals estimation stage (within NMFS Catch Accounting System, "CAS", see Section 2.2.2), and could be accounted for in the stock assessment. In Alaska, the CAS is where catch mortality estimates (retained and discarded) are generated for groundfish species. CAS estimates are used by in-season management to effectively open and close fisheries; analyses that would affect total catch should be applied during in-season management. In accounting for total removals, the stock assessment applies a DMR to the predicted total discard estimates to calculate the predicted dead discards. The model fitting process then uses maximum likelihood estimation to minimize differences between the CAS estimated discards and model-predicted discards (along with the other data components) to estimate critical model parameters. The incorporation of a DMR and associated retention selectivity function into the stock assessment allows total fishing mortality to be partitioned into landings and dead discard components when deriving population estimates and recommended quotas.

2.2.2 Element 2: Catch and Release Mortality Accounting

Sablefish catch and release mortality associated with the IFQ fishery will be accounted for in the stock assessment. The analysis should describe the potential implications of voluntary discards on the sablefish stock assessment, specifications process and catch accounting in the context of other uncertainties.

Catch accounting for sablefish discards in the pot and H&L fisheries fundamentally relies on data collected by at-sea observers. The sampling protocols followed by at-sea observers provide statistically reliable data of not only the weight and numbers of sablefish, but also independently verified location data of sablefish discarded (which are minimal, as discards are currently limited to 'drop-offs', overages, and damaged catch). Electronic monitoring (EM) systems provide count and location data, but rely on at-sea observer data for weight estimates. To estimate total catch, 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 either as reported on industry reports for catcher vessels (CVs) (e.g., fish tickets) or estimated from observer data on catcher processors (CPs). This estimate of total catch is required under National Standard 1 Guidelines and is used in the stock assessment and for management of the fishery.

Observer data collection methods are well established and documented (AFSC 2024; Cahalan et al. 2014; Cahalan and Faunce 2020). On a randomly selected fishing set (haul), an at-sea observer will randomly select several portions (samples) of the gear being retrieved and record the species, number, and disposition (estimated percentage of discarded or retained by species) of fish caught during the sample. These species composition samples are used to estimate the species-specific total number of fish caught (the number of fish sampled extrapolated to the size of the set or haul). The number of fish is then converted to a weight of fish caught by multiplying by the average weight per fish estimated from a sample of unsorted catch. When collecting the sample of unsorted catch, the crew are asked to bring every fish in the sample onboard for the observer to collect data. Hence the mean weight per fish collected from unsorted catch is generally for that specific set, and the mean weight per fish is an unbiased estimate for the fish caught.

Previous documents related to this action have discussed the challenges associated with collecting unbiased discard estimates for size-selective discards in the sablefish IFQ fishery (NPFMC 2018; NPFMC 2019a; NPFMC 2019b; NPFMC 2021; NPFMC 2024). These documents also assessed the feasibility of new methods of collecting these data specifically under Alternative 2, Option 1. NMFS has summarized and updated some of this information here as it relates to accounting for discards.

A shoreside program that could be used to sample sablefish shoreside does not currently exist for Alaska's federal fisheries. Creation of such a program would be prohibitively expensive and would require developing a new sampling regime to cover ports where sablefish are landed (see NPFMC 2021). Additionally, shoreside sampling would not provide characteristics of discarded sablefish. For these reasons, shoreside sampling is not considered further in this analysis.

Another option that has been proposed is using logbook data. Participants in the sablefish IFQ fishery are subject to logbook requirements if their vessel exceeds 60 ft in length or if they utilize pot gear. With the rapid adoption of pot gear in recent years (see Section 3.1.1), there has been a substantial increase in logbook usage. Logbooks are completed either on paper or in electronic (eLogbooks) format, with paper logbooks being the preferred option among participants. The adoption of eLogbooks remains voluntary, and, so far, only a fraction of the fleet has embraced this digital format. The data from paper logbooks is not readily available and relying solely on logbooks poses limitations in providing verifiable data regarding sablefish discards quantities and individual sizes crucial for stock assessment and catch accounting to estimate discards accurately. Moreover, the preference for paper logbooks, driven by the increase of pot gear, raises concerns for NMFS regarding increased burdens in data collection and verification that could strain capacity without significant trade-offs in other programs that would require further analysis.

Impacts of fishery catch and release on data and catch accounting

Bias – Observer Data

Current data collection processes and estimation methods for sablefish are designed to assess total catch and are not designed to evaluate size-selective discards. Observers collect representative samples at sea 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. Under this sampling model, all the necessary data are collected at-sea, and the observer must balance sablefish biological and catch sampling with the logistical constraints on the vessel and other sampling priorities.

The total weight of sablefish is currently calculated under the assumption that the size distribution of any discard of sablefish is reflective of the full size distribution of the catch since the fishery is required to retain all sablefish, regardless of size. Hence, the estimated total weight of sablefish for each haul is calculated by multiplying the total number of sablefish caught by the mean weight per fish for the unsorted catch. The estimated weight of sablefish discarded is the estimated total weight of sablefish multiplied by the proportion of sablefish discarded. Similarly, the estimated weight of sablefish retained on a haul is the product of the total weight caught and the proportion (by number) of sablefish retained (equal to one minus the proportion discarded). These estimates of retained and discarded catch are used to generate discard rates that are, in turn, multiplied by total catch to estimate total sablefish discards for the fishery. Because observers currently sample the unsorted catch using randomized sampling methods, these estimates of the weight (and number) of sablefish discarded for each sampled haul are unbiased. When there is no difference in the size composition of discarded catch and total catch (i.e., when there is no size-dependent discarding of catch) the current data collected with status-quo protocols can also be used to generate unbiased estimates of the weight of sablefish discarded at sea. However, when fish are discarded or retained based on size, the proportion of the weight of catch that is discarded is not equal to the proportion of the number of fish that are discarded, and new monitoring methods would need to be implemented if there is the need to avoid biased estimates of at-sea discards.

Under Alternative 2, Option 1, operators could discard fish of any size. If fishermen were to discard in a size-selective manner, this would violate the assumption (under the current data collection methods and the estimation model) that the weight distribution of discarded sablefish is similar to the weight distribution of retained sablefish. These same concerns exist for Alternative 2, Option 2, under which sablefish may only be discarded below the minimum size retention requirement of 22”.

Bias - EM data

Catch estimation for the EM portion of the fleet follows a similar estimation process as is used for observer data, with one important difference: the average weight per fish used to convert the estimated number of fish to an estimated weight of fish is based on data collected by observers. These average weights are then multiplied by counts recorded during EM video review in order to generate estimates of total catch. As with observer data, discarded catch weights are estimated as the product of total weight and the proportion (by number) of sablefish discarded. Under this model, we make the same assumption with EM data that we do with observer data: that the size distribution of discards is reflective of the size distribution of total catch. With EM, we are making the additional assumption that the size of fish caught by the observed fleet is the same as the size of fish caught by the EM fleet. If this latter assumption is invalid, it has the potential to bias estimates of EM total catch, and depending on the chosen estimation method, bias estimates of EM discards. Under Alternative 2, the estimation issues described above for observer data-based estimates would also apply to data collected in the EM strata.

Accounting for size-dependent discards

Operationalizing size-selective discards without an adjustment to total catch estimation methods would result in an overestimate of discarded sablefish weight since the average weight per fish used to estimate discarded catch will incorporate the weight of larger retained fish. This was an issue in the halibut IFQ fishery and the amount of bias was not trivial (~35%, Cahalan and Gasper 2022). An important difference between halibut and sablefish data collection, however, is that lengths are collected during viability sampling for discarded halibut and halibut has a regulated size limit, whereby all halibut under 32” must be discarded. Therefore, the unbiased estimation methods developed for halibut would not apply to sablefish.

Unbiased estimates of at-sea sablefish discards could be obtained by calculating the difference between the landed sablefish weight reported on the fish ticket and the total sablefish weight estimated from observer data for each monitored trip. The total estimated weight of sablefish for the trip is the product of the mean weight of sablefish per sampled haul (set) and the total number of sets on the trip. This is an unbiased estimator of total catch with which data from each set on the trip contributes equally to the estimate (as opposed to the use of ratio estimator methods where larger sets contribute more to the estimated mean). Estimated discard weight of sablefish is this trip-total weight of sablefish minus the weight of retained sablefish reported on the fish ticket. To estimate the total at-sea discard for the fishery, the average sablefish discard weight per trip could be calculated from the observed trips and expanded to the total number of trips in the fishery.

These proposed methodological changes would provide an estimate of the total mortality (all catch, inclusive of DMR) for the assessment and the information necessary to monitor management quantities, as appropriate (e.g., OFL, ABC, TAC, discard accounts, IFQ/CDQ trips). We note that accounting for IFQ and CDQ (sablefish not discarded at-sea) would be unchanged from current methods. Implementation of this discard estimation method would require substantial modification to the CAS estimation processes and compared with other groundfish species, would be a unique process for sablefish. **NMFS would implement this new total catch accounting method for IFQ and CDQ sablefish fisheries on a timeline commensurate with available technical resources, noting that estimation methods may evolve in the future as available information changes, methodological improvements are explored, or technical constraints are encountered upon implementation.**

Under Alternative 2, CAS would undergo modifications to revise estimation methods for discard accounting, including using a specified DMR. As described previously, the specification of the DMR would be determined through the assessment/harvest specifications process and subsequently applied in CAS to the overall estimate of discards for the calculation of total sablefish mortality.

Impact of fishery catch and release on inseason management

An important feature of the sablefish IFQ program is that, under current full retention requirements, only retained fish accrue towards the annual amount of IFQ for each permit holder. Thus, enforcement of catch limits relative to quota program rules are directly linked to the permit holder and activity of the catching vessel. Accounting for discard under quota share programs, such as in the GOA Rockfish Program, Amendment 80, or Amendment 91 Chinook, requires data on discard amounts specific to the harvesting vessel. As such, all vessels have at least 100% monitoring. Without 100% monitoring, the amount of discard on unobserved vessel would be based on an estimate derived from discard activity on a mix of vessels that are observed. Functionally, for the IFQ program, this means that discards that would accrue to a permit holder's annual quota limit would not be based on the permit holder's fishing activity, which is not a legally sufficient accounting method to manage individual fishing quota. Similarly, under other catch share programs, such as the Amendment 80 Program, NMFS concluded that the use of bycatch rates from observed vessels to estimate the bycatch of unobserved vessels was not appropriate due to the incentive for unobserved vessels to fish differently than observed vessels and influences NMFS’ ability to estimate accurate groundfish discard and bycatch rates.

Inseason management for all groundfish species, including IFQ and CDQ sablefish, relies on estimates of discards at sea and discards at the processing plant. Since the IFQ Program for sablefish was implemented in 1995, NMFS has estimated sablefish discards from non-IFQ fixed gear vessels. However, because the fixed gear TAC is fully allocated to IFQ and CDQ sablefish fisheries, and none of the TAC is set aside for non-IFQ sablefish caught incidentally in other fixed gear fisheries (i.e. in the Pacific cod and halibut IFQ fisheries) discards from non-IFQ trips accrues towards the TAC and has resulted in overages of the fixed gear allocation of the sablefish TAC in some years and areas. Fixed gear harvest and discards that exceeded TACs is highlighted in the twenty-year programmatic review of the halibut and sablefish IFQ program (NPFMC and NMFS 2016b). In the WGOA, the total fixed gear harvest and discards exceeded the fixed gear TAC in 2008, 2009, and 2011. In the CGOA the total fixed gear harvest and discards exceeded the fixed gear TAC in 2004, 2007–2011, and 2013–2015. In the WY District, the total fixed gear harvest and discards exceeded the fixed gear TAC in 2007–2011, and 2013–2015. In the SE Outside District, the total fixed gear harvest and discards exceeded the TAC in 2004–2005, and 2007–2015. In recent periods, overall TAC (all TAC categories) exceedance in the GOA ranged between 2% to 8% in the years 2016 through 2020, and the overall GOA TAC was not fully utilized 2020-2023 (Table 2-1). In the BSAI, TAC overages have occurred 2019-2021, largely driven by the trawl sector exceeding their allocation, with fixed gear in the Bering Sea exceeding its allocation by 15% in 2022 only.

Table 2-1 Percent of sablefish allocation caught, 2016-2023. Data complied from NMFS Inseason Management reports at https://www.fisheries.noaa.gov/resource/document/alaska-inseason-management-annual-reports-north-pacific-fishery-management

	Percent of Allocation Caught							
	2016	2017	2018	2019	2020	2021	2022	2023
Western GOA Fixed Gear	98	103	95	97	83	83	90	70
Western GOA Trawl	18	24	73	101	47	37	30	23
Central GOA Fixed Gear	104	100	88	105	77	84	75	66
Central GOA Trawl	101	132	215	174	161	74	77	60
West Yakutat Fixed Gear	114	105	100	105	86	82	86	84
West Yakutat Trawl	93	98	98	52	28	31	23	20
Southeast Fixed Gear	106	107	101	103	85	80	87	82
Overall percent TAC	102	104	105	108	86	79	79	70

If fixed gear vessels with sablefish IFQ available are allowed to discard, NMFS will need to determine the amount needed for an incidental catch allowance (ICA) to account for sablefish discards. In the annual harvest specifications, NMFS makes ICA determinations for most species that are fully allocated to a catch share program. IFQ sablefish is one of the only catch share programs that does not already include an ICA. NMFS determines the ICAs that are used in setting annual harvest specifications by reviewing the incidental catch in previous years and the amount of TAC set for other target fisheries for that fishing year. Usually, when a catch share program is newly implemented, NMFS sets a conservative ICA and adjusts it over time as more information becomes available on the incidental catch. Setting the ICA annually allows NMFS to make adjustments each year depending on the most recent information. The Southeast Alaska Chatham Strait sablefish managed by the State of Alaska which allows voluntary release of sablefish employs a similar process to account for all sources of known mortality before setting an annual TAC each season. The State's Chatham Strait sablefish assessment incorporates a 16% DMR to account for small sablefish release mortality in the commercial fishery which is used in the acceptable biological catch (ABC) calculation. Once the ABC has been calculated, the State applies DMRs to other known sources of mortality which includes bycatch of sablefish in the halibut IFQ fishery (25% DMR), sport fishery (11.7% DMR), personal use and subsistence fishery (16%), deadloss mortality using a 3-year rolling average estimated from the State's annual sablefish longline survey, and estimates longline survey removals before setting the TAC for the upcoming commercial fishing season (Joy and Ehresmann 2022).

The trawl gear allocations of the sablefish TACs are not further allocated to other catch share programs except for the CDQ allocations in the BS and AI and the Rockfish Program secondary species allocations in the Central Gulf of Alaska. The BS and AI CDQ allocations are 7.5 percent of the trawl sablefish TAC and the remaining amount supports the non-CDQ trawl fisheries. The Rockfish Program trawl allocation is about 50 percent of the Central GOA trawl allocation and the remaining amount supports the non-Rockfish Program trawl fisheries. Trawl vessels fishing for a Rockfish Program cooperative are prohibited from discarding sablefish (§ 679.7(n)(6)(i)). All other trawl catch of sablefish may be discarded and retained and discarded sablefish accrues to the trawl TACs. If the trawl gear allocation of sablefish is opened for directed fishing in an area, then NMFS sets aside an inseason ICA if the trawl TAC is expected to be reached. If the trawl TAC does not support opening directed fishing then the entire amount is considered the ICA.

Under Alternative 2, this would create a new ICA for the sablefish IFQ catch share program to account for sablefish discards for the fixed gear fleet. The application of ICAs would differ between the GOA and BSAI due to CDQ reserve requirements in the BSAI. To account for fixed gear discards each year, ICAs would be set for fixed gear after the CDQ reserves are determined and would not impact how CDQ reserves are determined or apply to trawl gear. The CDQ groups would continue to account for fixed gear sablefish discards under status quo. Since CDQ reserves do not apply in the GOA, only fixed gear discards would apply. **GOA.**

Figure 2-1 shows how ICAs would apply under Alternative 2.

Table 2-2 provides a numerical example of how sablefish fixed-gear ICAs would be applied in the BS and AI using a hypothetical scenario for TACs and ICAs. **NMFS would use this approach in using fixed gear discard estimates to apply ICAs for BS, AI, and GOA.**

Figure 2-1 Sablefish Allocations: Includes ICAs under Alternative 2 and status quo allocations which remain unchanged.

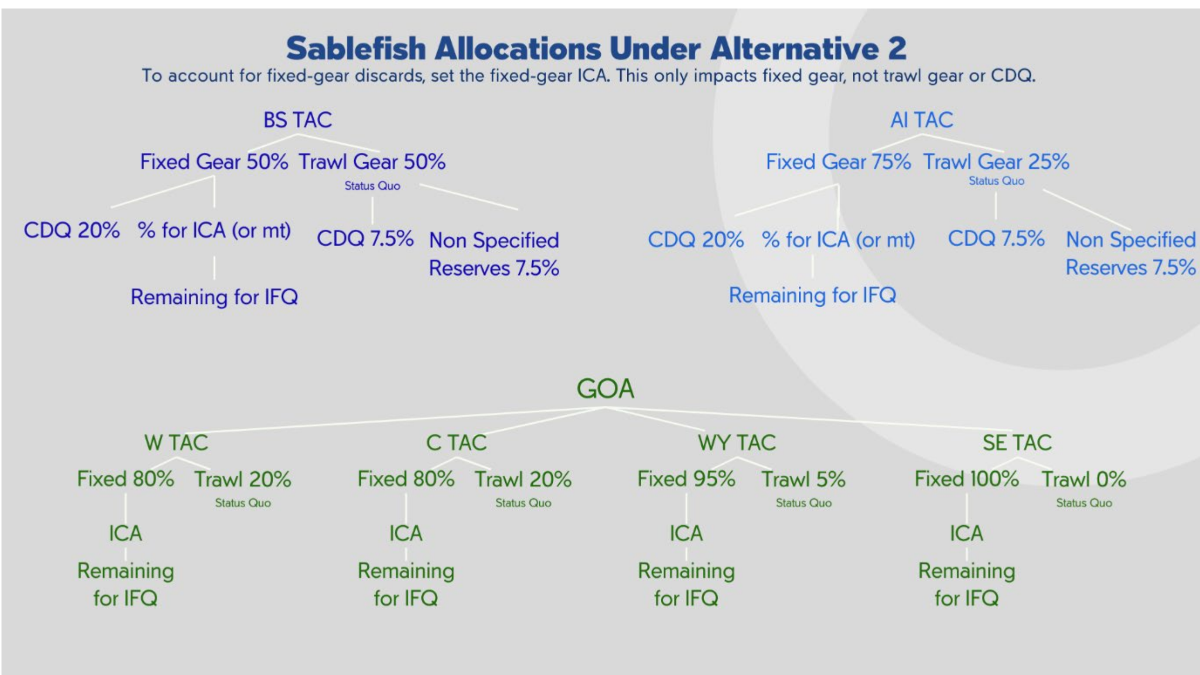


Table 2-2 Example of Gear Shares and CDQ Reserve of BSAI Sablefish TACs with an Incidental Catch Allowance (ICA) of 5% for Fixed Gear.

New calculation using an Fixed gear Incidental Catch Allowance of 5%

Gear Shares and CDQ Reserve of BSAI Sablefish TACs **with Incidental Catch Allowance (ICA) for Fixed Gear**

[Amounts are in metric tons]

Subarea and gear	Percent of TAC	Share of TAC	Fixed gear ICA	ITAC	CDQ reserve	Nonspecified reserve
Bering Sea						
Trawl gear[1]	50	500	na	425	38	38
Fixed gear[2]	50	500	20	380	100	na
TOTAL	100	1,000	20	805	138	38
Aleutian Islands						
Trawl gear[1]	25	250	na	213	19	19
Fixed gear[2]	75	750	30	570	150	na
TOTAL	100	1,000	30	783	169	19

Note: Seasonal or sector apportionments may not total precisely due to rounding.

[1] For the sablefish TAC allocated to vessels using trawl gear, 15 percent of TAC is apportioned to the non-specified reserve (§ 679.20(b)(1)(i)). The ITAC for vessels using trawl gear is the remainder of the TAC after subtracting this reserve. In the BS and AI, 7.5 percent of the trawl gear allocation of the TAC is assigned from the non-specified reserve to the CDQ reserve (§ 679.20(b)(1)(ii)(D)(1)).

[2] For the portion of the sablefish TAC allocated to vessels using fixed gear, 20 percent of the allocated TAC for the BS and AI is reserved for use by CDQ participants (§ 679.20(b)(1)(ii)(B)). The ITAC for vessels using fixed gear is the remainder of the TAC after subtracting the CDQ reserve and ICA for each subarea. The Council recommended, and NMFS concurs, that specifications for the fixed gear sablefish IFQ fisheries be limited to one year.

This element also requests potential implications of voluntary discards on the sablefish stock assessment. This is described in detail in Appendix 5. Refining the current assessment to account for discarding would require major changes to the modeling framework as well as accurate data on the discarding process (i.e., the magnitude and size or age composition of discards with similar precision to data on landed catch). The stock assessment and resulting ABC projections would be likely to increase in uncertainty, given the increase in parameters (i.e., DMR, retention selectivity) and the limited, imprecise data available to inform them. Moreover, loss of data on incoming year classes (i.e., fish less than 22 inches) would further increase the uncertainty in estimates of recent recruitment events, which are already difficult to estimate in the first few years after recruitment to the fishery. Because of this uncertainty, assessment authors might recommend a larger catch buffer as part of the risk table process.

2.2.3 Element 3: Monitoring and Enforcement

The analysis should describe potential monitoring and enforcement provisions that could improve estimates of voluntary and regulatory discards.

Monitoring Considerations

Changing at-sea observer sampling methodology to account for size-dependent sablefish discards is possible, but comes with its own costs and potential sources of bias and imprecision. Firstly, with no mandatory requirement to discard below a minimum size, a harvester's choice to discard or retain a fish is dependent on many variables including anticipated ex-vessel prices, catch rates, vessel capacity, and condition of the catch. Unlike with halibut, for which harvesters are able to hold the fish up to a pre-measured legal length marker on the vessel and make an objective decision as to whether the fish is legal to retain, a voluntary discard program for sablefish would require situational decisions about whether or not to discard. The presence of an observer or active EM system could also impact the decision to discard fish, introducing an observer effect (or bias) that would propagate to all unobserved trips to which estimates are applied.

Secondly, collecting disposition-specific (retained or discarded) size information on sablefish at sea is challenging from a logistical perspective. Sablefish are targeted mainly by small vessels on which the ability of the crew and observers to safely separate catch for sampling is limited and data collection could rely more heavily on crew assistance (which may slow normal crew operations). In order to add collection of disposition-specific sablefish size data to the observer's workflow, other critical data elements may need to be removed from the observer's sampling duties. In addition, the observer database and data transmission applications would need to be updated to accommodate disposition-specific catch and length data. Any large database and software change would involve significant resources to build, test and implement.

Changing observer at-sea sampling methods is a complex task that involves working with data users and evaluating their data needs. Each year the Council develops its list of fishery monitoring data collection priorities. NMFS takes these priorities into account, along with the needs of stock assessment authors, legal requirements and other mandates (such as collecting data on marine mammal takes), and the needs of other fisheries managers (such as ADF&G and IPHC). These priorities are generally reflected in the Annual Deployment Plan (ADP) and the Annual Observer Sampling Manual. The draft ADP is presented at the October Council meeting while the final ADP is provided at the December meeting and describes how observers and EM are deployed into the fisheries. In addition, the Fisheries Monitoring and Analysis Division (FMA) at the AFSC can define observer duties that are specific to a fleet and target fishery. Determination of observer duties are not a part of the ADP process, but rather are determined by FMA in conjunction with all fishery-dependent data users.

Because the ADP does not consider fishery or individual species when allocating sampling resources to strata, adopting Alternative 2 would not impact the ADP process or affect the monitoring rates for each stratum regardless of changes in discarding activity. Under both Alternative 1 (No Action) and Alternative 2 (Allow Release of Sablefish in the IFQ Fishery), observer coverage rates will continue to be determined through the ADP process, which was established in 2013 under the Restructured Observer Program (NMFS 2013). In the 2024 ADP, new stratification and sample allocation methods were adopted to minimize data gaps and decrease the potential for small sample sizes within a sampling stratum, and these new methodologies will be unaffected by whichever alternative is chosen here (NMFS 2023).

Should the Council move forward to allow size-selected discards of sablefish, FMA would assess data needs and observer duties, and would define observer duties in order to best meet all identified data collection needs. If observers were requested to collect length and age data for discarded fish (e.g., to support stock assessment activities), the frequency and/or tasking of other data collections may be adjusted to allow time for these additional collections. This could include decreases in the size or frequency of species composition sampling, or decreased collection of biological data on species such as halibut and/or rockfish data. In addition, there would be increased reliance on crew to assist in observer data collections. For example, during sample collection, all fish could be required to be brought onboard, retained, and discarded catch sampled separately, requiring additional deck space, and crew would then need to identify which fish would have been discarded (potentially introducing an observer effect). Regardless of data collection trade-offs, vessels that are size-selecting sablefish discards will need to work closely with the observer to provide assistance as requested.

Enforcement Considerations

The Enforcement Committee met on January 28, 2021 to discuss the issue now captured under Alternative 2, Option 1. While at the time, Option 2 was not presented, the Enforcement Committee presciently discussed a potential future size threshold nevertheless. Therefore, the key topics of discussion remain relevant. The Committee noted the importance of careful release provisions, and ensuring that discards are accurately reported in the logbook as required. Further, careful release regulations would need to be specific, similar to the careful release regulations for halibut. The primary compliance monitoring tools would consist of at-sea boardings, observed trips, and electronic monitoring (EM) trips. The Enforcement Committee discussed the potential need for increasing observer/EM coverage for IFQ sablefish vessels to better determine sablefish discard mortality estimates. There could be differential bias due to the high value of larger fish, and very different behavior may occur during observed versus unobserved trips (i.e., observer effect) which could imply a downstream need for increased observer/EM coverage. The Enforcement Committee noted the likely added costs that would be incurred to review electronic monitoring video for illegal discards. Increases to observer or EM coverage on IFQ sablefish vessels would aid compliance monitoring and enforcement efforts associated with observer/EM reported violations. Finally, the Enforcement Committee discussed implementing a size limit in a future analysis, as Option 2 presents. As discussed in the monitoring section, this would create additional enforcement concerns pertaining to the limited compliance monitoring tools that would be available to enforce a size limit and detect prohibited species discarding violations; current EM technology is not able to identify illegal discard (size limit) of sablefish to the accuracy/fidelity required as evidence to support a violation for prosecution.

To minimize the discard mortality for sablefish, the Council may wish to recommend mandated careful handling of discarded sablefish. This would carry a simultaneous benefit of disincentivizing discard of dressed/processed fish. Without a careful handling requirement, discard of dressed/processed fish (to improve marketability of catch) could be made legal by either option.

Example provisions regarding careful release of PSC can be found at 50 CFR 679.21. Existing regulatory language at 679.102 and 679.7 address careful release requirements for discarded halibut. OLE recommends consistent regulatory language to require careful release of sablefish discards.

The following table provides a summary of relevant regulations applicable to halibut careful release requirements and PSC careful release.

Table 2-3 Relevant regulations applicable to halibut careful release and PSC careful release.

50 CFR 679.21 Prohibited species bycatch management	(a)(2)(ii). After allowing for sampling by an observer, if an observer is aboard, sort its catch immediately after retrieval of the gear and, except for salmon prohibited species catch in the BS pollock fisheries and GOA groundfish fisheries under paragraph (f) or (h) of this section, or any prohibited species catch as provided (in permits issued) under the PSD program at § 679.26, **return all prohibited species, or parts thereof, to the sea immediately, with a minimum of injury, regardless of its condition**.
50 CFR 679.102 Halibut Deck Sorting	(e)(6) ***Careful handling.*** Handle all halibut sorted on deck with a minimum of injury.
50 CFR 679.7 Prohibitions	(a)(13) **Halibut** caught with fixed gear: it is unlawful to: • Fail to release the halibut outboard a vessel's rails. o Release halibut caught with longline gear by any method other than— ▪ Cutting the gangion. ▪ Positioning the gaff on the hook and twisting the hook from the halibut. ▪ Straightening the hook by using the gaff to catch the bend of the hook and bracing the gaff against the vessel or any gear attached to the vessel. o Puncture the halibut with a gaff or other device. o Allow halibut caught with longline gear to contact the vessel, if such contact causes, or is capable of causing, the halibut to be stripped from the hook.
IPHC Regulations (Section 7)	1. All Pacific halibut that are caught and are not retained shall be immediately released outboard of the roller and returned to the sea with a minimum of injury by: (a) hook straightening; (b) cutting the gangion near the hook; or (c) carefully removing the hook by twisting it from the Pacific halibut with a gaff.

The IPHC regulations also impose a minimum size threshold of 32 inches (81.3cm), where halibut 32" and above (that a vessel has quota for during open season in the relevant IPHC regulatory area) must be retained, and fish under 32" must be discarded. NMFS, in collaboration with OLE, suggests that, were Council to recommend Alternative 2, a similar careful handling requirement and mishandling prohibition be promulgated to improve discard mortality and prohibit discarding dressed/processed sablefish.

It should be noted that OLE has some limitations regarding enforcing careful handling and release requirements, as well as with retention requirements. Observers, while trained to report potential mishandling of halibut and other PSC species to OLE, must prioritize sampling duties, and therefore cannot witness all instances of noncompliance with careful handling and retention provisions. Observers do, however, provide OLE with the most reliable data for review and potential subsequent enforcement action by OLE. Observers may witness the measuring and subsequent discard or retention of sublegal and legal halibut. This capability could be mirrored under Alternative 2, Option 2, establishing a minimum size retention requirement of 22 inches for sablefish, below which voluntary discarding would be allowed. This would also require changes to observers' current sampling duties. Under Option 2, an observer would have to witness and report the discard of legal sablefish (≥22") and report that to OLE, and under Option 1 or 2, could likewise report suspected noncompliance with careful handling and release provisions. In the current regulatory framework, within the Fixed Gear Electronic Monitoring Program, illegal discard of sablefish is enforceable. Speaking to EM, both Option 1 and 2 would complicate that enforceability to varying degrees. Under Option 1, discard of all sizes and conditions of sablefish would be legal in absence of careful handling and release provisions. With Option 2, detecting discard violations based on handling provisions would mirror OLE's limited capability with halibut, and greater limitations with detecting size-based violations. As a heuristic, enforcing required retention and/or discard of halibut in the Fixed Gear EM Program is complicated, based on the minimum size requirement of 32 inches. Under current sampling protocols, data reviewers note the disposition of the halibut: retained or discarded, and if discarded, what release method was used, and each animal's release condition (if it can be ascertained). A change to data review protocols would be required for reviewers to extend these data collections to sablefish. They do not currently have the capability to determine the size of the released animal; program changes would be required, employing technologies or catch handling changes in order to record accurate size data, for any potential enforcement action to be taken. This would also almost certainly require extra effort by the fixed gear fleets in order to ensure these data could be reliably collected by EM. In both the observed and the EM fleets, if the vessels head the fish (as part of dressing), OLE will be unable to detect size-dependent violations post-processing (e.g., at the dock).

An increasing proportion of the IFQ sablefish fleet has implemented fishing with pot gear, particularly with the development of slinky pots. Current regulations do not specifically address careful handling on pot vessels. It is likely that discard mortality of sablefish caught on pot vessels is disparate from that of sablefish caught on hook and line gear: they do not suffer hook or crucifier injuries, but may spend longer out of the water, and may have opportunity to incur contact injuries from within the pots, from the sorting table, and through crew handling practices. Council and NMFS could consider whether drafting of pot gear-specific careful handling requirements and/or prohibitions may be beneficial to discarded sablefish mortality, the industry by prescribing well-understood best handling practices, and enforcement in determining if a violation has occurred. The current broad language "immediately, with a minimum of injury," while enforceable, may lead to differing interpretations between and among the fleet/s and enforcement personnel. Prescriptive language (examples are not all-inclusive) such as 'at the first opportunity to sort,' 'prior to handling retained fish,' and example/s such as those used in the Fixed Gear EM program VMPs, such as "completely clear all… [**sablefish**] off the table and deck before the next pot is dumped (so that catch from 2 pots is not mixed)" could be considered.

Risk may need to be assessed in a future review to ensure updated regulations or other management structures have not created unintended mismatches between sablefish discard accounting and discard reporting and monitoring mechanisms. Potential issues to be evaluated could include: (1) accuracy of trip-level discard reporting, (2) observer and EM data reviewer involvement in detecting, documenting, and reporting potential noncompliance.

2.2.4 Element 4: Review

> ***Option 1****: The ability to release sablefish will be reviewed in a) 3 years b) 5 c) 7 years following implementation.*
>
> ***Option 2****: The ability to release sablefish will sunset after 5 years following implementation.*

The Council can review realized impacts of this action a certain number of years post-implementation. This could mitigate any realized negative impacts of the action. Given the ecological changes which have potential to influence the sablefish stock (recruitment dynamics in particular), the ability to review regulatory changes and adapt to these changes is a valuable tool. Similarly, the economics of the sablefish market have changed in the last few years (see Section 3.3), and if market conditions continue to change, the Council may choose to revisit the effects of this action within the context of those changes at a later date. The Council has the ability to schedule a review of any action and does not *need* to choose an option under this element at this time, but it may choose to signal its intent to do so or include a preferred option for planning purposes.

A "sunset" provision establishes an expiration date for a regulation. Typically, this provision is written such that it is set to expire X number of years after implementation, and the expiration date is included in the regulation. Thus, the regulation expires on that date unless the action goes through a full Council analysis and the Council takes a positive action to extend the deadline, and the agency approves the extension or replacement regulation.

Sunset provisions have been added to Council actions in the past, particularly when there is a contentious issue. Typically, this has occurred when some group either does not want the regulation, or a group wants to try to add additional requirements to the regulations by forcing the Council to take the issue up again in the future. For example, the Kodiak Type 1,2, and 3 trawl closure areas were established under GOA Groundfish Amendment 15, with a 3-year sunset. The Council extended the regulation under Amendment 18 for another 3 years, and then finally made the regulation permanent under Amendment 26. In the most recent use of a sunset provision, the Council final action from February 2023 to remove Area 4 halibut IFQ vessel use caps included a sunset date (end of the fishing season 2027). The preferred alternative also included a note "If the Council decides to take subsequent action to modify vessel cap limits in area 4, such action will supersede if implemented before 2027", noting that the Council previously passed a motion in June 2022 that included alternative vessel caps for analysis. In this instance, intent of the sunset provision was to prioritize completion of the alternative vessel cap analysis.

Sunset provisions have been infrequently used due to the inherent drawbacks. A sunset provision commits a future Council to use resources (staff and Council time) to re-analyze the action, even if the regulation is working perfectly as envisioned. It also commits a future Council to prioritizing this action over all other actions, in that the action would need to be approved and implemented prior to expiration of the existing regulation. One consideration of a sunset provision for this action is the uncertainty surrounding trends of the sablefish stock and market in future years. If similar trends in recruitment (e.g., large influxes of small sablefish) or sablefish markets (e.g., low prices) continue over the next several years, and the sunset provision were to expire while the fishery continues experiencing catches of small, low value fish, the sunset would eliminate any flexibility provided by this action and any associated benefits, until additional analyses can be completed.

These challenges are further exacerbated when the sunset provisions are established to expire after only a few years. For example, a 3- year sunset provision would require the Council to initiate an analysis for an extension of the regulation at the beginning of year 2 of the regulation being in place by the expiration date. At that point, the data may not even be available to evaluate whether the regulation met its objectives in that first year. Nevertheless, the analysis would need to be completed and positive action taken by the Council, and for NMFS to complete the proposed rule and final rule requirements prior to the original regulation expiring.

Because of these drawbacks, and the fact that all Council actions and regulations can be revisited and revised at any point, sunset provisions should be used sparingly, if at all. A reasonable alternative to sunset provisions is for the Council to commit to prioritizing any analysis of alternative regulations (e.g., vessel use caps), or simply reviewing the efficacy of the existing regulation after there is sufficient data available. For example, when the Council took action in April 2015 to allow the use of pot gear in the GOA sablefish fishery, the motion included a statement “A review on the effects of allowing GOA Sablefish longline pot gear will be conducted 3 years after implementation.” This review occurred in April 2021, and subsequently, changes to the regulations were proposed, analyzed, and acted upon.

2.2.5 Discussion of Escape Rings and Selectivity

The analysis should include a discussion of selectivity in sablefish pots and whether requiring escape mechanisms meets the objectives of this action. Escape rings on pots can influence the size selectivity of the gear type, in that both the presence and specific size of escape rings can affect the relative probability that a fish of specific age or size is caught. Size selectivity is a key component of the analysis and is mentioned throughout the document.

In June 2023, the Council discussed whether to include escape rings as an element in the alternatives of the motion. Ultimately, the Council decided to not to include an element that would consider a requirement for escape mechanisms on sablefish pot gear and articulated that this should be separate. The Council’s decision to not include a requirement for escape rings as an element in the motion signaled to staff that it did not need to be carried subject to a full impact analysis at this time. Staff have included this discussion in Appendix 3. **If the Council would like to include this as a regulatory requirement, staff would complete a more thorough level of analysis in the EA/RIR prior to final action.**

2.3 Comparison of Alternatives

Table 2-4shows a high-level comparison of the impacts of Alternative 1 and Alternative 2, Option 2.

Table 2-4 Comparison of Alternatives

	Alternative 1: No Action	Alternative 2: Option 2
Differences in Alternatives		
Discarding of sablefish	Prohibited in IFQ fishery	Voluntary release of sablefish under 22“ total body length in fixed gear IFQ/CDQ fisheries. Retention of sablefish ≥ 22” required.
Environmental Impacts		
Sablefish	No changes	Simulation results for projecting ABC (Appendix 5) show negligible (not significant) impacts on the stock under current ABC utilization. • Minimal dead discards and spawning stock biomass was reduced slightly compared to full retention. • No strong risk of the stock entering an overfished state • Age-2 total mortality declined by less than 1% from full retention (Alt 1) to a 12% DMR (i.e., the highest discarding survival scenario).
Marine Mammals, PSC, non-target species, seabirds, habitat	No changes	Limited increase in fishing effort could result in minimal increases in interactions with or catch of these resource components. Release of sablefish could increase whale predation on discarded fish. Impacts are not expected to be significant.
Economic Impacts		
Harvesters	Status quo revenue costs associated with requirement to deliver less marketable fish	Simulation results from the sablefish model (Appendix 5) show slight improvements in total revenue for the sablefish IFQ fleet. Some perceived flexibility to improve ex-vessel revenue and reduce waste of sablefish IFQ that has little or no economic value. Harvesters could face challenges in realizing increased ex-vessel revenue.
Processors	Status quo conditions	Could see increased first wholesale revenue under Alternative 2. Processors will also face challenges in realizing increase first wholesale revenue for many of the same reasons as harvesters.
Communities	Status quo conditions	Those sablefish IFQ harvesters and processors that can realize ex-vessel and first wholesale returns under Alternative 2 will likely increase their directed expenditures in communities which would increase indirect and induced expenditures.

3 Description of the Sablefish Fisheries

Sablefish (*Anoplopoma fimbria*) is a demersal species, living on or near the seabed. Sablefish are typically harvested in waters from 1,300 to 3,200 feet on the continental slope and in or near underwater canyons and gullies. The directed commercial sablefish fishery has been prosecuted by longline, pot, and trawl gear. Participants in the sablefish fisheries have generally used H&L gear and pot gear because it is more efficient than jig, troll, or handline gear. Sablefish are also caught as bycatch in other longline fisheries (e.g., Pacific cod) and in the trawl fisheries.

U.S. fishermen have been harvesting sablefish as a byproduct of halibut fishing since the end of the 19th century. Japanese longliners began harvesting sablefish in the EBS around 1958 and expanded into the AI and GOA through the 1970s. Japanese catches increased throughout the 1960s, and peak sablefish catch exceeded 50,000 mt in 1972. High fishing pressure in the early 1970s by Japanese and USSR vessels may have resulted in a population decline of sablefish in the mid-1970s. In 1988, only US fishermen harvested sablefish in the GOA and BSAI. As sablefish was increasingly harvested as a derby-style fishery in the late 1980s and early 1990s, the Council recommended an individual fishing quota (IFQ) Program for management of the fixed gear (hook and line) halibut and sablefish fisheries off of Alaska. The Secretary of Commerce approved the Council's IFQ Program in 1993, and the program was implemented by NMFS for the fishing season in 1995 (58 FR 215) through Amendments 15 to the BSAI Groundfish FMP and Amendment 20 to the GOA Groundfish FMP. The IFQ Program allocates a specific portion of the total allowable catch to individual fishermen or groups, known as quota share owners. Fishermen are then given individual quotas, dictating the amount of sablefish they are allowed to catch over the fishing season. This system aims to prevent overfishing, reduce bycatch, and provide economic stability for fishermen.

To provide context in understanding the effects of voluntary releasing small sablefish on the human environment and the economic and social environment, below is a description of the sablefish fisheries. This chapter includes information on management of sablefish fisheries, an overview of harvest of sablefish to include catch in the target fishery and non-target fisheries, patterns of community engagement and dependence on the sablefish fishery, and a description of sablefish products and markets. While IFQ fisheries are generally described in terms of pounds (see Section 3.1.1), the analysts have used metric units to the extent practicable per SSC recommendations from 2021.

3.1 Harvests

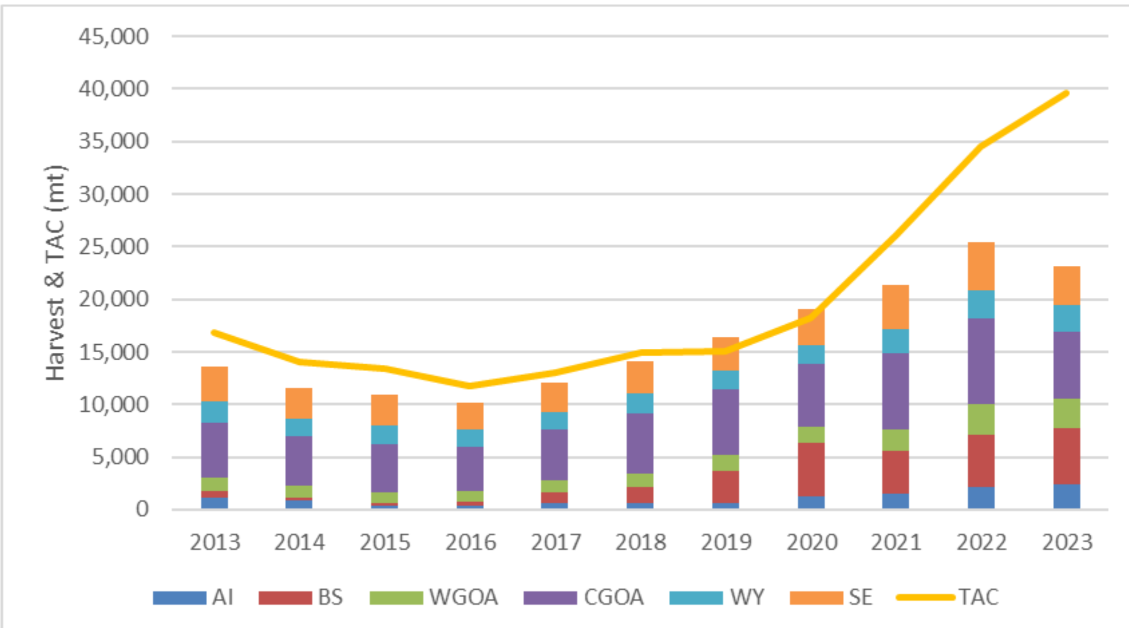
Table 3-1 shows the TACs and harvest for each of the FMP subareas from 2013 through 2023. As seen in the table and Figure 3-1, sablefish harvest has tracked with the total combined TAC level. Between 2013 and 2016, harvest on average was 83 percent of the total combined TACs. In 2017 and 2018, harvest of sablefish as a percent of total combined sablefish TACs increased to 93 percent and 94 percent, respectively. 2019 and 2020 saw harvest of sablefish as a percent of the total combined TACs increased even further, followed by a sharp decline in harvest of sablefish relative to TAC the following three years.

Table 3-1 Total allowable catch (mt) and harvest of sablefish (mt) by FMP subarea, 2013 through 2023

Year	AI		BS		WG		CG		WY		SE		Total	
	TAC (mt)	Harvest (mt)	TAC (mt)	Harvest (mt)	TAC (mt)	Harvest (mt)	TAC (mt)	Harvest (mt)	TAC (mt)	Harvest (mt)	TAC (mt)	Harvest (mt)	TAC (mt)	Harvest (mt)
2013	2,140	1,082	1,580	625	1,750	1,352	5,540	5,158	2,030	2,082	3,190	3,335	16,230	13,634
2014	1,811	813	1,339	299	1,480	1,191	4,681	4,706	1,716	1,671	2,695	2,862	13,722	11,543
2015	1,802	422	1,333	192	1,474	975	4,658	4,581	1,708	1,866	2,682	2,869	13,657	10,905
2016	1,557	340	1,151	462	1,272	995	4,023	4,153	1,475	1,651	2,317	2,503	11,795	10,105
2017	1,735	588	1,274	1,079	1,349	1,116	4,514	4,788	1,605	1,694	2,606	2,853	13,083	12,119
2018	1,988	663	1,464	1,423	1,544	1,347	5,158	5,754	1,829	1,861	2,974	3,051	14,957	14,099
2019	2,008	662	1,489	3,049	1,581	1,464	5,178	6,254	1,828	1,802	2,984	3,148	15,068	16,379
2020	2,039	1,222	1,861	5,134	1,942	1,460	6,445	6,037	2,343	1,835	3,663	3,317	18,293	19,005
2021	4,717	1,561	3,396	4,065	2,428	1,983	8,056	7,266	2,929	2,329	4,579	4,193	26,105	21,397
2022	6,463	2,209	5,264	4,848	3,727	2,945	9,965	8,142	3,437	2,750	5,665	4,515	34,521	25,407
2023	8,440	2,463	7,996	5,285	4,473	2,750	9,921	6,457	3,205	2,442	5,602	3,711	39,637	23,108

Source: Harvest Specifications for ABC and TAC and AKFIN for harvest

Figure 3-1 Sablefish harvest (mt) by FMP subarea and total allowable catch (mt) for all FMP subareas combined, 2013 through 2023



Source: Harvest Specifications for TACs and AKFIN for harvest

The next series of tables and figures provide TACs and harvests by sector for each FMP subarea from 2013 through 2023 (see Table 3-2 through Table 3-7 and Figure 3-2 through Figure 3-7). These figures and tables help illustrate several trends that are occurring in the sablefish fishery. One of these trends that is illustrated in the figures is the increasing percentage of TAC that has remained unharvested in the most recent two years. Between the two FMP areas, TACs in the GOA have been nearly or fully harvested prior to 2020, while in the AI harvest has ranged from 22 percent to 62 percent of TACs. In the BS, harvest as percent of TAC was well below 50 percent, but starting in 2017, harvest as percent of TAC increased sharply. Since 2020, harvests in the GOA and BS as a percent of TAC have declined sharply. For example, in the normally fully utilized CG, 2022 and 2023 saw 82 percent and 65 percent utilization, respectively. This same trend is also occurring in the WY and SE sablefish fisheries. Likely the softening of the sablefish market and continued overwhelming harvest of small sablefish are likely the main factors in the under-utilized sablefish fishery.

Another trend that is illustrated by the figures is the sharp increase in harvest of sablefish by the trawl sector as a proportion of BS total harvest. This trend is more prevalent in the BS but is also present in the AI, WG, and the CG albeit more moderate. In the BS, the percentage of trawl harvest ranged from 9 percent in 2015 to 21 percent in 2013. Starting in 2015, sablefish harvest by the trawling sector increased to 52 percent and increased every year until 2020 where it peaked at 87 percent. Following the peak in 2020, trawl harvest as a proportion of total BS harvest started to diminish. In 2023, the trawl harvest in the BS was 52 percent of the total BS harvest.

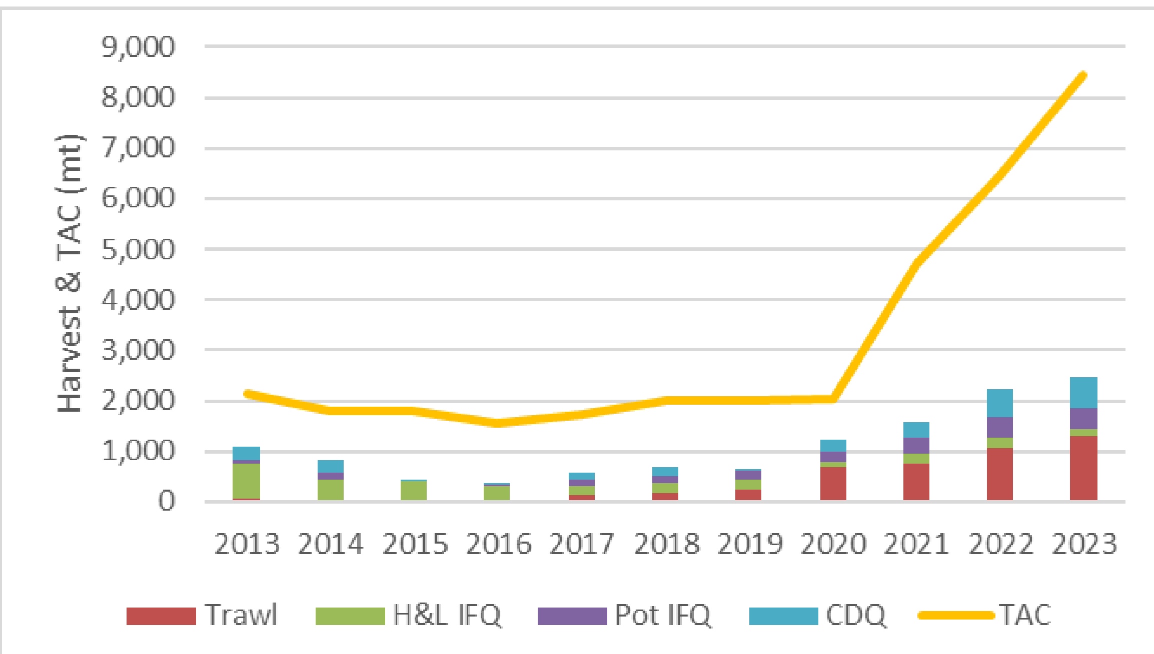
Yet another trend depicted in the figures is the growing utilization of pot gear to harvest IFQ sablefish. This is most apparent in the GOA FMP areas. Starting in early 2017, pot gear was authorized as legal gear in the GOA to harvest sablefish IFQ. Since then, there has been a noticeable shift in the utilization of pot gear to harvest sablefish IFQ. For example, in 2017, approximately 74 percent of the total sablefish harvest in the WG was harvested using H&L gear, while in 2023 only 4 percent of the total harvest of sablefish in the WG was harvested using H&L gear. At the same time, pot gear starting in 2017 accounted for 20 percent of the total harvest of sablefish in the WG while in 2023, pot gear accounted for 88 percent of the total harvest of sablefish in the WG.

Table 3-2 AI sablefish TACs and harvest (mt) by sector from 2013 through 2023

				AI harvest (mt)			
Year	TAC	Trawl	H&L IFQ	Pot IFQ	CDQ	Total	Harvest as % of TAC
2013	2,140	55	694	73	260	1,082	51%
2014	1,811	25	417	120	252	813	45%
2015	1,802	15	394	12	1	422	23%
2016	1,557	29	284	21	7	340	22%
2017	1,735	124	190	125	148	588	34%
2018	1,988	172	199	122	170	663	33%
2019	2,008	233	214	168	48	662	33%
2020	2,039	672	120	183	247	1,222	60%
2021	4,717	738	214	303	306	1,561	33%
2022	6,463	1,073	187	410	539	2,209	34%
2023	8,440	1,312	118	418	615	2,463	29%

Source: Harvest Specifications for TACs and AKFIN for harvest

Figure 3-2 AI sablefish TACs and harvest (mt) by sector from 2013 through 2023



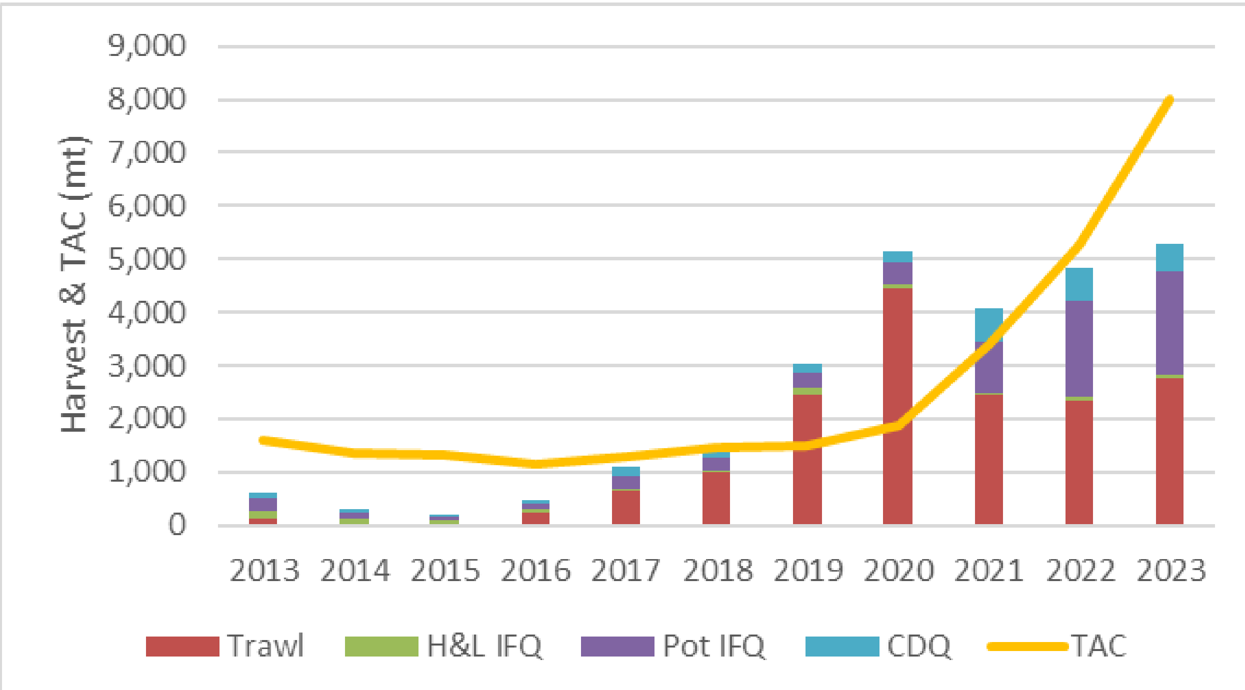
Source: Harvest Specifications for TACs and AKFIN for harvest

Table 3-3 BS sablefish TACs and harvest (mt) by sector from 2013 through 2023

		BS harvest (mt)					
Year	TAC	Trawl	H&L IFQ	Pot IFQ	CDQ	Total	Harvest as % of TAC
2013	1,580	129	139	223	134	625	40%
2014	1,339	33	88	105	73	299	22%
2015	1,333	17	65	76	34	192	14%
2016	1,151	242	41	133	46	462	40%
2017	1,274	649	36	238	157	1,079	85%
2018	1,464	985	31	236	171	1,423	97%
2019	1,489	2,461	120	278	190	3,049	205%
2020	1,861	4,452	69	424	189	5,134	276%
2021	3,396	2,448	47	959	611	4,065	120%
2022	5,264	2,353	58	1,789	648	4,848	92%
2023	7,996	2,761	71	1,940	513	5,285	66%

Source: Harvest Specifications for TACs and AKFIN for harvest

Figure 3-3 BS sablefish TACs and harvest (mt) by sector from 2013 through 2023



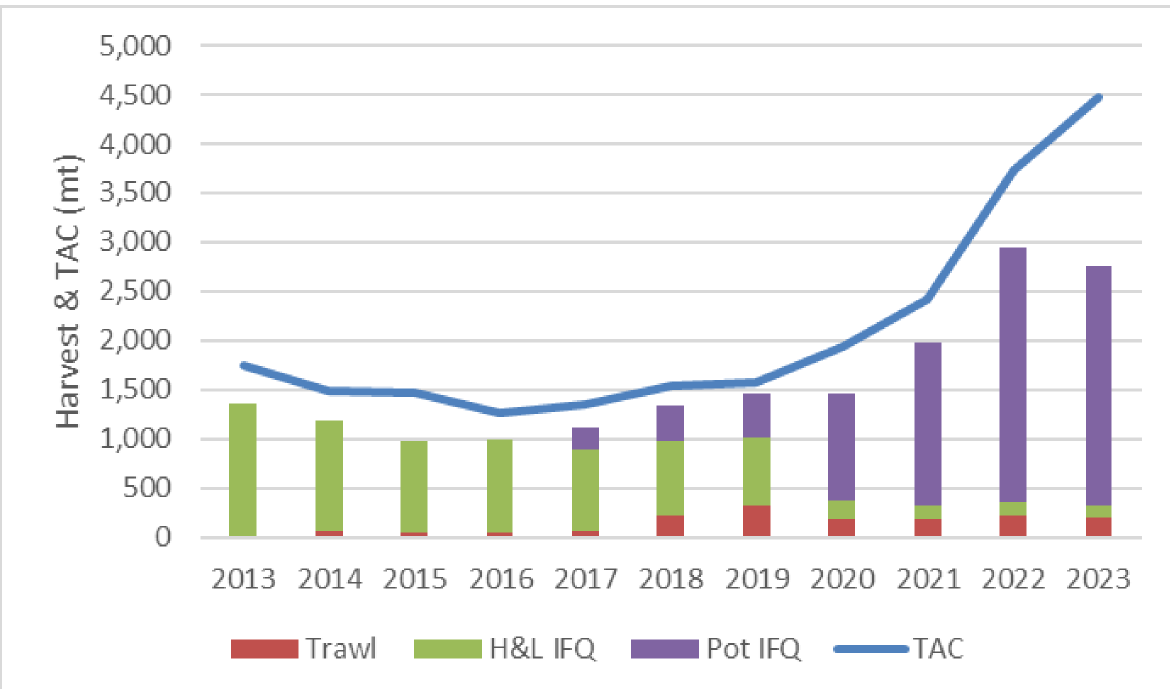
Source: Harvest Specifications for TACs and AKFIN for harvest

Table 3-4 WG sablefish TACs and harvest (mt) by sector from 2013 through 2023

		WG harvest (mt)				
Year	TAC	Trawl	H&L IFQ	Pot IFQ	Total	Harvest as % of TAC
2013	1,750	13	1,340		1,352	77%
2014	1,480	61	1,131		1,191	80%
2015	1,474	43	932		975	66%
2016	1,272	47	949		995	78%
2017	1,349	66	824	226	1,116	83%
2018	1,544	224	759	365	1,347	87%
2019	1,581	320	689	455	1,464	93%
2020	1,942	183	196	1,080	1,460	75%
2021	2,428	181	143	1,659	1,983	82%
2022	3,727	226	129	2,590	2,945	79%
2023	4,473	210	116	2,424	2,750	61%

Source: Harvest Specifications for TACs and AKFIN for harvest

Figure 3-4 WG sablefish TACs and harvest (mt) by sector from 2013 through 2023



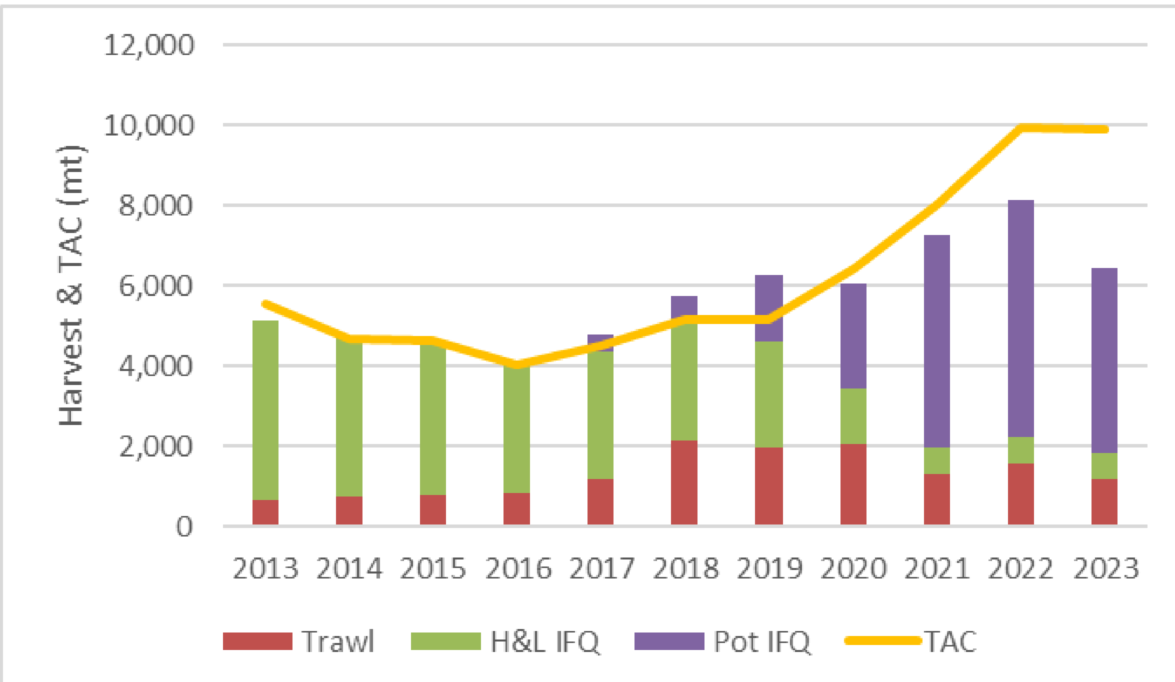
Source: Harvest Specifications for TACs and AKFIN for harvest

Table 3-5 CG sablefish TACs and harvest (mt) by sector from 2013 through 2023

		CG harvest (mt)				
Year	TAC	Trawl	H&L IFQ	Pot IFQ	Total	Harvest as % of TAC
2013	5,540	660	4,498		5,158	93%
2014	4,681	752	3,954		4,706	101%
2015	4,658	802	3,778		4,581	98%
2016	4,023	826	3,327		4,153	103%
2017	4,514	1,192	3,160	436	4,788	106%
2018	5,158	2,124	3,080	549	5,754	112%
2019	5,178	1,960	2,679	1,615	6,254	121%
2020	6,445	2,064	1,367	2,606	6,037	94%
2021	8,056	1,304	655	5,307	7,266	90%
2022	9,965	1,550	693	5,899	8,142	82%
2023	9,921	1,183	649	4,625	6,457	65%

Source: Harvest Specifications for TACs and AKFIN for harvest

Figure 3-5 CG sablefish TACs and harvest (mt) by sector from 2013 through 2023



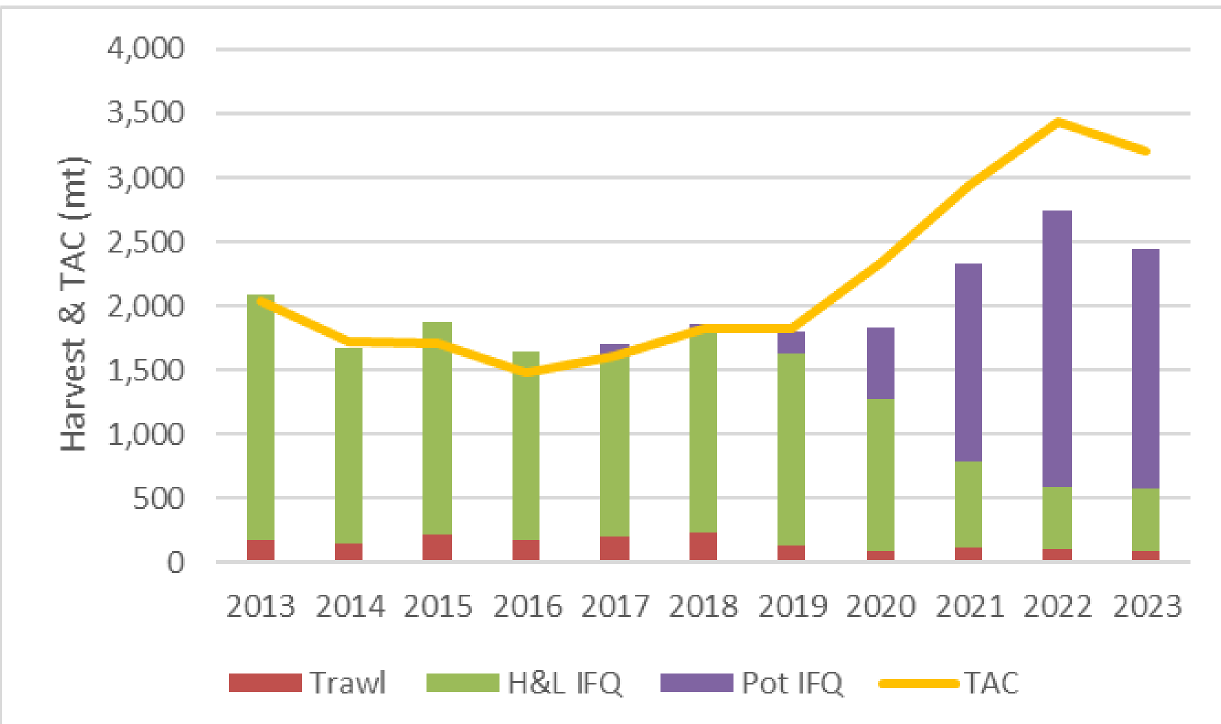
Source: Harvest Specifications for TACs and AKFIN for harvest

Table 3-6 WY sablefish TACs and harvest (mt) by sector from 2013 through 2023

	WY harvest (mt)					
Year	TAC	Trawl	H&L IFQ	Pot IFQ	Total	Harvest as % of TAC
2013	2,030	173	1,909		2,082	103%
2014	1,716	152	1,519		1,671	97%
2015	1,708	212	1,654		1,866	109%
2016	1,475	177	1,474		1,651	112%
2017	1,605	206	1,396	92	1,694	106%
2018	1,829	236	1,581	45	1,861	102%
2019	1,828	126	1,508	168	1,802	99%
2020	2,343	83	1,190	561	1,835	78%
2021	2,929	117	677	1,536	2,329	80%
2022	3,437	105	483	2,161	2,750	80%
2023	3,205	90	481	1,871	2,442	76%

Source: Harvest Specifications for TACs and AKFIN for harvest

Figure 3-6 WY sablefish TACs and harvest (mt) by sector from 2013 through 2023



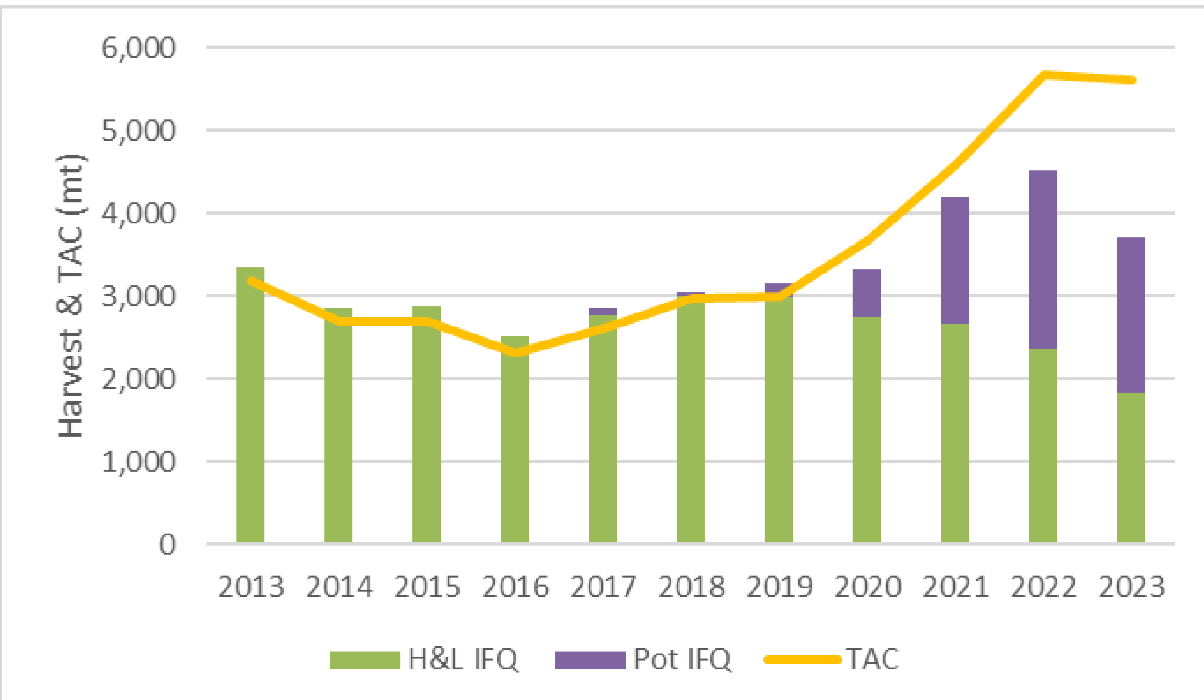
Source: Harvest Specifications for TACs and AKFIN for harvest

Table 3-7 SE sablefish TACs and harvest (mt) by sector from 2013 through 2023

		SE harvest (mt)			
Year	TAC	H&L IFQ	Pot IFQ	Total	Harvest as % of TAC
2013	3,190	3,335		3,335	105%
2014	2,695	2,862		2,862	106%
2015	2,682	2,869		2,869	107%
2016	2,317	2,503		2,503	108%
2017	2,606	2,761	92	2,853	109%
2018	2,974	3,006	45	3,051	103%
2019	2,984	2,980	168	3,148	106%
2020	3,663	2,756	561	3,317	91%
2021	4,579	2,657	1,536	4,193	92%
2022	5,665	2,354	2,161	4,515	80%
2023	5,602	1,840	1,871	3,711	66%

Source: Harvest Specifications for TACs and AKFIN for harvest

Figure 3-7 SE sablefish TACs and harvest (mt) by sector from 2013 through 2023



Source: Harvest Specifications for TACs and AKFIN for harvest

3.1.1 Sablefish IFQ Fishery

In the sablefish fishery of the late 1980s, rapid growth in the fleet, overcapacity and congestion on fishing grounds impacted the fishery, and in response to this growth, the sablefish TAC was divided among the gear types prosecuting the fishery – fixed gear and trawl gear. For both gear types, growth in fishing effort under open access had necessitated large reductions in length of the fishing season and caused a host of undesirable biological, economic, and social effects. By the late 1980s, the Council adopted a Statement of Commitment to pursue development of a license limitation or IFQ Program for the sablefish fishery, in response to requests from the sablefish fleet to address issues with overcapacity.

The IFQ Program was implemented in 1995 in response to these issues that had emerged from management of the sablefish and halibut fisheries under the open access regime.

Following implementation of the sablefish IFQ Program, only persons holding quota shares (QS; sing/plural) are allowed to make fixed gear landings of halibut and sablefish in the regulatory areas identified. There are several key provisions of the IFQ Program: the process for initial allocation of QS; assignment of shares to vessel categories; share transfer provisions; quota share use and ownership limits; QS ‘blocks’ to mitigate excessive consolidation; a process for allocating annual IFQ based on participants’ QS; and the establishment of Community Quota Entities (CQE). Thorough descriptions of each of these components are provided on or linked to from the Council website: www.npfmc.org.

The basic long-term use privilege in the IFQ Program for sablefish is quota shares. As percentages of the total QS pool for each IFQ regulatory area, a participant’s QS annually translate area-specific TAC into fishable pounds available for that participant. The QS or IFQ specified for one IFQ regulatory area may not be used in a different IFQ regulatory area. (i.e., BS versus CG) An individual’s IFQ is determined annually as the ratio of their QS to the area quota share pool (QSP) and the area-specific TAC, such that:

$$(QS/QSP) * TAC = IFQ$$

Regulations at 679.20(a)(4)(iii) and (iv) require allocation of the sablefish TAC for the BS and AI subareas between the trawl gear and fixed gear sectors. As described in 2.2.2, gear allocations of the sablefish TAC for the BS are 50 percent for trawl gear and 50 percent for fixed gear. Gear allocations of the TAC for the AI are 25 percent for trawl gear and 75 percent for fixed gear. Section 679.20(b)(1)(ii)(B) requires that NMFS apportions 20 percent of the fixed gear allocation of sablefish TAC to the CDQ reserve for each subarea. Also, § 679.20(b)(1)(ii)(D)(1) requires that in the BS and AI 7.5 percent of the trawl gear allocation of sablefish TAC from the non-specified reserve, established under § 679.20(b)(1)(i), be assigned to the CDQ reserve.

Section 679.20(a)(4)(i) and (ii) require allocations of sablefish TACs for each of the GOA regulatory areas and districts to fixed and trawl gear. In the WG and CG areas, 80 percent of each TAC is allocated to fixed gear, and 20 percent of each TAC is allocated to trawl gear. In the EG area, 95 percent of the TAC is allocated to fixed gear, and 5 percent is allocated to trawl gear. The trawl gear allocation in the Eastern Regulatory Area may only be used to support incidental catch of sablefish using trawl gear while directed fishing for other target species (§ 679.20(a)(4)(i)).

Table 3-8 shows the allocation of available 2023 sablefish IFQ harvest by area. Table 3-9 provides annual IFQ allocations by FMP area from 2013 through 2023.

Table 3-8 2023 allocation of sablefish TAC by area

2023 Sablefish IFQ Allocations								
Sablefish area	TAC (mt)*	Fixed gear allocation (mt)	% IFQ	IFQ allocation (mt)	IFQ allocation (lbs.)	% CDQ	CDQ allocation (mt)	CDQ allocation (lbs.)
SE	5,602	5,602	100%	5,602	12,350,169	0%		
WY	3,205	2,765	100%	2,765	6,095,719	0%		
CG	9,921	7,936	100%	7,936	17,495,706	0%		
WG	4,473	3,578	100%	3,578	7,888,059	0%		
All GOA	23,201	19,881		19,881	43,829,653			
AI	8,440	6,330	80%	5,064	11,164,094	20%	1,013	2,232,819
BS	7,996	3,998	80%	3,198	7,050,311	20%	640	1,410,062
All BSAI	16,436	10,328		8,262	18,214,405		1,652	3,642,881
Total	39,637	30,209		28,143	62,044,059			

Source: Harvest Specifications and RAM Individual Fishing Quota (IFQ) and Landing Report

*TAC includes incidental catch allocation for traw l sectors in areas other than Southeast Outside.

Table 3-9 IFQ allocations by area (mt), 2013 through 2023

Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
BS	632	536	534	460	510	586	596	744	1,358	2,106	3,198
AI	1,284	1,086	1,081	934	1,041	1,193	1,205	1,223	2,830	3,878	5,064
WG	1,400	1,184	1,179	1,018	1,079	1,235	1,265	1,554	1,942	2,982	3,578
CG	4,432	3,745	3,726	3,218	3,611	4,126	4,142	5,156	6,444	7,972	7,936
WY	1,769	1,495	1,489	1,285	1,394	1,589	1,587	2,043	2,554	2,982	2,765
SE	3,190	2,695	2,682	2,317	2,606	2,974	2,984	3,663	4,579	5,665	5,602

Currently, release of sablefish by the IFQ target fisheries is prohibited by regulation at 50 CFR 679.7(d)(4)(ii) and 50 CFR 679.7(f)(11). When the sablefish fishery is open for directed fishing, any sablefish caught by a vessel using fixed gear with unused sablefish IFQ aboard must be retained by that vessel. Discards of sablefish is required under § 679.20 or, in waters within the State of Alaska since discards of sablefish is required under laws of the State of Alaska. Discards consist of 'drop-offs', overages, and damaged catch.

For vessels using fixed gear that are fishing for a CDQ group with an allocation of fixed gear sablefish, CDQ must retain the sablefish landed unless retention of sablefish is not authorized under § 679.23(e)(4)(ii) or, in waters within State of Alaska which the State requires discarding of sablefish.

If the sablefish fishery is not yet open for directed fishing, any sablefish landed must be discarded. In the period following the directed sablefish closure, vessels with sablefish quota aboard must retain the sablefish landings up to the appropriate maximum retainable amount (MRA) and, if the vessel does not have IFQ aboard, sablefish landings must be discarded.

3.1.1.1 Sablefish IFQ Gear Types

Historically, the primary gear used for directed sablefish harvest offshore Alaska has been longline hook-and-line gear (H&L), which is fished on-bottom (see Table 3-2 through Table 3-7 and Figure 3-2 through Figure 3-7). Since the inception of the IFQ system, average set length in the directed fishery for sablefish has been near 9 km and average hook spacing is approximately 1.2 m. The gear is baited by hand or by machine, with smaller boats generally baiting by hand and larger boats generally baiting by machine. Circle hooks are usually used, except for modified J-hooks on some boats with machine baiters. The gear is usually deployed from the vessel stern with the vessel traveling at 5-7 knots. Some vessels attach weights to the longline, especially on rough or steep bottom, so that the longline stays in place on bottom.

The GOA and BSAI FMPs originally banned the use of pots for fishing for sablefish during open access management. The prohibition on sablefish longline pot gear use was removed for the BS, except from 1 to 30 June to prevent gear conflicts with trawlers in 1996. The Council, in 2015, recommended allowing sablefish pot fishing in the GOA as a response to increased whale depredation (Section 3.1.3), and pots were legal effective of early 2017. As a result of these regulatory changes, combined with the development of lightweight, collapsible slinky pots that can be fished on both large and small vessels, the use of pot gear has increased in both the BSAI and GOA. In the GOA in particular, this allowance was followed by a substantial shift in sablefish fishing effort from H&L to pot gear, though there are differences across subareas, as noted in Table 3-2 through Table 3-7 and Figure 3-2 through Figure 3-7. Pot catches comprised approximately 10% of GOA landings in 2017, but now exceeds H&L gear in all areas except the SE which is currently at 50% of IFQ landings.

Pots are typically strung to neutrally buoyant groundlines, which reduce the likelihood of lost gear. Fishing gear is expensive to purchase and replace, so participants have an incentive to incur small additional costs to reduce the likelihood of gear conflicts, or increased chances of gear retrieval in the case of a hang-up. Fishermen may operate in proximity to one another over many fishing days and seasons, so avoidance of gear conflict between individuals has both a private and a social benefit. A study of pot use in BSAI fisheries, covering 1999 through 2005, showed that soak times – the amount of time that gear is left baited on the grounds before retrieval – was typically on the order of one to three days, and 90% of pots were soaked for fewer than seven days.

Recently, jig gear was authorized for the sablefish IFQ fishery. Amendment 124 to the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP) and Amendment 112 to the Fishery Management Plan for Groundfish of the Gulf of Alaska (GOA FMP), authorized jig gear as a legal gear type for harvesting sablefish IFQ and CDQ, effective for the 2023 IFQ fishing season. This amendment provides an opportunity for some IFQ participants to harvest sablefish IFQ with a new gear type, potentially increasing operational efficiency and revenue for those who take advantage of this opportunity. There was no observed sablefish IFQ landings using jig gear in 2023.

3.1.1.2 Sablefish IFQ/CDQ Vessel Count and Vessel Class Categories

Table 3-10 shows the number of vessels active in the CDQ fixed gear sablefish fishery and the IFQ sablefish fishery from 2013 through 2023. For the CDQ fixed gear fishery, the number of vessels ranged from zero to five in the AI and four to seven vessels in the BS. In the IFQ fishery, the SE has the highest vessel count ranging from 151 in 2023 to a high of 186 in 2013 followed by the CG with a range of 119 vessels in 2020 to a high of 175 vessels in 2013. In total, the number of IFQ/CDQ fixed gear vessels active ranged from a low of 266 vessels in 2020 to a high of 331 vessels in 2013.

Table 3-10 Annual count of vessels in the IFQ and CDQ fixed gear sablefish fisheries, 2013 through 2023

Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
						CDQ						
AI	6	6	0	4	2	1	2	1	2	2	3	16
BS	4	5	5	7	4	4	4	4	5	7	7	24
CDQ total	**9**	**9**	**5**	**11**	**4**	**4**	**6**	**4**	**6**	**8**	**8**	**31**
						IFQ						
AI	29	29	26	21	19	22	20	14	17	18	15	61
BS	34	31	31	26	24	22	22	24	22	26	28	77
CG	175	167	160	155	150	147	133	119	130	136	121	276
SE	186	183	178	177	171	174	169	161	152	156	151	298
WG	57	59	54	61	60	60	50	45	46	52	45	118
WY	112	103	99	103	103	95	90	82	85	84	83	180
IFQ total	**330**	**315**	**306**	**303**	**292**	**293**	**278**	**266**	**270**	**274**	**275**	**513**
Total	**331**	**316**	**307**	**304**	**292**	**294**	**279**	**266**	**271**	**275**	**275**	**514**

Source: AKFIN; sourcefile is sablefish_removals(4-15-24)

Table 3-11 shows distinct QS holders for each vessel class and management area from 2013 through 2023. The classes correspond to vessel operational type (CV/CP) and vessel size. The division of QS among vessel class designations is intended to maintain the diversity of the IFQ fleets.

- Class A shares are CPs, and do not have a vessel length restriction.
- Class B shares are CVs greater than 60 feet LOA
- Class C shares are CVs equal to or less than 60 feet LOA

Table 3-12 shows sablefish IFQ landings by vessel class and area from 2013 through 2023.

Table 3-11 Count of distinct QS holders for each vessel class and sablefish management area in Alaska, 2013 through 2023

Vessel class	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
						AI						
A	14	17	14	9	5	9	8	3	7	7	6	**42**
B	14	12	10	8	10	9	10	6	6	9	6	**24**
C	7	8	6	8	8	10	9	8	10	4	4	**18**
Total	29	29	26	21	19	22	21	14	17	18	15	**62**
						BS						
A	13	14	15	12	11	11	10	12	13	14	16	**45**
B	20	16	14	11	11	11	12	12	18	18	18	**46**
C	13	10	10	10	10	9	9	9	9	9	9	**28**
Total	34	33	34	28	25	26	24	24	23	25	28	**76**
						CG						
A	39	45	43	40	40	48	45	40	36	45	36	**115**
B	100	98	93	94	93	88	82	67	73	75	67	**178**
C	109	97	91	94	92	91	89	73	81	86	73	**196**
Total	176	167	159	156	150	147	133	119	130	135	121	**275**
						SE						
A	29	28	28	29	27	29	27	25	28	25	27	**85**
B	54	55	57	60	60	64	61	56	56	63	58	**137**
C	157	153	146	143	140	143	137	129	121	125	127	**244**
Total	186	183	178	177	171	174	169	161	152	155	151	**298**
						WG						
A	27	24	27	28	29	27	27	22	23	23	20	**76**
B	40	43	32	39	40	40	34	30	32	35	31	**84**
C	21	25	16	21	22	25	21	20	19	21	17	**55**
Total	57	59	54	61	60	60	52	45	46	51	46	**118**
						WY						
A	18	17	16	19	15	13	20	11	15	14	14	**58**
B	67	64	61	63	63	62	58	57	54	52	52	**121**
C	66	61	59	64	60	58	51	41	48	46	45	**119**
Total	112	103	99	103	103	95	90	82	86	84	83	**180**
Total all areas	**331**	**315**	**306**	**304**	**293**	**295**	**280**	**266**	**271**	**273**	**275**	

Source: AKFIN

Table 3-12 Sablefish IFQ landings (mt) by area and vessel class, 2013 through 2023

Vessel class	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
					AI						
A	488	263	226	152	159	125	141	158	246	357	366
B	226	229	151	130	129	165	181	81	179	193	149
C	16	29	28	16	27	27	20	33	45	22	7
Total	731	521	405	299	315	318	342	272	470	572	522
					BS						
A	138	104	46	56	147	187	188	260	394	793	1,041
B	176	65	70	91	109	74	113	143	478	758	686
C	48	24	28	29	17	22	54	71	132	261	269
Total	362	193	143	176	274	283	355	474	1,004	1,812	1,997
					CG						
A	699	589	564	512	557	580	623	765	984	1,078	850
B	2,022	1,804	1,731	1,503	1,663	1,588	1,711	1,845	2,888	3,322	2,793
C	1,560	1,336	1,288	1,132	1,232	1,223	1,258	1,142	1,856	2,037	1,454
Total	4,280	3,729	3,582	3,148	3,452	3,391	3,592	3,752	5,727	6,437	5,096
					SE						
A	299	249	247	216	241	264	265	185	349	435	416
B	627	551	531	477	529	563	589	632	687	1,004	886
C	2,187	1,882	1,865	1,613	1,815	2,002	1,995	2,128	2,680	3,583	3,219
Total	3,114	2,681	2,642	2,306	2,584	2,829	2,849	2,945	3,716	5,022	4,521
					WG						
A	525	422	379	409	408	440	445	488	725	1,101	915
B	543	489	374	345	423	441	473	561	755	1,143	1,183
C	223	196	164	149	189	199	171	180	274	424	419
Total	1,291	1,107	917	903	1,020	1,080	1,089	1,228	1,754	2,668	2,517
					WY						
A	147	124	123	103	112	128	132	143	189	216	215
B	1,070	891	894	771	841	922	929	999	1,379	1,614	1,384
C	549	459	457	399	431	476	475	469	583	742	691
Total	1,765	1,474	1,474	1,273	1,384	1,525	1,536	1,611	2,151	2,572	2,290

Source: AKFIN; Source file is sabl_ifq_landings(3-5-24)

3.1.1.3 Sablefish IFQ Revenue

Sablefish IFQ allocations (mt), landings (mt) and ex-vessel revenue (millions of $) from 2013-2023[4] are provided in Table 3-13 and Figure 3-8 and Figure 3-9 below by regulatory areas. Total ex-vessel revenue for IFQ sablefish for all regulatory areas combined from 2013 through 2016 ranged between $88 million and $92 million. In 2017, total ex-vessel revenue increased to a high of $112 million. Following the high of 2017, the total ex-vessel revenue declined incrementally to a low of $54 million in 2020. This incremental decline in ex-vessel revenue was due in part to the decline in ex-vessel prices for IFQ sablefish at all grades. Following 2020, ex-vessel revenue increased over the next two years to a high of $124 million in 2022. The increase in revenue during the 2021 and 2022 fishing seasons is the result of a large increase in harvest of sablefish during these two years (see Table 3-2 through Table 3-7 and Figure 3-2 through Figure 3-7) in combination with slightly higher ex-vessel prices for some grades of sablefish in 2021 and 2022 relative to the ex-vessel prices in 2020 (Table 3-16 and Figure 3-11). Although not official yet, the estimated total sablefish IFQ ex-vessel revenue for the 2023 fishing year is estimated at $51 million, which is the lowest total ex-vessel revenue since before 2013.

As noted in Table 3-13, Figure 3-8, and Figure 3-9, CG and SE contributed the largest portion of sablefish IFQ landings and total ex-vessel revenue from the IFQ sablefish fishery during the 2013 through 2022

[4] Ex-vessel revenue is not yet available for 2023.

period, while the AI and BS contributed the smallest portion sablefish IFQ landings and total ex-vessel revenue during these same years.

Table 3-14 provides sablefish IFQ ex-vessel revenue by regulatory area and gear. Similar to the growth of pot gear in the sablefish IFQ fishery as noted in Table 3-2 through Table 3-7 and Figure 3-2 through Figure 3-7, the proportion of ex-vessel revenue attributed to pot gear has also increased since 2017 in the GOA regulatory areas.

Figure 3-8 Sablefish IFQ landings (mt) by area, 2013 through 2023

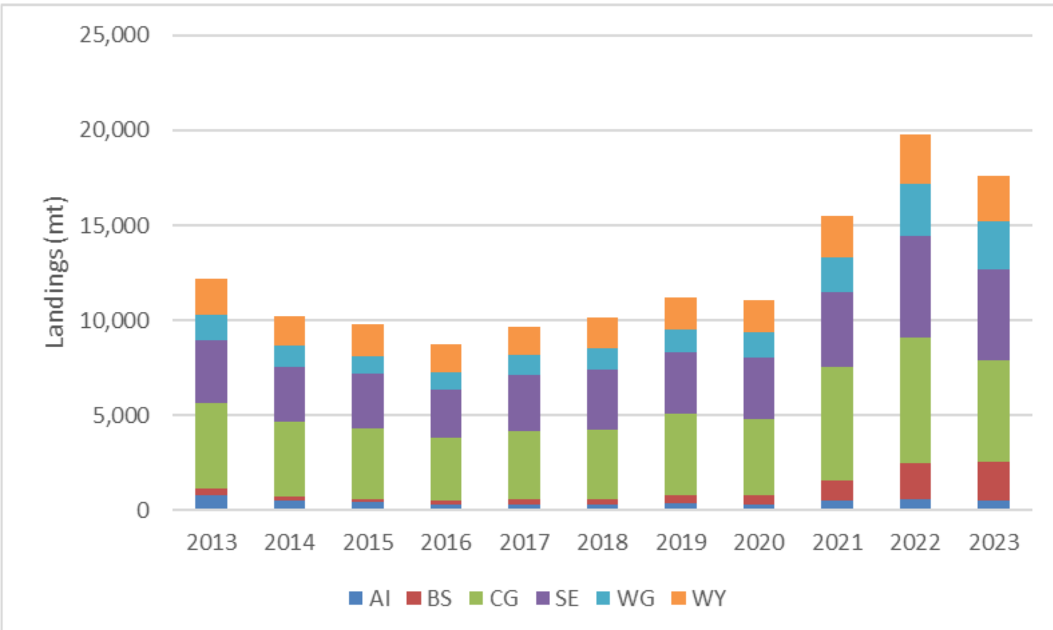


Figure 3-9 Sablefish IFQ ex-vessel revenue (millions of $) by area, 2013 through 2022

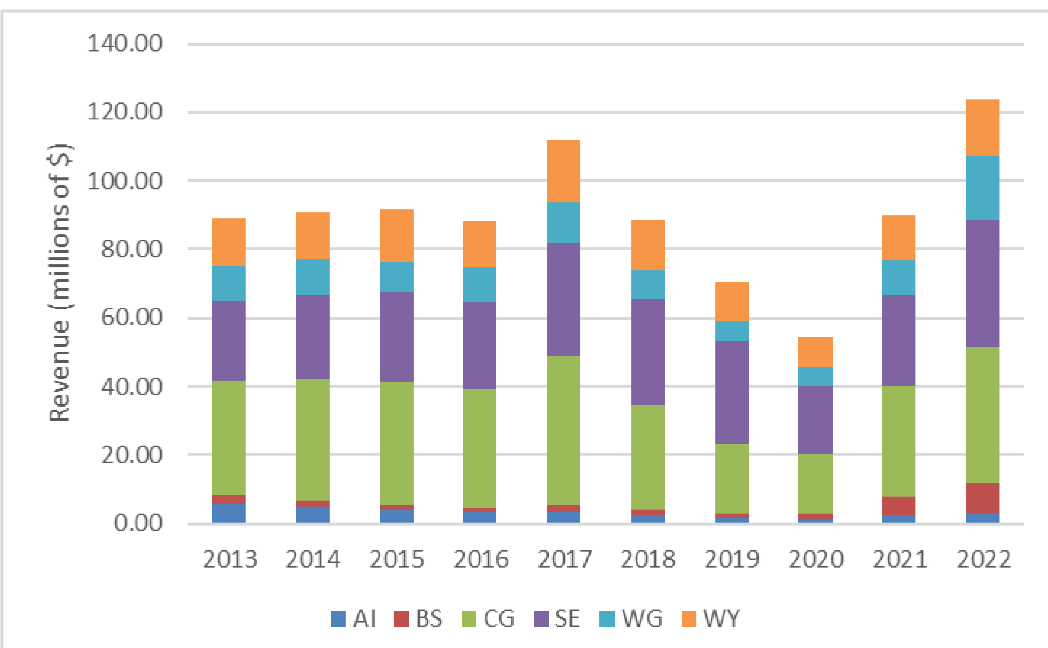


Table 3-13 Sablefish IFQ allocations (mt), landings (mt) and ex-vessel revenue (millions of 2022 $) by area, 2013 through 2023

Year	AI			BS			CG			SE			WG			WY			Total		
	IFQ allocations (mt)	Landings (mt)	Revenue (millions $)	IFQ allocations (mt)	Landings (mt)	Revenue (millions $)	IFQ allocations (mt)	Landings (mt)	Revenue (millions $)	IFQ allocations (mt)	Landings (mt)	Revenue (millions $)	IFQ allocations (mt)	Landings (mt)	Revenue (millions $)	IFQ allocations (mt)	Landings (mt)	Revenue (millions $)	IFQ allocations (mt)	Landings (mt)	Revenue (millions $)
2013	1,284	767	5.85	632	362	2.55	4,432	4,501	33.39	3,190	3,335	23.37	1,400	1,340	10.17	1,769	1,909	13.56	12,707	12,214	88.89
2014	1,086	536	4.91	536	193	1.61	3,745	3,956	35.43	2,695	2,862	24.72	1,184	1,131	10.60	1,495	1,519	13.61	10,741	10,197	90.89
2015	1,081	406	4.04	534	141	1.28	3,726	3,780	35.88	2,682	2,869	26.21	1,179	932	9.09	1,489	1,654	15.06	10,691	9,782	91.57
2016	934	305	3.13	460	174	1.35	3,218	3,333	34.76	2,317	2,503	25.39	1,018	949	9.92	1,285	1,474	13.79	9,232	8,738	88.34
2017	1,041	315	3.25	510	274	2.25	3,611	3,603	43.40	2,606	2,898	32.84	1,079	1,050	12.15	1,394	1,488	17.99	10,241	9,628	111.87
2018	1,193	321	2.38	586	267	1.69	4,126	3,646	30.32	2,974	3,170	31.13	1,235	1,123	8.36	1,589	1,625	14.96	11,703	10,152	88.83
2019	1,205	381	1.55	596	398	1.45	4,142	4,322	19.93	2,984	3,242	29.99	1,265	1,143	6.30	1,587	1,676	11.16	11,779	11,163	70.40
2020	1,223	303	1.00	744	493	1.69	5,156	4,010	17.35	3,663	3,255	20.17	1,554	1,277	5.39	2,043	1,751	8.80	14,383	11,089	54.40
2021	2,830	517	2.41	1,358	1,006	5.40	6,444	5,988	32.38	4,579	3,987	26.65	1,942	1,802	9.89	2,554	2,213	13.15	19,707	15,513	89.89
2022	3,878	597	2.79	2,106	1,847	9.10	7,972	6,658	39.64	5,665	5,351	37.18	2,982	2,719	18.52	2,982	2,644	16.73	25,585	19,816	123.96
2023	5,064	536	N/A	3,198	2,011	N/A	7,936	5,314	N/A	5,602	4,837	N/A	3,578	2,540	N/A	2,765	2,352	N/A	28,143	17,591	51.24*

Source: AKFIN; Source file sablefish_removals(2-27-24)

N/A indicates that ex-vessel revenue for 2023 is not yet available.

*Estimated revenue

Table 3-14 Sablefish IFQ ex-vessel revenue (millions of 2022 $) by area and gear, 2013 through 2022

Year	AI			BS			CG			SE			WG			WY			Total of all areas		
	HAL	Pot	Total	HAL	Pot	Total	HAL	Pot	Total	HAL	Pot	Total	HAL	Pot	Total	HAL	Pot	Total	HAL	Pot	Total
2013	5.36	0.49	5.85	1.04	1.51	2.55	33.39	0.00	33.39	23.37	0.00	23.27	10.17	0.00	10.17	13.56	0.00	13.56	86.88	2.01	88.89
2014	3.89	1.02	4.91	0.72	0.90	1.61	35.43	0.00	35.43	24.72	0.00	24.69	10.60	0.00	10.60	13.61	0.00	13.61	88.97	1.91	90.89
2015	3.94	0.10	4.04	0.64	0.65	1.28	35.88	0.00	35.88	26.21	0.00	26.05	9.09	0.00	9.09	15.06	0.00	15.06	90.82	0.75	91.57
2016	2.97	0.15	3.13	0.40	0.96	1.35	34.75	0.00	34.75	25.39	0.00	25.39	9.92	0.00	9.92	13.79	0.00	13.79	87.23	1.11	88.33
2017	2.25	1.00	3.25	0.42	1.83	2.25	38.59	4.81	43.40	31.28	1.57	32.83	9.95	2.20	12.15	16.94	1.05	17.99	99.42	12.45	111.87
2018	1.46	0.92	2.38	0.21	1.48	1.69	26.28	4.05	30.32	29.59	1.53	30.87	6.18	2.18	8.36	14.67	0.29	14.96	78.38	10.45	88.83
2019	1.02	0.53	1.55	0.36	1.09	1.45	14.31	5.62	19.93	27.97	2.02	29.83	4.30	2.01	6.30	10.36	0.80	11.16	58.33	12.06	70.40
2020	0.36	0.64	1.00	0.16	1.53	1.69	5.90	11.46	17.35	17.13	3.04	20.17	0.82	4.57	5.39	5.98	2.82	8.80	30.34	24.06	54.40
2021	0.82	1.59	2.41	0.14	5.26	5.40	3.54	28.84	32.38	17.90	8.75	26.65	0.75	9.14	9.89	4.04	9.12	13.15	27.20	62.69	89.89
2022	0.87	1.92	2.79	0.13	8.97	9.10	3.68	35.96	39.64	16.80	20.39	37.03	0.69	17.83	18.52	3.20	13.53	16.73	25.36	98.60	123.96

Source: AKFIN

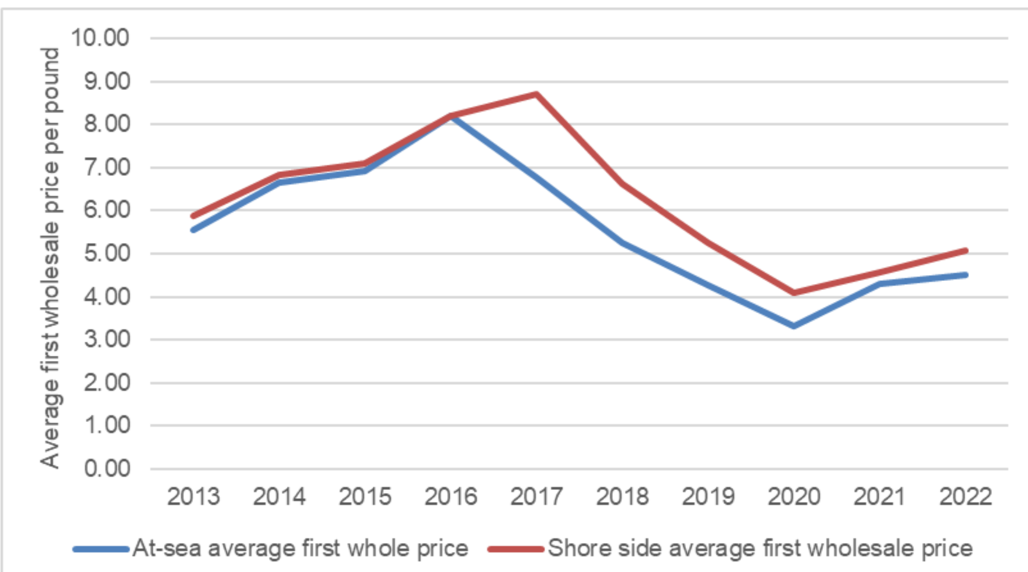
Table 3-15 and Figure 3-10 provide the average sablefish IFQ first wholesale prices for at-sea processors and shoreside processors. As seen in the figure, average first wholesale prices were similar until 2016, but during 2017 through 2020 shoreside prices on average were slightly higher than at-sea prices. Starting in 2020, prices were once again similar. Note that prices within each sector and between sectors did vary widely throughout the 2013 through 2022 period.

Table 3-15 Average sablefish IFQ first wholesale prices for at-sea processors and shoreside processors, 2013 through 2022

Year	At-sea average first whole price	Shoreside average first wholesale price
2013	5.56	5.87
2014	6.64	6.84
2015	6.91	7.11
2016	8.19	8.22
2017	6.77	8.71
2018	5.24	6.63
2019	4.27	5.26
2020	3.33	4.10
2021	4.29	4.58
2022	4.51	5.09

Source: AKFIN; source file is Sablefish_Proc_Value(4-18-24)

Figure 3-10 Average sablefish IFQ first wholesale prices for at-sea processors and shoreside processors, 2013 through 2022



3.1.1.4 Sablefish IFQ Processor Grade Prices and Composition

Before describing processor grade composition of sablefish IFQ, it should be noted that data on sablefish size grades are subject to variability. Sablefish are size-graded when they are landed and this information is recorded on the fish ticket. Sablefish prices are based on the size of the landed catch with larger fish yielding higher prices. It is worth noting the size grades used by the processing plants are not standardized but are rather an unformatted text field. A review of eLandings records from 2006 through 2020 resulted in approximately 3,000 variations of grade records (across all processors). Additionally, in some cases a single grade may encompass a relatively large weight range (e.g., 5 lbs. plus, 3-5 lbs., 7 lbs. plus are all different size grades). Any analyses converting size of landed fish is subject to large amounts of variability when using these grade data. For the purposes of this analysis, fish under 22" are considered <2lbs. **dressed weight.**

As noted in Table 3-16 and Figure 3-11, with the exception of 2022, prices for all processor size grades move in the same direction and tended to be uniform from year to year. Prices for all size grades increased from 2015 through 2017, but following the peak in prices in 2017, prices for all processor grades declined every year until 2020. In 2021, prices for all processors grades increased slightly. However, in 2022, price movements were mixed with grades 7+ lbs., 5 lbs. to 7 lbs., and 4 lbs. to 5 lbs. increasing in price while grades 3 lbs. to 4 lbs., 2 lbs. to 3 lbs., and 1 lbs. to 2 lbs. decreased in price. In 2023, once again all size grades prices were uniformly lower.

Table 3-17 provides prices for all processor size grades by regulatory area during the 2015 through 2023 period. Overall, the prices for all processor size grades by regulatory area follow a similar trend as noted in Figure 3-11 with prices increasing between 2015 to 2017 followed by a decline in prices each year until 2020. Additionally, prices are similar across regulatory areas. Prices in 2021 increased for all processor grades in all regulatory areas, but prices in 2022 were mixed with lower processor grades declining except for the Southeast for 2 lbs. to 3 lbs. grade and 3 lbs. to 4 lbs. grade and West Yakutat for 3 lbs. to 4 lbs. grade while prices for higher processor grades (3-4 lbs., 4-5 lbs., 5-7 lbs., and 7+ lbs.) increased for all regulatory areas.

Table 3-16 Alaska-wide average sablefish processor size grade prices in 2022 dollars, 2015 through 2023

Year	1 lbs. - 2 lbs.	2 lbs. - 3 lbs.	3 lbs. - 4 lbs.	4 lbs. - 5 lbs.	5 lbs. - 7 lbs.	7+ lbs.
2015	4.37	4.44	5.69	6.33	7.84	9.07
2016	4.76	5.21	6.03	6.91	8.54	10.61
2017	5.56	6.25	7.40	8.48	9.93	11.02
2018	1.72	3.04	4.34	5.51	8.61	9.71
2019	1.52	2.45	3.42	4.51	7.35	8.66
2020	0.46	1.55	2.29	2.89	4.43	6.90
2021	1.10	2.30	2.96	3.42	4.50	6.65
2022	0.99	2.10	2.88	4.36	7.18	8.32
2023	0.56	1.19	1.69	2.36	5.43	6.69

Source: AKFIN; Tables are in Sablefish_Grading(3-5-24) w ith new data at Sablefish_Grading(4-30-24)

Figure 3-11 Alaska-wide average sablefish processor size grade prices in 2022 dollars, 2015 through 2023

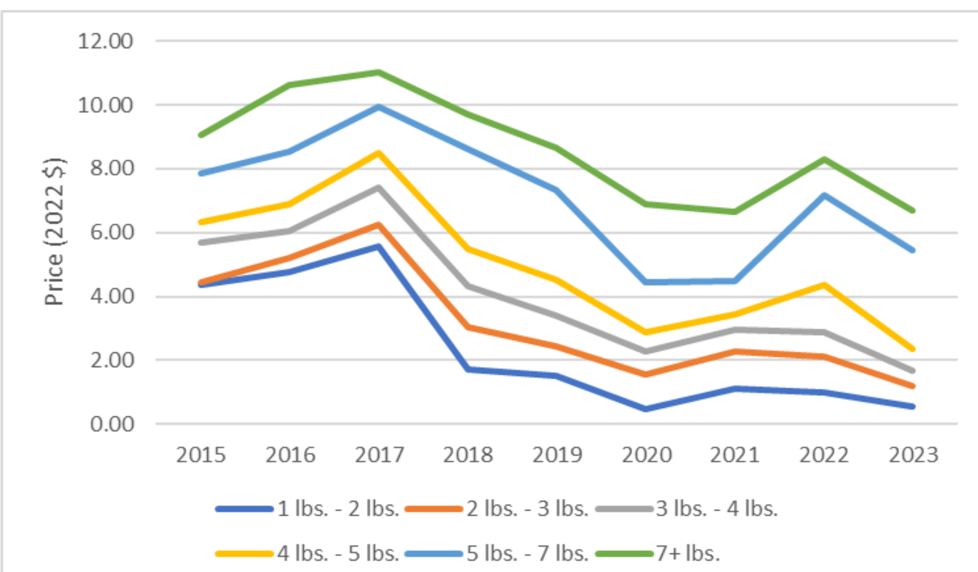


Table 3-17 Average sablefish processor size grade prices in 2022 dollars by regulatory area, 2015 through 2023

Areas	2015	2016	2017	2018	2019	2020	2021	2022	2023
					1 to 2 lbs.				
All areas combined	4.39	4.76	5.56	1.72	1.54	0.46	1.10	0.99	0.56
AI	3.77	3.93	4.79	2.12	1.38	0.54	0.92	0.84	0.63
BS	3.71	4.61	4.76	1.60	1.28	0.50	1.02	0.97	0.63
CG	4.54	5.00	6.08	1.80	1.53	0.42	1.14	0.96	0.48
SE	4.35	5.04	6.12	1.55	1.93	0.55	1.11	1.08	0.63
WG	4.26	4.72	5.18	1.63	1.20	0.44	1.13	1.06	0.52
WY	4.41	4.98	6.13	1.70	1.57	0.48	1.07	0.99	0.59
					2 to 3 lbs.				
All areas combined	4.44	5.20	6.24	3.04	2.46	1.55	2.30	2.10	1.20
AI	4.10	4.83	5.95	2.99	2.27	1.58	2.24	1.86	1.12
BS	4.30	4.76	6.00	2.62	2.44	1.67	2.23	1.94	1.17
CG	4.49	5.39	6.36	3.25	2.53	1.55	2.32	2.10	1.15
SE	4.63	5.24	6.28	2.87	2.44	1.45	2.33	2.17	1.20
WG	4.37	4.92	6.07	2.94	2.20	1.56	2.30	2.15	1.10
WY	4.28	5.01	6.21	3.15	2.50	1.53	2.25	2.17	1.29
					3 to 4 lbs.				
All areas combined	5.69	6.04	7.40	4.31	3.42	2.29	2.96	2.86	1.69
AI	5.28	5.63	7.17	4.57	3.46	2.16	2.76	2.67	1.62
BS	5.66	5.92	7.11	4.29	3.54	2.09	2.80	2.81	1.61
CG	5.80	6.32	7.69	4.49	3.42	2.32	2.99	2.86	1.58
SE	5.36	5.85	6.87	3.93	3.42	2.32	2.88	2.87	1.75
WG	5.66	6.18	7.47	4.34	3.35	2.21	3.07	2.81	1.60
WY	5.69	5.97	7.52	4.51	3.47	2.29	2.89	2.88	1.84
					4 to 5 lbs.				
All areas combined	6.33	6.91	8.48	5.50	4.51	2.89	3.43	4.36	2.36
AI	6.32	6.61	8.34	5.68	4.54	2.69	3.30	4.32	2.23
BS	6.41	6.91	8.31	5.70	4.63	2.72	3.34	4.34	2.43
CG	6.75	7.29	8.88	5.67	4.47	2.96	3.44	4.36	2.30
SE	5.55	6.35	7.93	5.27	4.57	2.88	3.41	4.37	2.42
WG	6.62	7.03	8.57	5.56	4.32	2.77	3.52	4.36	2.19
WY	6.67	6.89	8.61	5.54	4.57	2.88	3.37	4.36	2.52
					5 to 7 lbs.				
All areas combined	7.83	8.52	9.92	8.61	7.35	4.45	4.50	7.18	5.43
AI	7.98	8.30	9.85	8.63	7.49	5.11	4.09	6.97	4.93
BS	8.04	8.55	9.88	7.71	7.81	4.23	4.48	6.97	4.59
CG	8.31	8.96	10.11	8.97	7.34	4.34	4.64	7.35	5.46
SE	7.04	7.84	9.71	8.07	7.29	4.54	4.48	7.15	5.74
WG	8.27	8.82	10.00	9.05	7.66	4.68	4.51	7.04	4.66
WY	8.07	8.55	9.78	8.73	7.36	4.40	4.39	7.14	5.91
					7 + lbs.				
All areas combined	9.04	10.61	10.97	9.70	8.66	6.90	6.65	8.32	6.69
AI	9.02	10.29	11.12	9.37	8.76	6.52	6.31	8.19	6.48
BS	9.61	10.51	11.15	9.04	8.89	6.94	6.57	8.31	6.24
CG	9.70	10.93	11.45	10.07	8.67	6.88	6.94	8.39	6.49
SE	8.49	10.36	10.63	9.51	8.63	6.98	6.46	8.33	6.92
WG	9.71	10.73	11.25	10.11	8.93	6.51	6.86	8.35	6.32
WY	9.37	10.61	11.13	9.49	8.61	6.91	6.76	8.24	7.01

Source: AKFIN; Table file is Sablefish_Grading(4-8-24) and new data w as from Sablefish_Grading(4-30-24)

To provide information on price formation by grade, Table 3-18 shows the number of unique processors by regulatory area and by processor grade from 2015 through 2023. During this period, the number of unique processors in the BS and AI by the different processors has been as low as three to as high as seven. In the GOA regulatory areas, the number of unique processors has been as low as five to as high as 25.

Table 3-18 Number of unique processors by regulatory area and processor grade, 2015 through 2023

Year	Areas	1 to 2 lbs.	2 to 3 lbs.	3 to 4 lbs.	4 to 5 lbs.	5 to 7 lbs.	7 +
2015	AI	6	7	7	7	7	7
	BS	6	6	7	7	7	7
	CG	17	19	21	21	22	21
	SE	14	17	18	18	18	18
	WG	10	11	11	11	11	11
	WY	14	14	17	18	17	18
	Total	**27**	**30**	**32**	**32**	**32**	**31**
2016	AI	6	6	7	7	7	7
	BS	5	5	6	6	7	7
	CG	19	21	22	22	22	22
	SE	12	14	15	15	15	15
	WG	12	11	13	13	13	13
	WY	17	14	20	20	20	20
	Total	**28**	**31**	**34**	**34**	**34**	**34**
2017	AI	6	4	6	5	6	5
	BS	5	5	5	5	5	4
	CG	20	22	24	24	25	25
	SE	14	15	16	16	16	16
	WG	13	13	13	12	12	12
	WY	13	13	15	15	15	16
	Total	**31**	**31**	**35**	**35**	**36**	**34**
2018	AI	5	6	6	6	6	6
	BS	4	4	4	4	4	4
	CG	17	22	22	22	21	21
	SE	12	17	17	17	17	18
	WG	11	12	13	13	13	13
	WY	16	17	18	18	18	18
	Total	**29**	**34**	**34**	**34**	**34**	**35**
2019	AI	7	8	8	8	7	7
	BS	5	7	7	7	7	4
	CG	22	24	25	24	24	24
	SE	14	17	18	18	18	18
	WG	13	15	15	15	14	15
	WY	17	18	18	18	17	17
	Total	**32**	**36**	**37**	**37**	**37**	**36**
2020	AI	3	3	3	3	3	2
	BS	3	4	4	4	4	4
	CG	22	23	23	23	23	22
	SE	18	19	19	19	19	19
	WG	13	14	14	14	14	12
	WY	17	18	18	18	18	18
	Total	**33**	**33**	**33**	**33**	**33**	**32**
2021	AI	3	3	3	3	3	3
	BS	5	5	5	5	5	5
	CG	19	19	19	19	19	19
	SE	18	20	20	20	20	20
	WG	11	11	11	11	11	10
	WY	17	18	18	18	18	18
	Total	**31**	**31**	**31**	**31**	**31**	**31**
2022	AI	3	3	3	3	3	3
	BS	4	4	4	4	4	4
	CG	18	18	18	18	18	18
	SE	20	20	20	20	20	20
	WG	9	12	12	12	12	8
	WY	17	20	20	20	19	18
	Total	**33**	**34**	**34**	**34**	**34**	**34**
2023	AI	3	3	3	3	3	3
	BS	4	4	4	4	4	4
	CG	15	16	15	15	16	16
	SE	13	13	14	14	14	14
	WG	5	7	7	7	7	7
	WY	15	19	19	19	19	19
	Total	**29**	**29**	**30**	**30**	**30**	**30**

Source: AKFIN; Source file is Sablefish_Grading(4-4-24)

Table 3-19 provide the percent of total sablefish IFQ landings by grade for all regulatory areas combined from 2015 through 2023. As noted in the table, the composition of total sablefish IFQ landings is changing where premium grade sablefish landings are diminishing as a percent of total landings while some of the smaller grade (2 lbs. to 3 lbs. & 3 lbs. to 4 lbs.) sablefish IFQ landings are increasing as a percent of total landings during the 2015 through 2023 period. As an example, in 2015 7+ lbs. grade sablefish IFQ landings accounted for 23 percent of total sablefish IFQ landings while in 2023 this grade accounted for 3 percent of total sablefish IFQ landings. In contrast, the 2 to 3 lbs. grade sablefish IFQ landings accounted for 5 percent but in 2023 they accounted for 25 percent. Note that 1 to 2 lbs. sablefish IFQ, which is the processor grade sablefish IFQ that would be authorized for discarding under Alternative 2, ranged from 1 percent in 2015 to 7 percent in 2019, 2021, and 2022. In 2023, 1 to 2 lbs. sablefish landings accounted for 5 percent of the total landings.

Table 3-19 Percent of sablefish IFQ landings by grade for all regulatory areas combined, 2015 through 2023

Grades	2015	2016	2017	2018	2019	2020	2021	2022	2023
7 UP	23%	20%	24%	22%	12%	7%	4%	3%	3%
5 to 7 Lbs	27%	26%	26%	23%	21%	19%	9%	10%	14%
4 to 5 Lbs	22%	24%	19%	21%	19%	22%	15%	17%	20%
3 to 4 Lbs	23%	20%	18%	18%	24%	25%	37%	32%	32%
2 to 3 Lbs	5%	7%	9%	13%	18%	21%	28%	31%	25%
1 to 2 Lbs	1%	3%	5%	4%	7%	5%	7%	7%	5%

Source: AKFIN; source file is sablefish_Grading_Area(4-30-24)

Looking at the composition of landings across the six market categories for each regulatory area (Figure 3-12 and Figure 3-17), there are some similarities across areas but there is also some uniqueness in each area. In general, the 2 lbs. to 3 lbs. grade increased as a proportion of total sablefish IFQ landings in each area and 7+ and to a lesser degree 5 lbs. to 7 lbs. grade diminished in proportion to total sablefish IFQ landings in each area.

Starting with the AI (Figure 3-12), the 1 lbs. to 2 lbs. grade increased in proportion to total sablefish IFQ landings from 2 percent in 2015 to a high of 35 percent in 2017, but then trended downward to a low of 6 percent in 2023. For 2 lbs. to 3 lbs. grade ranged from 2 percent in 2016 to a high of 41 percent in 2020, but then declined to 32 percent in 2022 and 2023. The 7+ lbs. grade ranged from a high of 34 percent in 2016 to a low of 1 percent in 2020, while the 5 lbs. to 7 lbs. grade was 40 percent in 2015 but then declined to a low of 3 percent in 2021 followed by a slight recovery in 2022 and 2023.

In the BS (Figure 3-13), the 2 lbs. to 3 lbs. grade made up a majority of the catch composition in the BS during the 2015 through 2023. The grade ranged from a high of 63 percent in 2020 to a low of 23 percent in 2016. In contrast, the 7+ lbs. grade and the 5 lbs. to 7 lbs. grade made a significantly smaller proportion of total sablefish landings in the BS. For 7+ lbs. grade, landings ranged from a low of 0 percent in 2019 to a high of only 6 percent in 2016, while 5 lbs. to 7 lbs. grade landings ranged from a low of 1 percent in 2020 and 2022 to a high of 14 percent in 2015.

For the CG (Figure 3-14), 1 lbs. to 2 lbs. grade, like other GOA regulatory areas, only contributed to a small proportion of catch composition. The grade ranged from a low of 1 percent in 2015 to a high of 10 percent in 2021. In contrast, the 2 lbs. to 3 lbs. grade, which contributed a larger share of total landings in recent years, increased from a low 6 percent in 2015 to high of 35 percent in 2022. The 7+ lbs. grade trended down from a high of 16 percent in 2015 to a low of 2 percent in 2022. The composition of landings across the remaining grades were varied across the years and were more evenly divided.

In the SE (

Figure 3-15), the most noticeable trend across the grades is the dramatic decline in 7+ lbs. grade. The proportion of the landings for 7+ lbs. grade declined from a high of 37 percent in 2017 to a low of 2 percent in 2022. In addition, the 5 lbs. to 7 lbs. grade also declined from a high of 28 percent in 2016 to a low of 13 percent in 2021 but did increase in 2023 to 18 percent. Also noticeable for the SE is the small percent of total catch composition from 1 lbs. to 2 lbs. grade sablefish IFQ landings, which generally ranged from 1 to 3 percent annually. In addition, the 2 lbs. to 3 lbs. grade increased as a proportion of landings in recent years, increasing from a low 2 percent in 2015 and 2016 to high of 27 percent in 2022.

In the WG (Figure 3-16) and WY (Figure 3-17), 7+ lbs. grade and 5 lbs. to 7 lbs. grade landings contributing a significantly smaller proportion of total catch composition during the 2015 through 2023 period, while 1 lbs. to 2 lbs. grade landings consistently contributed a small proportion of total catch during the same period. In addition, the 2 lbs. to 3 lbs. grade contributed a larger percentage of landings in recent years.

Figure 3-12 Percent composition of sablefish IFQ landings for AI by processor grade, 2015 through 2023

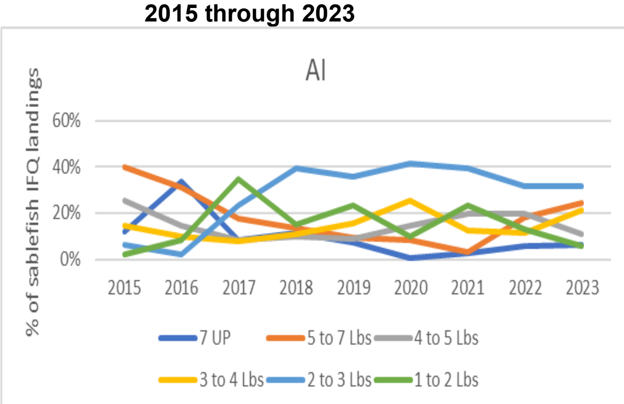


Figure 3-13 Percent composition of sablefish IFQ landings for BS by processor grade, 2015 through 2023

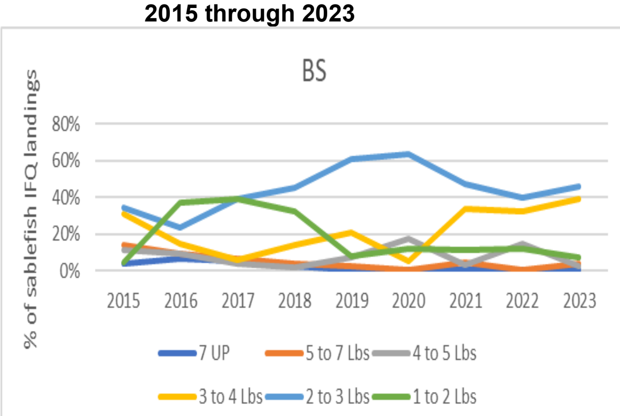


Figure 3-14 Percent composition of sablefish IFQ landings for CG by processor grade, 2015 through 2023

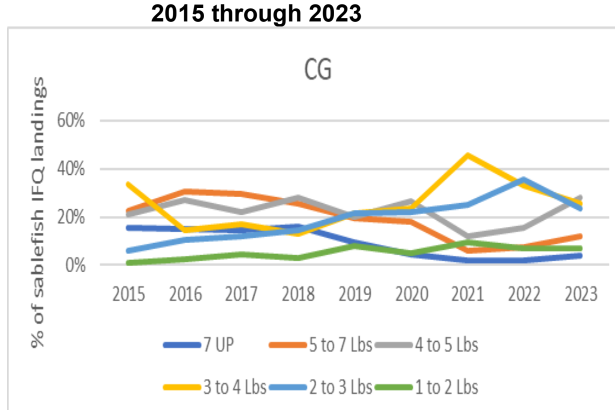


Figure 3-15 Percent composition of sablefish IFQ landings for SE by processor grade, 2015 through 2023

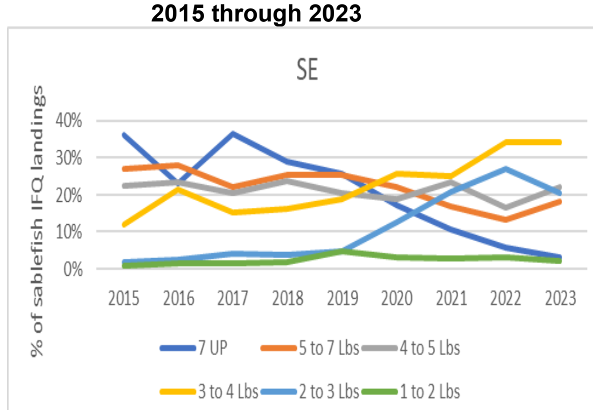


Figure 3-16 Percent composition of sablefish IFQ landings for WG by processor grade, 2015 through 2023

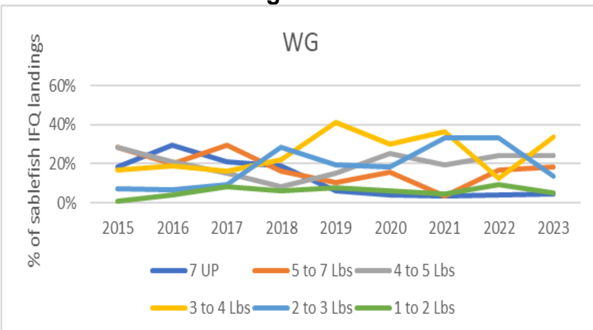


Figure 3-17 Percent composition of sablefish IFQ landings for WY by processor grade, 2015 through 2023

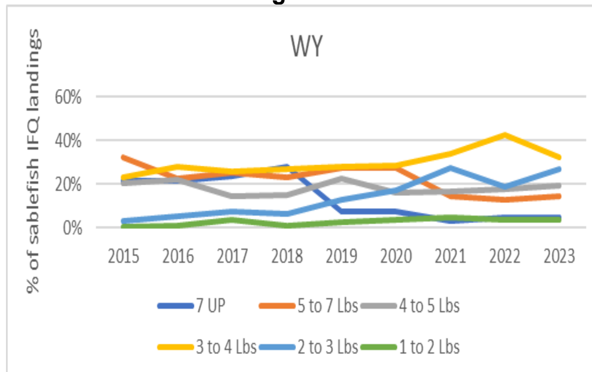


Table 3-20 provides the percentage of sablefish IFQ gross ex-vessel revenue by regulatory area and market grade from 2015 through 2023. As noted in the table, the percentage of total ex-vessel revenue from 1 lbs. to 2 lbs. grade is generally very small, ranging from 1 percent to 3 percent for all areas combined. The 2 lbs. to 3 lbs. grade generally increased as a percent of total ex-vessel gross revenue during the 2015 through 2021 period, but then declined in 2022 and 2023. As for the 7+ lbs. grade, the relatively contribution to total ex-vessel revenue has declined during 2015 through 2022 but then increased slightly in 2023.

Table 3-20 Percent of sablefish IFQ gross ex-vessel revenue by regulatory area and market grade from 2015 through 2023

All Areas Combined							
Year	7 UP	5 to 7 lbs.	4 to 5 lbs.	3 to 4 lbs.	2 to 3 lbs.	1 to 2 lbs.	Total
2015	29%	29%	19%	18%	3%	1%	100%
2016	28%	29%	21%	15%	5%	2%	100%
2017	29%	29%	18%	15%	6%	3%	100%
2018	33%	31%	18%	12%	6%	1%	100%
2019	22%	32%	18%	17%	9%	2%	100%
2020	17%	29%	22%	20%	11%	1%	100%
2021	8%	14%	18%	37%	21%	3%	100%
2022	8%	21%	22%	27%	19%	2%	100%
2023	10%	32%	20%	23%	13%	1%	100%
AI							
Year	7 UP	5 to 7 lbs.	4 to 5 lbs.	3 to 4 lbs.	2 to 3 lbs.	1 to 2 lbs.	Total
2015	16%	46%	23%	11%	4%	1%	100%
2016	43%	32%	12%	7%	1%	4%	100%
2017	13%	25%	10%	8%	20%	24%	100%
2018	23%	24%	12%	10%	25%	7%	100%
2019	18%	21%	12%	16%	24%	10%	100%
2020	2%	21%	18%	26%	31%	2%	100%
2021	6%	5%	27%	14%	37%	9%	100%
2022	13%	35%	24%	8%	16%	3%	100%
2023	16%	46%	9%	13%	14%	1%	100%
BS							
Year	7 UP	5 to 7 lbs.	4 to 5 lbs.	3 to 4 lbs.	2 to 3 lbs.	1 to 2 lbs.	Total
2015	7%	20%	13%	31%	26%	3%	100%
2016	11%	14%	12%	15%	19%	29%	100%
2017	10%	10%	5%	7%	38%	30%	100%
2018	8%	10%	3%	21%	41%	18%	100%
2019	1%	7%	12%	25%	51%	4%	100%
2020	2%	2%	27%	6%	59%	3%	100%
2021	1%	8%	5%	39%	43%	5%	100%
2022	2%	2%	25%	36%	30%	5%	100%
2023	3%	12%	4%	41%	36%	3%	100%
WG							
Year	7 UP	5 to 7 lbs.	4 to 5 lbs.	3 to 4 lbs.	2 to 3 lbs.	1 to 2 lbs.	Total
2015	25%	32%	26%	13%	4%	0%	100%
2016	39%	22%	18%	14%	4%	2%	100%
2017	27%	33%	15%	14%	6%	5%	100%
2018	33%	25%	8%	17%	15%	2%	100%
2019	13%	21%	17%	36%	11%	2%	100%
2020	10%	28%	26%	25%	11%	1%	100%
2021	7%	5%	23%	37%	26%	2%	100%
2022	9%	32%	28%	9%	19%	3%	100%
2023	12%	36%	22%	23%	6%	1%	100%
CG							
Year	7 UP	5 to 7 lbs.	4 to 5 lbs.	3 to 4 lbs.	2 to 3 lbs.	1 to 2 lbs.	Total
2015	21%	27%	20%	27%	4%	1%	100%
2016	21%	34%	25%	12%	7%	2%	100%
2017	19%	33%	22%	15%	9%	3%	100%
2018	25%	35%	24%	9%	7%	1%	100%
2019	18%	32%	20%	16%	12%	3%	100%
2020	12%	28%	28%	20%	12%	1%	100%
2021	4%	10%	14%	47%	20%	4%	100%
2022	5%	17%	22%	30%	24%	2%	100%
2023	11%	29%	29%	18%	12%	1%	100%
SE							
Year	7 UP	5 to 7 lbs.	4 to 5 lbs.	3 to 4 lbs.	2 to 3 lbs.	1 to 2 lbs.	Total
2015	44%	27%	18%	9%	1%	0%	100%
2016	32%	29%	20%	17%	2%	1%	100%
2017	43%	24%	18%	11%	3%	1%	100%
2018	40%	30%	18%	9%	2%	0%	100%
2019	38%	32%	16%	11%	2%	2%	100%
2020	34%	28%	15%	17%	5%	0%	100%
2021	20%	22%	23%	21%	14%	1%	100%
2022	13%	25%	19%	26%	16%	1%	100%
2023	8%	39%	20%	23%	9%	0%	100%
WY							
Year	7 UP	5 to 7 lbs.	4 to 5 lbs.	3 to 4 lbs.	2 to 3 lbs.	1 to 2 lbs.	Total
2015	27%	35%	18%	18%	2%	0%	100%
2016	30%	25%	20%	22%	3%	0%	100%
2017	29%	28%	14%	22%	5%	3%	100%
2018	38%	29%	12%	17%	3%	0%	100%
2019	13%	40%	20%	19%	6%	1%	100%
2020	16%	39%	15%	21%	8%	1%	100%
2021	6%	21%	19%	32%	20%	2%	100%
2022	10%	25%	21%	33%	11%	1%	100%
2023	12%	32%	19%	23%	13%	1%	100%

Source: AKFIN; source file is sablefish_Grading_Area(4-30-24)

Figure 3-18 and Figure 3-19 provides the percent composition of longline and pot sablefish IFQ landings by processor grades across all regulatory areas from 2015 through 2023. As noted in Figure 3-18, harvesters using longline gear have seen landings of smaller sablefish grades increase in proportion to the larger sablefish grades during the 2015 through 2023 period, while 7+ lbs. grade sablefish declined as proportion to other processors grades starting in 2017. As for harvesters using pot gear, the proportion of sablefish IFQ landings of 7+ lbs. grade has consistently been less than all other processor grades during the 2015 through 2023 period, but starting in 2019, have increased in proportion to other processor grades through 2023.

Figure 3-18 Percent composition of longline sablefish IFQ landings across all regulatory areas by processor grades, 2015 through 2023

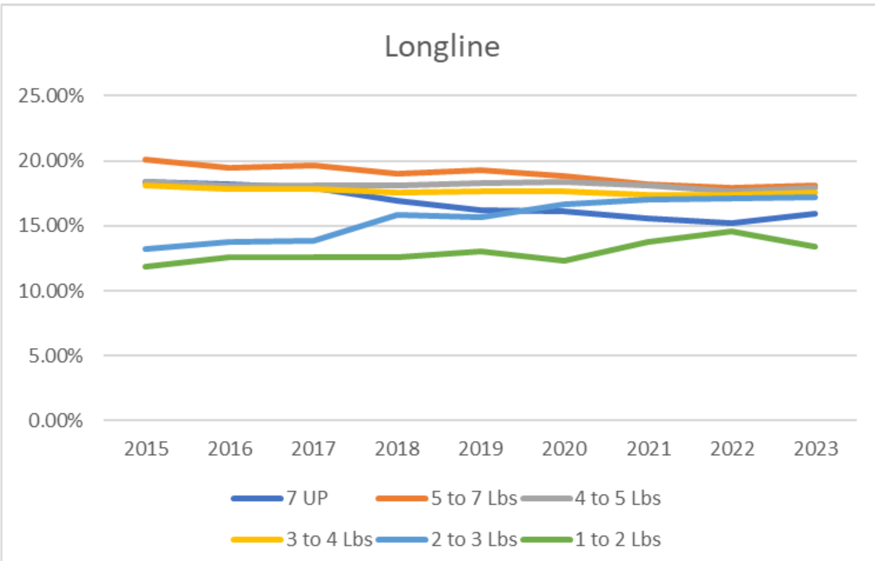
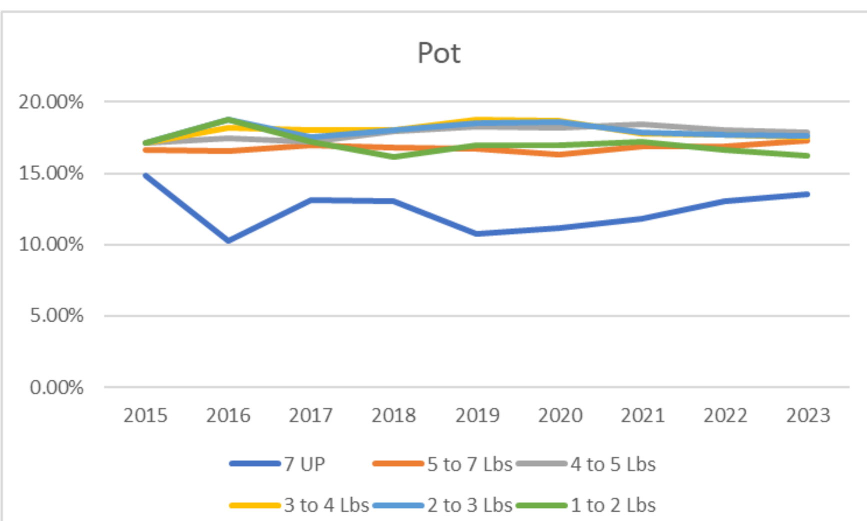


Figure 3-19 Percent composition for pot sablefish IFQ landings across all regulatory areas by processor grades, 2015 through 2023



3.1.2 CDQ Fixed-Gear Sablefish Fishery

The large-scale commercial fisheries of the BSAI developed in the eastern Bering Sea without participation from rural western Alaska communities. These fisheries are capital-intensive and require large investments in vessels, infrastructure, processing capacity, and specialized gear. The Community Development Program (CDQ) was developed to redistribute some of the BSAI fisheries' economic benefits to communities adjacent to the Bering Sea, by allocating a portion of commercially important BSAI species, including pollock, Pacific cod, crab, halibut, and various groundfish, to such communities.

The CDQ Program is an economic development program associated with federally managed fisheries in the BSAI. NMFS, the State of Alaska, and the Western Alaska Community Development Association (WACDA) administer the CDQ Program. Its purpose, as specified in the MSA, is to provide western Alaska communities the opportunity to participate and invest in BSAI fisheries, to support economic development in western Alaska, to alleviate poverty and provide economic and social benefits for residents of western Alaska, and to achieve sustainable and diversified local economies in western Alaska.

In fitting with these goals, NMFS allocates a portion of the annual catch limits for a variety of commercially valuable marine species in the BSAI to the CDQ Program. The percentage of each annual BSAI catch limit allocated to the CDQ Program varies by both species and management area. These apportionments are, in turn, allocated among six different non-profit managing organizations representing different affiliations of communities (CDQ groups), as dictated under the MSA. Eligibility requirements for a community to participate in the western Alaska Community Development Program are identified in the MSA at section 305(i)(1)(D).

There are 65 coastal Alaska communities currently eligible to participate in the CDQ Program, representing a population of 27,702 residents (U.S. Census 2010). The CDQ-qualifying communities have organized themselves into six non-profit groups, with between 1 and 20 communities in each group. The CDQ communities are geographically dispersed, extending from Atka, on the Aleutian chain, along the Bering Sea coast, to the village of Wales, near the Arctic Circle. The current CDQ groups include:

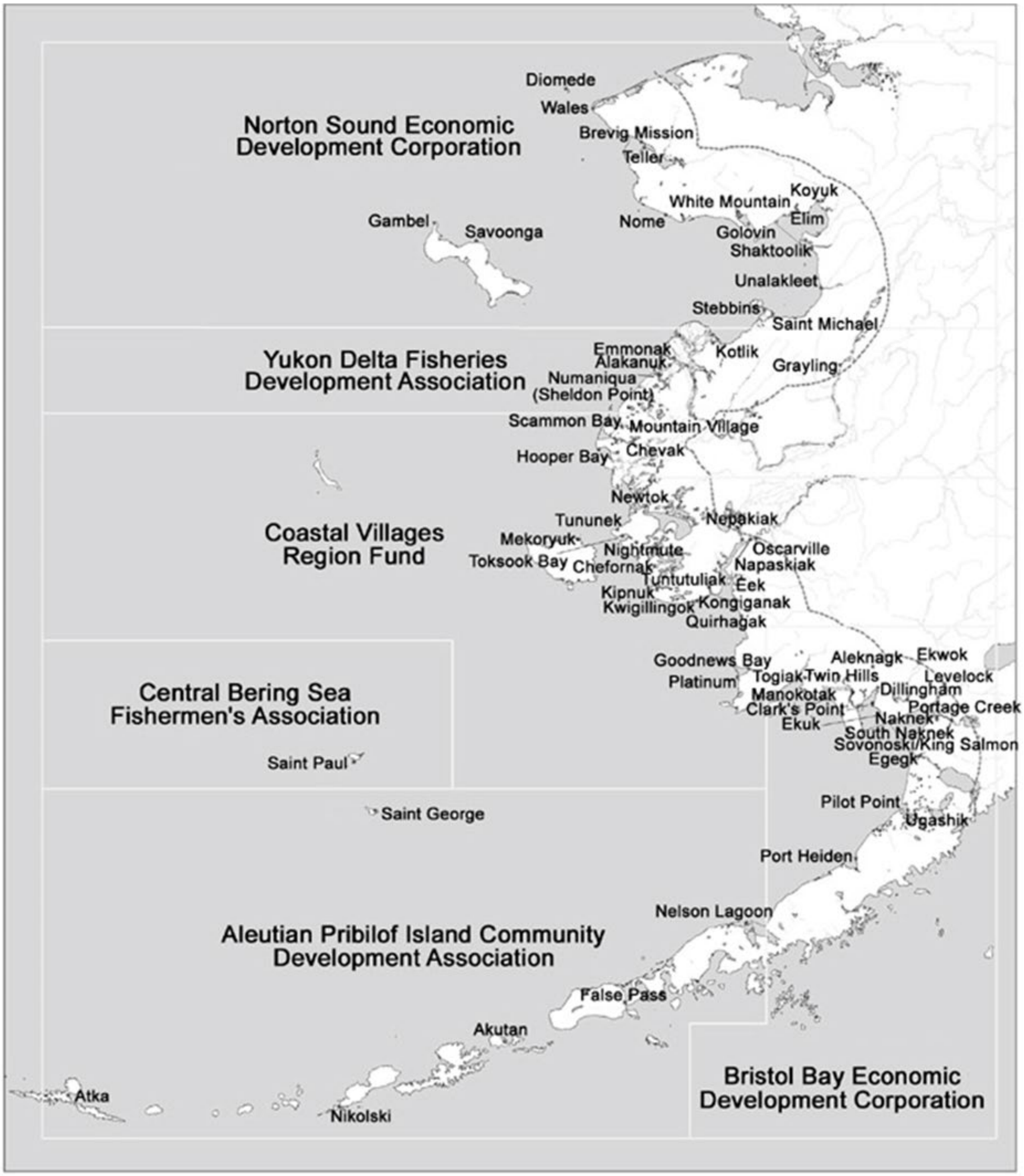
- Aleutian Pribilof Island Community Development Association (APICDA)
- Bristol Bay Economic Development Corporation (BBEDC)
- Central Bering Sea Fishermen's Association (CBSFA)
- Coastal Villages Region Fund (CVRF)
- Norton Sound Economic Development Corporation (NSEDC)
- Yukon Delta Fisheries Development Association (YDFDA)

CDQ groups use the revenue derived from the harvest of their fisheries allocations as a basis for funding economic development activities and for providing employment opportunities. Therefore, the successful harvest of CDQ Program allocations is integral to achieving the goals of the program. Annual CDQ allocations provide a revenue stream for CDQ groups through various channels, including the direct catch and sale of some species, leasing quota to various harvesting partners, and income from a variety of investments.

One of the most tangible direct benefits of the CDQ Program has been employment opportunities for western Alaska community residents. CDQ groups have had some success in securing career track employment for many residents of qualifying communities and have opened opportunities for non-CDQ Alaskan residents as well. Jobs generated by the CDQ Program include work aboard a wide range of fishing vessels, internships with the business partners or with government agencies, employment at processing plants, and administrative positions. CDQ groups continue to explore the means to provide continuing and additional employment opportunities for local residents.

Figure 3-20 identifies the names and locations of the CDQ groups and the communities they represent.

Figure 3-20 Western Alaska CDQ communities and groups



Since Alternative 2 would remove the regulatory prohibition on discarding sablefish 22" inches or less that applies to sablefish IFQ participants, the alternative if selected would also apply to the 20 percent

CDQ fixed gear allocations in both the AI and the BS.[5] Section 679.20(b)(1)(ii)(B) requires that NMFS apportions 20 percent of the fixed gear allocation of sablefish TAC to the CDQ reserve for each subarea.[6] Table 3-8 shows the sablefish CDQ fixed gear allocation available for the 2023 fishing year by area.

As noted in Table 3-10, the number of vessels participating in the fixed gear CDQ fishery has ranged from zero to five in the AI and four to seven in the BS. Table 3-21 provides CDQ fixed gear allocations, CDQ fixed gear landings, and CDQ fixed gear landings as a percent of CDQ fixed gear allocations. In the AI, most of the years are confidential due to the low number of participating vessels, but in 2013 and 2014, 75 percent and 77 percent of the CDQ fixed gear allocations were harvested. However, during the remaining years, very little of the CDQ allocations were harvested. In the BS, CDQ fixed gear landings as percent of their CDQ fixed allocations are less than 10 percent every year since 2013 except for 2021 when landings was 66 percent of the allocation.

Table 3-21 Annual sablefish CDQ fixed gear allocations (mt), CDQ fixed gear landings (mt), and CDQ fixed gear landings as a percentage of annual sablefish CDQ fixed gear allocations

Year	AI			BS		
	CDQ fixed gear allocations (mt)	CDQ fixed gear landings (mt)	CDQ fixed gear landings as % of CDQ fixed gear allocations	CDQ fixed gear allocations (mt)	CDQ fixed gear landings (mt)	CDQ fixed gear landings as % of CDQ fixed gear allocations
2013	321	242	75%	158	3	2%
2014	272	210	77%	134	12	9%
2015	270	0	0%	133	2	1%
2016	234	5	2%	115	7	6%
2017	260	*	*	127	2	1%
2018	298	*	*	146	15	10%
2019	301	*	*	149	12	8%
2020	306	*	*	186	15	8%
2021	708	*	*	340	224	66%
2022	969	*	*	526	28	5%
2023	1013	*	*	640	13	2%

Source: AKFIN; source file is sablefish_removals(2-27-24)
* Denotes confidential data

3.1.3 Whale Depredation in the Sablefish IFQ/CDQ Fisheries

Sperm whales and killer whales are known to interfere with fishing operations when they prey upon fish that are hooked on fishing gear, particularly in Alaska's sablefish fisheries. Estimated depredation is generally below 1,000 t per annum, often composing less than 1% of the total catch (Goethel et al. 2023). Despite relatively low overall impact relative to total catch, the impact of depredation varies by area and species with killer whale depredation higher in western regions (primarily the WG) and sperm whale depredation more significant in the CG and EG (Goethel et al. 2023; Hanselman et al. 2018). Killer whale depredation in the BSAI occurs where high-value longline fisheries overlap with regions supporting some of the greatest densities of "fish-eating" or resident killer whales in the world (Forney and Wade 2006, Fearnbach et al. 2014), and whales seem to target fishing grounds with higher CPUEs (Peterson & Carothers 2013). Killer whales prey upon several groundfish species that are caught on longline gear in

[5] Section 104-297(i) ALASKA AND WESTERN PACIFIC COMMUNITY DEVELOPMENT PROGRAMS.—109-241, 109-479 1) B) (iv) REGULATION OF HARVEST.—of the MSA, the harvest of allocations under program for fisheries with individual quotas or fishing cooperatives shall be regulated by the Secretary in manner no more restrictive than for other participants in the applicable sector, including with respect to the harvest of nontarget species.
[6] Section 679.20(b)(1)(ii)(D)(1) requires that in the BS and AI 7.5 percent of the trawl gear allocation of sablefish TAC from the non-specified reserve, established under § 679.20(b)(1)(i), be assigned to the CDQ reserve.

Western Alaska, including sablefish, Greenland turbot, arrowtooth flounder and Pacific halibut (Yano and Dalheim 1995, Peterson et al. 2013). This reduces fishery catch rates and decreases the accuracy of stock assessments. State and federal fishery managers have received reports of killer whales actively attacking slinky pots and ripping out the mesh to get to the sablefish around Dutch Harbor (personal communication, K. Milani, May 2023). Potential impacts of these interactions on sperm and killer whales are assessed in Section 4.5.

3.1.4 Non-target Sablefish Catch

The ubiquitous distribution of sablefish off Alaska leads to inevitable catches of sablefish by fisheries directed on other species and can occur in almost any gear type. Overall, total trawl landings for all regulatory areas combined relative to total landings for all gears ranged from 10 percent to 17 percent from 2013 through 2016. However, between 2017 and 2020, the percentage of landings that can be attributed to trawl gear increased with a range of 24 percent to 47 percent. Following 2020, the percentage of landings attributed to trawl gear declined slightly ranging from 25 percent to 28 percent.

Looking at specific regulatory areas, sablefish has been a regular component of AI and BS trawl bycatch, with the total catch, which includes CDQ (Table 3-23 and Table 3-24). For the BS, sablefish ranged between 9 percent to 21 percent of the overall BS sablefish catch from 2013 to 2015, but that changed beginning in 2016 when the percentage of BS sablefish landings from trawl jumped to 52 percent. By 2019 trawl sablefish landings increased to 81 percent of the total BS sablefish catch and 87 percent in 2020. However, starting in 2021, trawl percentages declined annually to a low of 49 percent in 2022. In the AI, sablefish landings for the Amendment 80 sector increased from 3 percent in 2014 and 2015 to a high of 50 percent in 2023. Although the percentage of sablefish landings attributed to trawl gear did not increase to levels seen in the BS or the AI, Table 3-25 shows that sablefish landings for vessels using trawl gear in the GOA areas did increase as a proportion to total sablefish landings for all gears starting in 2017 and continuing through 2020.

Trawl fisheries have exceeded several area-based trawl sablefish allocations in past years (Table 3-23, Table 3-24, and Table 3-25). Catch data suggest that this is also an occurrence coincident with incoming large year classes and occurs primarily in the BS and CG. Before 2016, total sablefish catch in the trawl fisheries was generally less than 5 percent of the trawl allocation of the TAC in the BS, AI, and WG. The Amendment 80 trawl fleet retains sablefish up to the MRA 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 American Fisheries Act (AFA) pollock trawl catch. However, since 2018 the AFA CV sector sablefish catch has increased their catch relative to 2013 through 2017.

These increases in trawl bycatch of sablefish were driven by the sudden appearance of sablefish from strong year classes on the fishing grounds. In other words, these fish were not the larger, more valuable fish targeted by the sablefish fishery. As this phenomenon continued, however, the average weight of sablefish caught by trawl gear reflected growth of the dominant year classes that were being caught (Goethel et al., 2020).

Within the affected trawl fisheries, the BS pelagic trawl fishery (AFA CPs and CVs) that targets pollock and that has been a historic non-factor in sablefish bycatch, saw landings of sablefish increased by a factor of over nine between 2018 and 2020.

Table 3-22 Total trawl landings and percent of trawl landings relative to total landings for all gears and areas

Year	Total trawl landings for all areas	Total landings all gear for all areas	Percent of trawl landings relative to total landings for all gears
2013	1,029	10,299	10%
2014	1,022	8,681	12%
2015	1,089	8,035	14%
2016	1,320	7,601	17%
2017	2,192	9,266	24%
2018	3,733	11,048	34%
2019	5,081	13,230	38%
2020	7,359	15,688	47%
2021	4,653	17,204	27%
2022	5,293	20,892	25%
2023	5,483	19,398	28%

Source: AKFIN; source file is sablefish_removals(2-27-24)

Table 3-23 AI trawl quota (mt), trawl landings (mt), remaining quota (mt), percent of trawl landings relative to total landings for all gears, 2013 through 2023

Year	AI				
	Trawl quota (mt)	Total trawl landings (mt)	Remaining quota (mt)	% of trawl gear landings relative to total landings all gear	Total landings all gears (mt)
2013	495	58	437	5%	1,082
2014	419	26	393	3%	813
2015	417	15	402	4%	422
2016	360	30	330	9%	340
2017	402	129	273	22%	588
2018	459	179	280	27%	664
2019	502	241	261	36%	663
2020	510	694	-184	56%	1,232
2021	1179	775	404	49%	1,578
2022	1616	1,115	501	50%	2,230
2023	2110	1,356	754	55%	2,487

Source: AKFIN; source file is sablefish_removals(2-27-24)

Table 3-24 BS trawl quota (mt), total trawl landings (mt), remaining trawl quota (mt), trawl landings by sector (mt), and percent of trawl landings relative to total landings for all gears, 2013 through 2023

Year	BS							
	Trawl quota (mt)	Total trawl landings (mt)	Remaining quota (mt)	Amendment 80 landings (mt)	AFA CPs landings (mt)	AFA CVs landings (mt)	% of trawl gear landings relative to total landings all gear	Total landings all gears (mt)
2013	731	129	602	129	0	0	21%	625
2014	619	33	586	33	0	0	11%	299
2015	617	17	600	17	0	0	9%	192
2016	532	242	290	226	11	5	52%	462
2017	637	648	-11	561	29	57	60%	1,079
2018	732	981	-249	596	36	350	69%	1,423
2019	745	2,458	-1,713	1,272	40	1,146	81%	3,049
2020	931	4,449	-3,518	1,057	31	3,361	87%	5,134
2021	1698	2,417	-719	1,342	16	1,059	59%	4,065
2022	2632	2,352	280	2,101	1	250	49%	4,848
2023	3998	2,757	1,241	2,308	0	449	52%	5,285

Source: AKFIN; source file is sablefish_removals(2-27-24)

Table 3-25 Trawl quota (mt), trawl landings (mt), and remaining trawl quota (mt) in the CG, WG, and WY, and total GOA trawl landings (mt), and percent of trawl landings relative to total landings for all gears, 2013 through 2023

Year	CG			WG			WY			GOA		
	Trawl quota (mt)	Trawl landings (mt)	Remaining trawl quota (mt)	Trawl quota (mt)	Trawl landings (mt)	Remaining trawl quota (mt)	Trawl quota (mt)	Trawl landings (mt)	Remaining trawl quota (mt)	Total GOA trawl landings (mt)	% of trawl gear landings relative to total landings all gear	Total landings all gears (mt)
2013	1108	660	448	350	13	337	261	173	88	846	10%	8,593
2014	936	752	184	296	61	235	221	152	69	965	13%	7,569
2015	932	802	130	295	43	252	220	212	8	1,058	14%	7,422
2016	805	826	-21	255	47	208	190	177	13	1,049	15%	6,799
2017	903	1,192	-289	270	66	204	211	206	5	1,465	19%	7,599
2018	1032	2,124	-1,092	309	224	85	240	236	4	2,584	29%	8,962
2019	1036	1,960	-924	316	320	-4	241	126	115	2,407	25%	9,520
2020	1289	2,064	-775	388	183	205	300	83	217	2,331	25%	9,332
2021	1612	1,304	308	486	181	305	375	117	258	1,602	14%	11,578
2022	1993	1,550	443	745	226	519	455	105	350	1,881	14%	13,836
2023	1985	1,183	802	895	210	685	440	90	350	1,483	13%	11,649

Source: AKFIN; source file is sablefish_removals(2-27-24)

Rapid increases in BS sablefish bycatch began to trigger PSC status changes for trawl gear starting in 2017. Changes to "bycatch" (prohibiting directed fishing) or "PSC" (prohibiting retention) status affect handling of sablefish by non-IFQ fisheries and are the inseason response to catch trends that threaten to contribute to TAC overages. In the BSAI, trawl catch triggered PSC status changes in the BS every year since 2017 through 2022. In the GOA, accumulation of catches triggered PSC status changes in the CG each year from 2016 through 2020, in the WG in 2019, and in WY in 2017 and 2018. When this occurred, the NMFS AKRO initiated information bulletins, "IB" in the table, notifying permit holders that sablefish may not be retained.

Retaining trawl caught sablefish is also permissible through the MRA provision in the Groundfish FMPs. The MRA allows vessels to top off on sablefish, as needed, but vessels can only retain incidentally caught sablefish when sablefish are in bycatch status. The percentage relates to the expected rate of catch and is intended to allow harvest for a species that is low in volume but high in value. MRAs were revised in the GOA by a regulatory amendment, effective in April 1997. The percentage depends on the target species: 1 percent for pollock, Pacific cod, Atka mackerel, "other species", and aggregated amounts of non-groundfish species. Fisheries targeting deep flatfish, rock sole, flathead sole, shallow flatfish, Pacific Ocean perch, northern rockfish, dusky rockfish, and demersal shelf rockfish in the Southeast Outside district, and thornyheads are allowed 7 percent. The MRA for arrowtooth flounder changed effective in 2009 in the GOA, to 1 percent.

3.2 Target Products

The following section utilizes parts of Chapter 8 Wholesale Market Profiles for Alaska Groundfish prepared by McKinley Research Groundfish, LLC that is included in the Stock Assessment and Fishery Evaluation Report for the Groundfish Fisheries of the Gulf of Alaska and Bering Sea / Aleutian Island Area: Economic Status of The Groundfish Fisheries Off Alaska, 2022 by the National Marine Fisheries Service.

Sablefish is a premium whitefish with a high oil content and delicate texture. Sablefish fillets are often marinated and served smoked, grilled, or sautéed. While Japan is the primary market for sablefish, it can be found in upscale restaurants and stores worldwide, including Hong Kong, United Arab Emirates, the U.S., and Europe, among others.

Shoreside processors – which accounted for 94 percent of production in 2022 – typically receive chilled sablefish either in the round (whole fish) or headed and gutted (Table 3-26 and Figure 3-21). The dominant sablefish wholesale product is IQF frozen H&G fish, often sold in 50-pound boxes. Relatively small amounts of heads, collars, fillets, and other products are also produced. Combined, non-H&G production made up just 6 percent of production volume in 2021. However, since 2019, the percentage of whole fish relative to other product forms has increased as noted in Table 3-26 and Figure 3-21.

Sablefish prices and markets are sensitive to the size of the fish, with larger sablefish worth much more than smaller fish. Ex-vessel prices in 2022 ranged from $1.00 per pound for fish less than two pounds to bout $7.00 per pound for fish greater than seven pounds. Unfortunately, smaller sablefish have become a larger portion of the harvest in recent years – a trend that is expected to continue in the near-term due to significant recruitment in recent age classes and other factors affecting fish size.

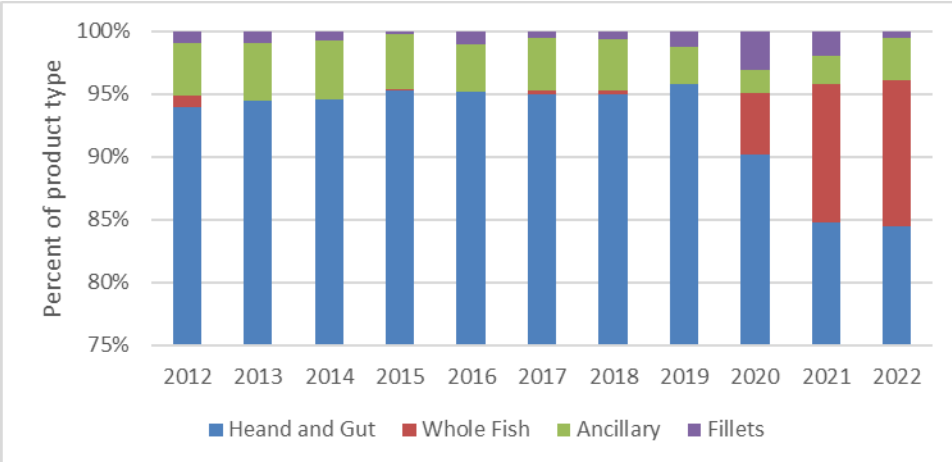
In 2019 and 2020, the first wholesale volume of sablefish products averaged just under 8,000 mt annually. Production is at the highest level in a decade, with the last period of a similar volume being 2011 to 2013. Unfortunately, the higher volume has flooded the market, and this is reflected in a decade-low price for sablefish in 2020. Foodservice closures in 2020 caused by the COVID-19 restrictions also likely contributed to the continued decline in prices that year. Preliminary data from 2021 indicates that prices were up, despite higher production volumes.

Table 3-26 Sablefish production (mt) by product form, 2012 through 2022

Year	Head and Gut	Whole Fish	Ancillary	Fillets	Total
2012	8,273	76	368	88	8,804
2013	7,680	3	374	76	8,133
2014	6,022	0	299	49	6,369
2015	6,119	4	283	16	6,421
2016	5,522	0	218	61	5,801
2017	6,378	18	283	35	6,713
2018	6,316	14	271	46	6,648
2019	6,893	0	211	89	7,194
2020	5,965	325	123	202	6,615
2021	10,279	1,342	264	243	12,128
2022	13,134	1,811	518	91	15,554

Source: AFKIN; source file is Sablefish_Products(4-8-24)

Figure 3-21 Percent of sablefish production by product form, 2012 through 2022



3.3 Markets

The following section utilizes parts of Chapter 8 Wholesale Market Profiles for Alaska Groundfish prepared by McKinley Research Groundfish, LLC that is included in the Stock Assessment and Fishery Evaluation Report for the Groundfish Fisheries of the Gulf of Alaska and Bering Sea / Aleutian Island Area: Economic Status of The Groundfish Fisheries Off Alaska, 2022 by the National Marine Fisheries Service.

Japan is the primary market for Alaska's sablefish, generally accounting for over 70 percent of total exports by volume. China (including Hong Kong) is the second-largest international market by volume and value in 2021, but their imports remain less than a third of Japan's market. If Hong Kong is split out as a market separate from China, it would be the second most important market by value for Alaska sablefish in the past three years because Hong Kong imports a disproportionate amount of large higher-priced sablefish. These imports serve both Hong Kong foodservice and retail markets as well as re-export markets in Southern China, Singapore, and other Southeast Asia countries with Japanese expatriate communities and business travelers. As a free port, exports to Hong Kong are not subject to Chinese tariffs. Wealthy markets including Singapore and the UAE usually import a modest but consistent volume of Alaska sablefish. Exports to these markets were down in 2020, likely because of COVID-19 foodservice closures.

The estimated size of the U.S. sablefish market has averaged about 6,000 mt per year in recent years. The volume of Alaska sablefish in the market has been relatively steady in this period, but U.S. imports have fluctuated significantly, with a surge in Canadian imports in 2016 and 2017. Industry interviews indicate Canadian imports were higher in this period because most Alaska sablefish was smaller sized fish during this period. Approximately 80 percent of Alaska sablefish is exported, and the remainder goes to the U.S. domestic market.

The U. S. and Canada account for nearly all global production of sablefish. Alaska is the primary supplier, contributing an annual average of 62 percent between 2016 and 2020. Harvest from other West Coast states accounted for 26 percent of global supply in this period and Canada (British Columbia) contributed 11 percent.

More recently, in a series of articles by Undercurrent News on February 15, 2024, February 29, 2024, and April 9, 2024, reports that IFQ harvesters and Japanese importers are concerned there could be a further softening of the Alaska sablefish market in Japan. In reported in the April 9, 2024, article, anecdotal reports from IFQ harvesters are indicating ex-vessel prices are lower since the start of the fishing season than 2023 ex-vessel prices (see Figure 3-11 and Table 3-18 for 2023 prices). The article also noted that sablefish IFQ fishery is off to a slow start compared to last in hopes that prices will improve later in the season. The February 15 and February 29 articles report that imports of sablefish from the U.S. was up 19 percent in 2023, while the average price for frozen Alaska sablefish in the Japanese market dropped 15 percent in 2023 ($6.53 kg), while for 2024 the outlook for imports of sablefish to the Japanese market could increase significantly given Russia increased its catch recommendations significantly. There is still some uncertainty how and if Russian fishing fleet can capitalize on these higher harvest recommendations, but if some portion of these higher quantities of sablefish enter the Japanese market, these increases in sablefish imports could push prices lower for sablefish in Japan. As noted in the February 29, 2024, Undercurrent News article, during the 2023 fishing year, Japan imported 352 mt of frozen sablefish from Russia which was the largest volume since the late 1980s. The price for these Russian imports was 28 percent lower than sablefish from the US. Combined with impacts from the COVID-19 pandemic which reduced demand for sablefish in U.S. restaurants and the large inventories of sablefish in the market, the growing supply of Alaska sablefish in the world market and the growing Russian harvests of sablefish is likely to put increased downward pressure on prices for sablefish at all market grades in the immediate future.

Current Alaska Seafood Market Challenges

The current state of extraordinary market challenges across a broad array of Alaska fisheries was recently highlighted by Alaska Seafood Marketing Institute (ASMI) – a public-private partnership between the State of Alaska and the Alaska seafood industry – published a public letter in October 2023 describing.

ASMI states that Alaska seafood is “subject to numerous geopolitical, trade inequity, and economic factors” that are not directly controlled by the participants (harvesters, processors, and distributors) within the state. The letter cites supply and demand imbalances domestically and abroad, large harvests by overseas product competitors with low relative currency valuations (e.g., Russia), and trade conflict with a major U.S. export receiver (China) resulting in a substantial drop in export volume to a traditionally key market. While facing drops in revenue, Alaska processors, exporters, and fishermen are facing higher operating costs due to domestic inflation for labor/materials/shipping/storage, high interest rates, high fuel prices, and labor supply shortfalls. Shipping volume and costs to some traditional Transpacific trading partners remain affected by logistical challenges that stem from the COVID-19 pandemic. U.S. products that are reprocessed internationally before entering the global market as finished goods are being forced to compete directly with seafood products that originate from countries that sell primary seafood products at lower prices and denominated in a weaker currency than the US dollar. High interest rates have affected processors’ ability to finance operations and continue needed investment to support vessel fleets and crews. Simultaneously, hold-over product inventories resulting from the supply-demand imbalance has devalued the asset that these Alaska fishery participants are producing. While primary producers are generally receiving lower prices while facing higher costs, retail product prices on the global market remain steady or high which has further affected demand by consumers in inflationary economies – including but not limited to the U.S. – who may be reducing spending in certain categories.

3.4 Local knowledge, traditional knowledge, and subsistence

When preparing this analysis, staff used the Local Knowledge (LK), Traditional Knowledge (TK), and Subsistence search engine to look for sources of information containing LK and TK specific to sablefish in the BSAI and GOA regions (https://lktks.npfmc.org/). The search engine contains scientific articles in peer-reviewed journals, white papers, archival references, and other sources of information related to LK, TK, the social science of LK and TK, and subsistence information. No results based on LK or TK from the sablefish IFQ fleet or communities substantially engaged in, or dependent on sablefish were returned.[7]

[7] A reader may submit suggestions of sources for LK, TK, the social science of LK and TK, and information about the subsistence way of life to npfmc.lktks@gmail.com. That information could assist in the preparation of future Council review documents.

LK is based on the observations and experience of local people in a region with significant in-situ expertise related to particular species, environments, and practices (Martin et al., 2007). Regarding sablefish fishing, LK holders such as long-term IFQ skippers or crew members may be some of the earliest observers of environmental and/or fishery changes because of their long-term experience working and harvesting specific areas (Johannes & Nies, 2007).

In addition to the commercial importance of sablefish, sablefish are also occasionally caught for personal use and subsistence using longline gear. Only a small percentage of people use sablefish for subsistence, likely due to the depths where sablefish are located. The ADF&G Division of Subsistence conducts household surveys which provide information about uses and harvests of wild resources. These surveys are not conducted every year, and not all communities are surveyed with the same frequency, so data are not comparable across years and are unable to be aggregated, but they can provide a minimum estimate of subsistence harvest in a certain community in the survey year. These data are entered into the ADF&G Community Subsistence Information System (CSIS).[8]

[8] https://www.adfg.alaska.gov/sb/CSIS/index.cfm?ADFG=main.home

4 Environmental Assessment

This chapter evaluates the potentially affected environment and the degree of the impacts of the alternatives and options on the various resource components, together with relevant past, present, and reasonably foreseeable actions. The socio-economic impacts of this action are described in detail in the Regulatory Impact Review (RIR) chapter of this analysis (Section 5).

Recent and relevant information, necessary to understand the affected environment for each resource component, is summarized in the relevant sections below. For each resource component, the analysis identifies the potential impacts of each alternative, and evaluates these impacts. If significant impacts are likely to occur, preparation of an EIS is required. Although an EA should evaluate economic and socioeconomic impacts that are interrelated with natural and physical environmental effects, economic and social impacts by themselves are not sufficient to require the preparation of an EIS (see 40 CFR 1508.14).

4.1 Methods for Environmental Impact Analysis

4.1.1 Resource Components Addressed in the Analysis

In considering the potential marginal impacts of the proposed action alternative, Table 4-1 shows the components of the human environment and whether the proposed action and its alternatives have the potential to impact that resource component and thus require further analysis. Extensive environmental analysis on all resource components is not needed in this document because the proposed action is not anticipated to have environmental impacts on all resource components.

Table 4-1 Resources potentially affected by the proposed action alternative.

Potentially affected resource component							
Target species: sablefish	Non-target species	Prohibited Species	Marine Mammals	Seabirds	Habitat	Ecosystem and Climate Change	Social and economic
Y	Y	Y	Y	Y	Y	N	Y

N = no impact anticipated by the action alternative on the component.
Y = an impact is possible if action alternative is implemented.

As described in Section 2.2, this analysis focuses on marginal impacts of Alternative 2, Option 2 (voluntary discarding of fixed gear sablefish IFQ/CDQ < 22” total body length). While not analyzed in this document, it is expected that impacts of Alternative 2, Option 1 would be similar in type but greater in magnitude than impacts of Option 2. This is due to the opportunity afforded to fishery participants to discard any size of sablefish under Option 1, and the resulting potential for greater increases in effort to replace discarded fish, as compared to Option 2, which would limit sablefish discards to a narrow size range (<22”).

Any effects of the action alternative on the resource components are likely to be caused by changes in the size or amount of sablefish discarded and/or changes in intensity of fishing effort in the BSAI and GOA sablefish IFQ/CDQ fisheries. Two methods are used in the EA to examine impacts to resource components, described below.

To explore the potential implications of the proposed action on the sablefish stock, the simulation framework for projecting Acceptable Biological Catch (ABC) for Alaskan sablefish was adapted to include fishery discarding. Appendix 5 provides the full study design and results of that analysis.

Analysis of non-sablefish resource components is not linked to the simulation framework but instead uses predictions about changes in fishing effort from Section 5 to estimate potential impacts to these resource components. This method and associated assumptions about fishing behavior are summarized below.

The total amount of fishing effort deployed under the action alternative (Alternative 2) could be similar to that of recent years but may also be greater since vessels choosing to discard some portion of their catch would need to fish more to harvest the same amount of quota. Increases in fishing effort could be effectuated through the amount of gear deployed by vessels participating in the fishery, or the amount of time gear is deployed. Expected impacts on resource components are dependent on the extent to which sablefish IFQ/CDQ harvesters use the flexibility provided under Alternative 2 to discard sablefish.

It is expected that any increase in effort as a result of this action would be constrained, due to regulatory constraints such as the location and timing of the fishery, harvest limits (individual IFQs and TACs), and gear restrictions, as well as operational constraints in the IFQ/CDQ fisheries (costs such as fuel, bait, crew, etc.). Any increase in the amount of fishing effort (e.g., number of hooks/pots in the water, or amount time gear is deployed) could have impacts to several resource components. As shown in Table 4-1, the action alternative has the potential to affect sablefish, non-target catch, prohibited species catch (PSC), and marine mammals, particularly cetaceans known to prey upon sablefish caught on fixed gear in the IFQ fisheries. This EA also analyzes potential impacts on seabirds as they are commonly associated with impacts from H&L gear deployment, as well as potential impacts of fishing gear on habitat. The social and economic impacts of this action relative to no action are discussed in Section 5 of this document.

Section 5.4.1 describes how the analysts operationalized potential increases in fishing effort (external to the sablefish simulation framework in Appendix 5). We used average 2021-2023 catch rates of grade 1/2 sablefish IFQ/CDQ by subarea and gear type to consider the maximum amount of sablefish IFQ/CDQ hypothetically discarded. This approach assumes knife-edge retention at age 3 (e.g., all grade 1/2 sablefish IFQ will be discarded), which is likely an overestimate of discarding behavior under Alternative 2, Option 2, because it is unlikely all harvesters intend to discard every fish <22”. Therefore, these percentages are likely the upper bound in terms of any increase in fishing effort. To predict the effort increase, the inverse of the retention rate was calculated and represents the amount of effort needed to maintain status quo catch). Table 5-17 shows the results of this exercise to estimate changes in fishing effort under Alternative 2, Option 2. This is the basis for describing impacts to non-sablefish resource components.

Based on the methods in Section 5.4.1 and shown in Table 5-17, fishing effort could increase by as much as 32% from the status quo (for pot gear in the Aleutian Islands), or by as little as 2% (H&L gear in the BS, WY, SE) as a result of this action. However, as of the end of the 2023 fishing season, less than 90% of the sablefish IFQ allocations were harvested in each regulatory area, and the overall combined harvest of sablefish IFQ allocations for all regulatory areas was 63% (Table 5-15). This indicates that under current allocations, there is potential for additional effort to be expended in this fishery. Section 5.3 explains some of the factors influencing sablefish harvester participation and behavior, such as depressed market conditions. This document analyzes incremental changes in impacts of the proposed action as compared to the status quo. As such, assumptions of effort and associated environmental impacts do not attempt to account for future changes in market conditions, which are outside the scope of this action. While it is not possible to predict the absolute level of increased fishing effort that may result under Alternative 2 (due to factors such as how year to year or regional differences in discarding behavior may change over time), it is feasible that increases in fishing effort could fall somewhere between the values in Table 5-17. Depending on the spatial resolution of the data for each resource component analyzed in the following sections, the analysts either use the percent change in effort by subarea, or a weighted average for the BSAI and GOA (i.e., BSAI uses a weighted average of sablefish catch in the BS and AI, GOA uses weighted average of WG, CG, WY, SE).

Ecosystem and Climate Change

Broader ecosystem changes as a result of this action are not expected due to the scope of the action and the limited magnitude of impacts as compared to the status quo. Ecosystem considerations for the groundfish fisheries are summarized annually in the annual Ecosystem Status Reports (ESR) (Ferris 2023; Ortiz and Zador 2023; Siddon 2023). These considerations are summarized according to the ecosystem effects on the groundfish fisheries, as well as the potential fishery effects on the ecosystem.

This action is also expected to have minimal impacts on climate change in terms of greenhouse gas emissions. Humans are increasing atmospheric concentrations of planet-warming gasses, including the three main greenhouse gasses produced by human activities: carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O). Since 1850, atmospheric concentrations of carbon dioxide have increased by more than 47%, nitrous oxide by 23%, and methane by more than 156%.1 Methane is a more potent greenhouse gas than CO2 but is shorter-lived and present in lower concentrations than CO2. Nitrous oxide is both long-lived and more potent, but its concentrations are also lower than CO2. The evidence for warming across multiple aspects of the Earth system is incontrovertible, and the science is unequivocal that increases in atmospheric greenhouse gasses are driving many observed trends and changes. The concentrations of greenhouse gasses in the atmosphere continue to increase primarily because humans have burned and continue to burn fossil fuels for transportation and energy generation. In addition, industrial processes, deforestation, and agricultural practices also increase greenhouse gasses in the atmosphere. As a result of increases in the atmospheric concentrations of these heat-trapping gasses, the planet is on average about 2°F (1.1°C) warmer than it was in the late 1800s (U.S. Global Change Research Program 2023).

Sablefish IFQ/CDQ fisheries can contribute to greenhouse gas emissions either directly or indirectly in the following ways:

- Emissions from fishing vessels
- Emissions from processing facilities
- Emissions from transportation of processed fish
- Emissions from vessel maintenance and repairs
- Emissions related to traveling to and from fishing vessels
- Emissions related to vessel supplies

Greenhouse gas emissions associated with the operation of Alaska's IFQ/CDQ fisheries are, in the short term, expected to remain similar to current levels. While an increase in fishing effort as a result of this action could increase fuel consumption and emissions from fishing vessels, any increase as a result of this action is expected to be de minimus. Emissions from the IFQ/CDQ sablefish fisheries and associated transportation and processing are expected to be extremely small relative to global emissions. Additionally, there is the potential for long term reductions in greenhouse gas emissions as transportation related to movement of goods and fishing vessels shift to renewable and more low-carbon, sustainable energy sources.[9] There is no evidence to suggest that these alternatives would exacerbate associated effects of climate change. However, climate change and associated effects are likely already affecting many species in the North Pacific, and the effects of climate change pose a substantial threat to the ecosystem as these effects intensify in the future.

This analysis does not analyze impacts of potential changes to monitoring requirements that may be necessary as a result of this action, as specific changes are not included in the alternatives. See Section 2.2.3 for a general discussion of potential impacts of changing current monitoring protocols.

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9 https://www.nrel.gov/news/program/2023/battery-electric-fishing-vessel-marks-a-sea-change-for-smallcommercial-fishers.html

4.1.2 Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions

This EA analyzes the effects of each alternative and the effects of past, present, and reasonably foreseeable actions (RFA). Table 4-1 shows the resources with potentially meaningful effects.

The aggregate effects on the other resources have been analyzed in numerous documents and the impacts of this proposed action and alternatives on those resources is minimal, therefore there is no need to conduct an additional aggregate impacts analysis.

Each section below provides a review of the relevant past, present, and RFA that may result in aggregate effects on the resource components analyzed in this document. A complete review of the past, present, and RFAs are described in the prior NEPA documents incorporated by reference (Section 1.4) and the SIR NMFS prepares to annually review of the latest information since the completion of the Alaska Groundfish Harvest Specifications EIS. SIRs have been developed since 2007 and are available on the NMFS Alaska Region website.[10] Each SIR describes changes to the groundfish fisheries and harvest specifications process, new information about environmental components that may be impacted by the groundfish fisheries, and new circumstances, including present and reasonably foreseeable actions. NMFS reviews the reasonably foreseeable actions described in the Harvest Specifications EIS each year to determine whether they occurred and, if they did occur, whether they would change the analysis in the Harvest Specifications EIS of the impacts of the harvest strategy on the human environment. In addition, NMFS considered whether other actions not anticipated in the Harvest Specifications EIS occurred that have a bearing on the harvest strategy or its impacts. The SIRs provide the latest review of new information regarding Alaska groundfish fisheries management and the marine environment since the development of the Harvest Specifications EIS and provide aggregate effects information applicable to the alternatives analyzed in this EA.

Actions are understood to be human actions (e.g., a designation of northern right whale critical habitat in the Pacific Ocean), as distinguished from natural events (e.g., an ecological regime shift). CEQ regulations require consideration of actions, whether taken by a government or by private persons, which are reasonably foreseeable. This requirement is interpreted to indicate actions that are more than merely possible or speculative. In addition to these actions, this aggregate effects analysis includes the effects of climate change.

Actions are considered reasonably foreseeable if some concrete step has been taken toward implementation, such as a Council recommendation or NMFS's publication of a proposed rule. Actions only "under consideration" have not generally been included, because they may change substantially or may not be adopted, and so cannot be reasonably described, predicted, or foreseen. Identification of actions likely to impact a resource component within this action's area and time frame will allow the public and Council to make a reasoned choice among alternatives. There are a number of actions moving through the Council process that could potentially increase the impacts of this action on the resource components identified in Table 4-1. However, under either alternative, the sablefish IFQ/CDQ fisheries will still be constrained by existing regulations concerning the location and timing of the fisheries and overall catch limits. Neither alternative proposes to change protections to habitat, protected species, nor overall limits for target species.

4.2 Target Species – Sablefish

BSAI and GOA sablefish are managed as one population in Federal waters due to their high connectivity across many life stages. The sablefish stock is assessed annually in the SAFE report with the most recent

[10] https://www.fisheries.noaa.gov/resource/document/alaska-groundfish-harvest-specifications-environmental-impact-statement-eis

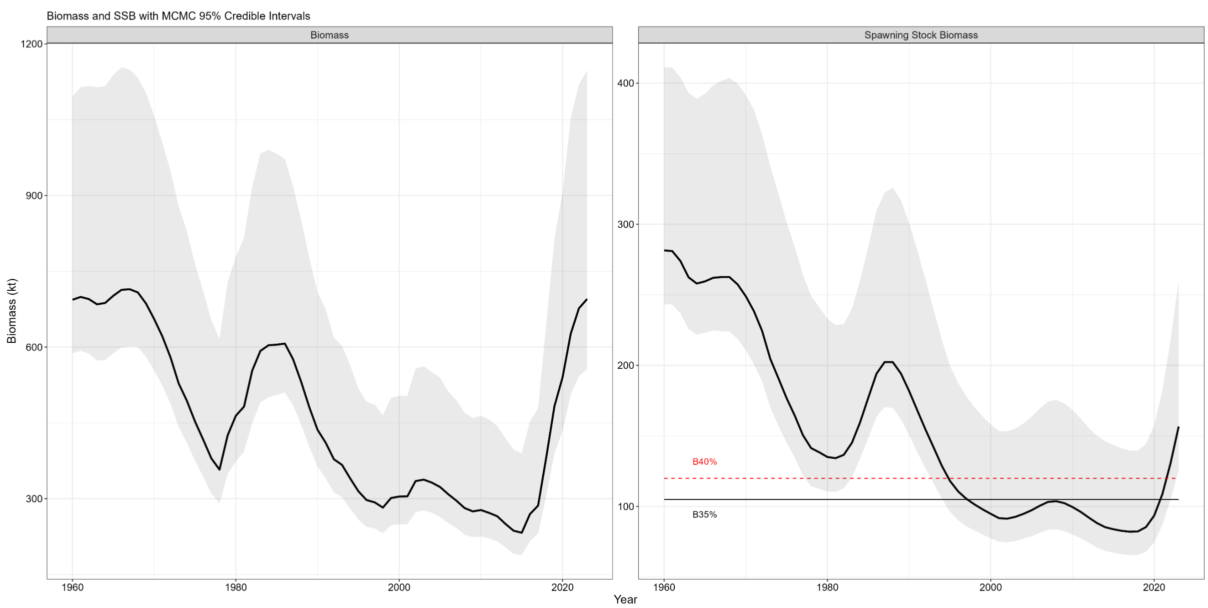
report from 2023. (Goethel et al. 2023). The sablefish assessment is based on a statistical sex-specific age-structured model which incorporates fishery data and fishery independent data from domestic (AFSC longline survey, GOA trawl survey) and Japan-US cooperative longline surveys.

4.2.1 Effects on sablefish

4.2.1.1 Alternative 1

Sablefish (*Anoplopoma fimbria*) are managed under Tier 3 of NPFMC harvest rules. Reference points are calculated using the mean size of the 1977 – 2019 year classes. The updated point estimate of $B_{40\%}$ is 119,960 t. Since projected female spawning biomass (combined areas) for 2024 is 185,079 t (equivalent to B62%), sablefish is in sub-tier "a" of Tier 3. Spawning biomass is projected to continue to increase rapidly in the near-term (Figure 4-1), reaching B_{70}% in 2025. The updated point estimates of F40% and F35% from this assessment are 0.086 and 0.101, respectively. Thus, the maximum permissible value of FABC under Tier 3a is 0.086, which translates into a 2024 maximum permissible ABC (combined areas) of 47,367 t. The OFL fishing mortality rate of 0.101, translates into a 2024 OFL (combined areas) of 55,385 t. After adjusting for whale depredation, the final OFL for 2024 is 55,084 t and final ABC is 47,146 t. Current model projections indicate that the Alaskan sablefish stock is not subject to overfishing, not overfished, and not approaching an overfished condition.

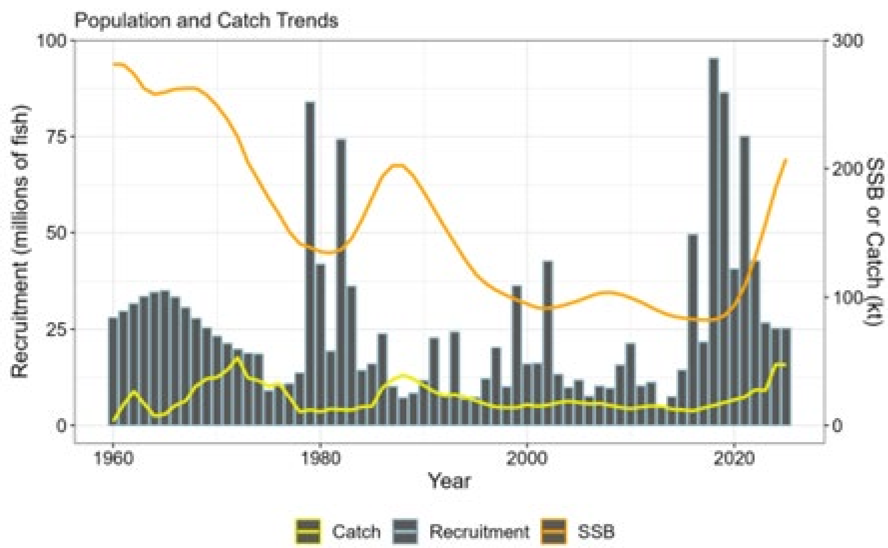
Figure 4-1 Estimated sablefish total biomass (left panel) and spawning biomass (right panel) with 95% MCMC credible intervals (grey fill). Values are in kilotons. The $B_{35\%}$ (black solid line) and $B_{40\%}$ (red dashed line) reference points are shown on the SSB panel.



Source: Goethel et al. 2023

According to the most recent assessment, sablefish productivity remains high and the population continues to grow rapidly (Goethel et al. 2023). However, Goethel et al. (2023) indicates that the lack of sablefish greater than 10 years of age (i.e., the age when sablefish are greater than 90% mature), especially compared to historic levels of older and larger fish, remains concerning for such an extremely long-lived species, and needs to be carefully monitored (see Figures 3.35-3.37 in the 2023 SAFE, Goethel et al. (2023)). The resulting evenness of the age distribution of sablefish has dropped rapidly as has the diversity in the ages contributing to the overall SSB. The 2023 model projects that the 2014 – 2020 year classes will comprise over 75% of total SSB in 2024, despite none of these cohorts being fully mature. If the recent increase in productivity is associated with transient environmental or ecosystem conditions, then it is likely that the sablefish resource and fishery will be reliant on these handful of year classes for a decade or more. For instance, the sudden appearance of numerous large year classes starting in 2014 occurred at historically low SSB levels, which suggests that these recruitment events may be environmentally driven. Because the exact drivers are not known, a transition to more depressed recruitment levels (as has typically happened following periods of high recruitment) may occur at any time (Figure 4-2). However, large year classes (e.g., 2016 and 2017) are helping to expand the age structure and will likely reach fully mature ages at relatively high abundance. As described in Goethel et al. (2023), juvenile sablefish spend their first two to three years on the continental shelf of the GOA and the southeast BS. After their second summer, they begin moving offshore to deeper water, typically reaching their adult habitat, the upper continental slope, at 4 to 5 years of age. This corresponds to the age range when sablefish start becoming reproductively viable (Mason et al. 1983, Rodgveller et al. 2016).

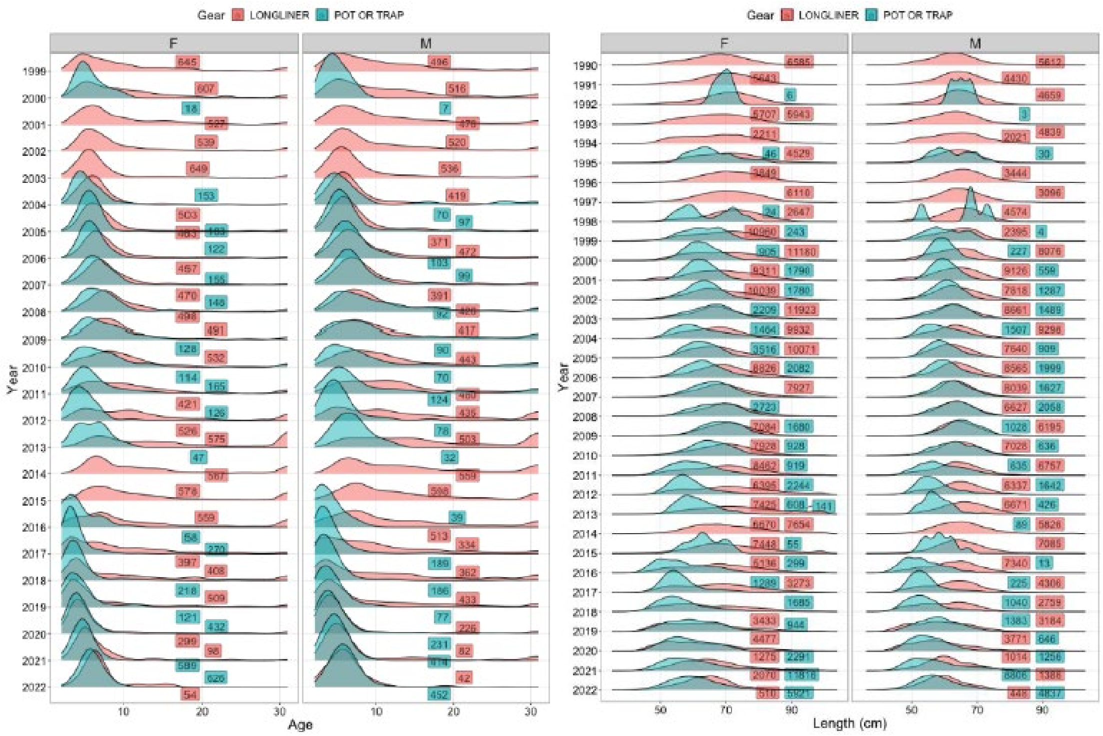
Figure 4-2 Time series of sablefish SSB (orange line), catch (yellow line), and recruitment (grey bars). Projected dynamics for 2024 and 2025 are included based on the maximum permissible ABC and average recruitment. Note the cyclical dynamics associated with spasmodic recruitment. Transitory increases in SSB subsequent to periods of strong recruitment are often followed by a persistent downward time series trend. Catches often rapidly increase following high recruitment periods, while recruitment reverts back towards average levels.



Source: Goethel et al. 2023

Sablefish recruit to the fishery around age 2. Analysis of recent trends in the fixed gear fishery is provided in Appendix 3E of Goethel et al. (2023). For recent years (i.e., post-2017, corresponding to when slinky pots were legalized in the GOA) when adequate sample sizes exist for both H&L and pot gear, size distributions demonstrate strong overlap, with pot gear appearing to select for slightly younger, smaller individuals (Figure 4-3). However, understanding the selectivity of pot gear is complicated by its increasing use occurring concomitantly with rapid changes in the population (i.e., skewed towards smaller and younger fish due to the large recent recruitment events).

Figure 4-3 Comparison of age (left panel) and length (right panel) compositions across years (y-axis), gears (colors), and sexes (panels). Numbers on the panels denote sample sizes for respective gear types.



Source: Goethel et al. 2023

The effects of the Alaska sablefish IFQ fishery on the sablefish stock are assessed annually in the SAFE report (Goethel et al. 2023) and were also evaluated in the Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007a). The sablefish stock is neither overfished nor subject to overfishing, and biomass levels are projected to increase rapidly in the near term (Goethel et al. 2023). It is estimated that the sablefish fishery under the status quo is sustainable for the sablefish stock. Alternative 1 is also included within the simulation analysis (Appendix 5) as the *Full_Retention* simulation scenario. Impacts of Alternative 2 (other simulation scenarios) as compared to the status quo are discussed within Appendix 5.

4.2.1.2 Alternative 2 (option 2)

Alternative 2, Option 2, proposes FMP amendments and regulatory changes to allow vessels participating in the sablefish IFQ/CDQ fisheries to discard small sablefish in the BSAI and GOA.

A dynamic simulation-projection model was used to evaluate potential impacts of discarding <22" sablefish on the stock and ABC projections (Appendix 5). Appendix 5 includes a full description of the method and study design, results, discussion, and conclusion of this analysis. Additionally, a web-based interactive application developed as part of this work to better aid comparisons across model scenarios and to help managers and stakeholders better digest the implications of the results. This application can be found at: https://shinyfin.psmfc.org/small_sablefish/.

An age-based retention function and DMRs of 12%, 20%, and 35% (described in Section 2.2.1) were integrated into the sex- and age-based projection module and associated F40% calculations. A variety of scenarios were then developed assuming full retention or discarding with a 22-inch total length minimum size limit, which was assumed equivalent to discarding only age-2 fish (i.e., by using a knife-edge retention function where no fish of age-2 are retained and all fish age-3 and older are retained). Three

DMRs were implemented based on recommendations provided by the SSC at their February 2024 meeting. Projections using biological and fishery inputs from Goethel et al. (2023) were carried out for 50 years and performance metrics such as SSB and dead discards were calculated and compared across scenarios. Sensitivity runs were also conducted (e.g., alternate recruitment, retention, and future price scenarios).

Results indicated that Alternative 2, Option 2 would have negligible impacts on the stock (e.g., dead discards were minimal and SSB was reduced slightly compared to full retention). These results held for all recruitment scenarios explored. None of the scenarios demonstrated a strong risk of the stock entering an overfished state, and the probability of becoming overfished was independent of discard scenario (i.e., allowing discarding did not increase the probability of becoming overfished compared to full retention). Overall, the limited influence of discarding was due to natural mortality (i.e., resulting in 10% mortality of age-2 fish) being the primary driver of age-2 dynamics. Age-2 total mortality declined by less than 1% (i.e., 12% to 11%) when moving from full retention to age-3 retention with a 12% DMR (i.e., the highest discarding survival scenario).

Under no scenario was the probability of entering an overfished state high, but it did increase under the full ABC utilization sensitivity run. However, the potential for entering an overfished state was generally independent of the discarding scenario, indicating that the NPFMC F40% harvest control rule and assumed future recruitment trajectory were the primary drivers, and it was not related to whether or not discarding was allowed.

The proposed action would also lead to increased uncertainty in the stock assessment as well as resulting catch advice, due to the limited data that will likely be available to inform the discarding process in the models (e.g., limited quantity and precision of data on discard magnitude and associated size or age composition of discarded catch, as described in Sections 2.2.2 and 2.2.3). Appendix 5 describes considerations of additional uncertainty in the assessment.

Under Alternative 2, while fishing effort may increase, the sablefish IFQ/CDQ fisheries would be constrained by existing regulations concerning the location and timing of the fishery, and allocations/ catch limits. The projection model is a simple biological model, which does not analyze the potential economic impacts or integrate dynamic behavior or decision-making. However, it is reasonable to assume that effort is not likely to increase to a level that would jeopardize the continued sustainability of the stock. As such, if actions under Alternative 2 were to result in greater target catch of sablefish, the fishery would still be closed once existing limits were reached, preventing any impact on stocks beyond those that have already been evaluated in the Groundfish PSEIS (NOAA 2004) and the Harvest Specifications Environmental Assessment (NMFS 2007).

Changes in fishing mortality as a result of this action are not likely to change the stock’s ability to sustain itself above MSST. The proposed action under Alternative 2, Option 2 is reasonably expected not to jeopardize the capacity of the stock to yield sustainable biomass on a continuing basis and is unlikely to affect the distribution of harvested stocks either spatially or temporally such that it has an effect on the ability of the stock to sustain itself. Any future concerns in the stock structure as a result of Alternative 2 could be addressed during the scientifically rigorous assessment process. Any potential impacts on prey availability and habitat are not likely to affect the sustainability of the stock. The sablefish stock would not be overfished or experience overfishing because the current harvest specifications process for setting TACs and managing harvests within the limits would continue. Therefore, impacts to the sablefish stock as a result of the action are expected to be not significant.

Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions on Target Species

Beyond the effects of the alternatives that have been discussed there are no reasonably foreseeable actions beyond climate change expected to result in changes to the sablefish stock. For example, in the reasonably foreseeable future, there are no known or expected changes to the timing, area, or authorized gear for sablefish fisheries in Alaska. While no specific RFAs have been identified, this aggregate effects analysis includes the effects of climate change.

As discussed in other sections of this EA, climate change may result in substantial changes to the composition and distribution of fish assemblages in the North Pacific (Cheung and Frölicher 2020; Yati et al. 2020). However, there is a high degree of uncertainty pertaining to the timing of these climate-induced changes, and how sablefish may be impacted as a result. Goethel et al. (2023) discusses the potential for recent increases in sablefish productivity to be associated with transient environmental or ecosystem conditions. These rapid changes in ecosystem conditions could become more frequent with the impacts of climate change. While the effects of marine heat waves and rapidly changing ecosystem variables, have not yet been evaluated carefully for sablefish, the most recent full ecosystem and socioeconomic profile (ESP) for sablefish includes ecological information and key ecosystem processes affecting sablefish survival by life history stage (Shotwell et al. 2019). Larval, juvenile, and adult sablefish are well known to be sensitive to ocean temperature for both optimal growth and reproduction (Sogard and Olla 1998). It is possible that increased recruitment is related to marine heat waves, perhaps due to higher productivity and increased food supply for larval sablefish (or competitive release because of mortality or movement of other predators from the marine heat waves). If marine heat waves become a regular occurrence perhaps this bodes well for future sablefish recruitment.

Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable actions listed above, the aggregate impacts of the proposed action are determined to be not significant.

4.3 Incidental catch: Non-target species

This section focuses on incidental catch in the sablefish IFQ/CDQ fisheries, including non-target groundfish. In this section we make the following distinctions: First, FMP-managed groundfish that may be targeted in other fisheries, but which do not dominate the catch in the sablefish fisheries. These species may, in some cases, be retained up to MRAs. Second, we include non-target species for which there is no significant market and generally no retention. These include species which are not managed under the FMPs, as well as Ecosystem Component species which are included in the groundfish FMPs but for which conservation, management, and stock assessments are not required. Prohibited Species Catch (PSC) are analyzed separately in Section 4.4.

Groundfish species that are managed under the GOA FMP and BSAI FMP and caught incidentally in the sablefish IFQ fishery are listed in Table 4-2. None of these species are either overfished or experiencing overfishing. Catch of rockfish species have decreased in recent years, likely due to the shift to pots from H&L gear. Further information on these groundfish species and, for some, their directed fisheries, can be found in the most recent GOA and BSAI Groundfish SAFE Reports available from: https://www.fisheries.noaa.gov/alaska/population-assessments/north-pacific-groundfish-stock-assessments-and-fishery-evaluation.

Table 4-2 Bycatch (t) of FMP groundfish species/species groups in the fixed gear IFQ/CDQ sablefish fisheries, 2013-2023.

Species / species group	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Average
Shark	2,074	977	778	1,010	1,387	3,046	1,544	1,260	1,776	2,401	2,678	1,721
BSAI Skate and GOA Skate, Other	1,450	1,726	1,096	833	889	1,332	1,133	952	1,283	1,085	657	1,130
Pacific Cod	2,409	1,307	637	422	480	355	562	818	1,012	1,154	1,428	962
GOA Skate, Longnose	1,259	666	714	638	707	569	708	505	1,067	998	1,080	810
GOA Skate, Big	518	424	384	680	672	626	522	462	481	639	847	569
Arrowtooth Flounder	811	662	516	342	458	346	383	363	431	503	398	474
Shortraker Rockfish	319	288	239	315	263	430	386	150	145	79	32	240
Other Rockfish	257	189	105	157	133	169	203	309	132	172	70	172
GOA Thornyhead Rockfish	470	188	205	181	166	222	80	22	13	10	8	142
Rougheye Rockfish	143	138	147	123	129	249	236	57	71	41	13	122
Octopus	121	72	43	21	7	36	45	14	10	50	96	47
BSAI Shortraker Rockfish	102	111	68	35	54	19	8	2	7	9	0	38
BSAI Kamchatka Flounder	71	96	15	23	45	24	11	15	4	21	22	32
GOA Deep Water Flatfish	25	13	19	16	19	16	12	15	21	38	16	19
Greenland Turbot	58	40	25	22	10	18	3	1	2	10	19	19
GOA Demersal Shelf Rockfish	15	19	8	6	5	10	26	9	14	18	18	14
Pollock	16	18	7	3	4	3	9	2	36	5	14	11
GOA Shallow Water Flatfish	13	4	7	7	13	7	7	12	13	16	9	10
GOA Dusky Rockfish	14	9	7	11	8	14	4	3	1	5	1	7
BSAI Other Flatfish	22	15	2	1	6	0	1	0	1	1	1	5
Pacific Ocean Perch	2	1	1	9	1	0	1	0	0	1	0	2
Flathead Sole	4	1	1	1	1	3	2	1	1	2	0	1
Northern Rockfish	7	1	1	2	1	1	1	0	0	0	0	1
Atka Mackerel	1	1	1	0	0	0	0	0	0	1	0	0
Rock Sole	1	0		0	0	0	0	1	0	1	1	0
Yellowfin Sole		1					0	0	0		1	0
GOA Rex Sole	0		0	0	0		0	0	0	0	0	0

Source: NMFS AKRO Blend/Catch Accounting System via AKFIN, April 30, 2024.

Non-target species caught incidentally in the sablefish IFQ fishery are listed in Table 4-3. Giant grenadier, a nontarget species that is an ecosystem component in both the GOA FMP and BSAI FMP, make up nearly all of the nontarget species bycatch. The highest bycatch of grenadiers in recent years was 15,309 t in 2013 but has remained below 10,117 t since then. Starting in 2017, bycatch of grenadiers declined and in 2023 it was 693 t. As an ecosystem component species, no ABC or OFL catch limits are adopted in the annual groundfish harvest specifications. However, every four years, reports by AFSC present tracking trends in abundance and catch and provides unofficial OFL and ABC values for grenadier based on Tier 5 calculations. Because overfishing is not defined for an Ecosystem Component, these values are not used for management or for determining if overfishing is occurring. According to the most recent report, the unofficial maximum allowable ABC for 2021 is 61,738 mt in the BSAI and 21,623 mt in the GOA (Rodgveller and Siwicke 2020). Catches are not approaching unofficial OFLs.

Other nontarget taxa that typically have catches over five tons per year in the fixed gear fisheries are sculpin, miscellaneous fishes, sea stars, snails, corals (bryozoans), and sea anemones (Table 4-3).

Table 4-3 Bycatch (t) of non-target species in the fixed gear IFQ/CDQ sablefish fisheries, 2013-2023.

Group name	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Avg.
Giant Grenadier	15,309.1	6,860.3	6,840.0	10,116.2	6,161.0	4,244.9	3,072.7	1,700.2	714.5	478.5	693.2	5,108.2
Rattail Grenadier Unidentified	2,205.2	1,515.4	1,245.7	585.9	1,026.4	1,232.5	1,287.3	528.4	195.1	140.2	74.4	912.4
Sculpin	1,161.5	231.6	309.3	296.6	242.4	439.1	380.1	292.0	718.4	898.5	878.7	531.7
Misc fish	360.3	355.7	326.7	276.1	267.2	328.4	394.7	194.4	328.9	483.5	419.0	339.5
Sea star	473.6	256.1	735.8	340.4	160.7	201.1	151.7	81.0	77.5	106.2	167.6	250.2
Snails	9.3	12.1	9.2	4.7	3.7	5.4	10.7	4.7	5.7	8.9	29.6	9.5
Corals Bryozoans	14.6	7.9	16.6	12.0	3.7	12.0	7.0	4.0	7.8	7.3	2.8	8.7
Sea anemone unidentified	3.6	6.2	15.3	3.6	3.5	14.3	3.5	1.7	4.0	3.0	2.6	5.6
Misc crabs	6.7	6.6	3.4	3.2	5.9	4.2	2.7	4.4	4.1	1.9	6.6	4.5
Sponge unidentified	4.7	2.2	3.2	3.4	5.7	1.3	1.2	3.3	1.7	1.2	1.2	2.6
urchins dollars cucumbers	0.9	4.4	2.0	1.2	0.7	3.6	1.5	1.4	1.0	0.6	1.8	1.7
Sea pens whips	0.5	4.5	3.7	1.7	1.8	0.6	1.2	1.4	0.4	0.2	0.1	1.5
Invertebrate unidentified	4.5	0.5	0.3	0.5	1.4	2.0	1.0	0.4	0.4	0.2	0.4	1.1
Brittle star unidentified	0.4	0.6	2.1	2.6	0.6	0.6	0.4	0.3	0.4	2.8	0.6	1.0
Benthic urochordata	0.1	0.1	3.0	0.3	0.3	0.6	0.4	1.9	0.2	0.0	0.0	0.6
Greenlings	0.6	0.2	0.1	0.6	0.1	0.9	0.2	1.4	0.2	0.7	0.1	0.5
Bivalves	0.2	0.7	0.1	0.9	0.4	0.3	0.0	0.5	0.1	0.8	0.7	0.4
Scypho jellies	0.0	0.3	0.4	0.2	0.0	0.2	0.7	0.9	0.4	0.5	0.3	0.4
Eelpouts	1.1	0.6	0.2	0.0	1.4	0.3	0.0	0.1	0.1	0.2	0.0	0.4
Squid	0.0	0.0	0.1		0.0	0.0	0.7		0.1	0.0	0.1	0.1

Source: NMFS AKRO Blend/Catch Accounting System via AKFIN, April 30, 2024.

4.3.1 Effects on non-target species

Alternative 1

The effects of the sablefish IFQ/CDQ fisheries on fish that are caught incidentally have been comprehensively analyzed in the annual BSAI and GOA SAFE reports (NPFMC 2023f) and was also evaluated in the Groundfish PSEIS (NMFS 2004; NMFS 2015), and Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007). These analyses concluded that under the status quo, neither the level of mortality nor the spatial and temporal impacts of fishing on fish species or prey availability are likely to jeopardize the sustainability of the target and ecosystem component fish populations. As a result, impacts on incidental catch under Alternative 1 are determined not to be significant.

Alternative 2

Alternative 2, Option 2, proposes an FMP amendment and regulatory change to allow vessels participating in the sablefish IFQ/CDQ fisheries to discard small sablefish in the BSAI and GOA. This could result in an increase in fishing effort, such as length of fishing trips or amount of gear deployed, since vessels that choose to discard will need to increase effort to achieve the same amount of quota.

While it is not possible to project how fishing effort may change from year to year under Alternative 2, we apply the estimated fishing effort from the methods described in Section 4.1 to the recent catch of the top ten non-target species that interact with each gear type (H&L or pot) in the BSAI or GOA (Table 4-4. Data are shown by FMP area because many of these species are managed at the FMP level, though some, such as rockfish and Pacific cod, have subarea TACs. The percent increase in effort in this case is a weighted average based on the discard rates for each subarea. This provides a reasonable but likely overestimate of expected incidental catch under Alternative 2.

Table 4-4 Top 10 non-target (and non-PSC) species caught in IFQ/CDQ sablefish fisheries from 2021-2023, with the estimated annual increase of bycatch based on area and gear type. Data from NMFS Alaska Region Catch Accounting System and ADFG Fish Tickets, compiled by AKFIN.

BSAI Pots	**3-year Avg (t)**	**114% effort**	**Tons Increase**
Giant Grenadier	52.01	59.29	7.28
Arrowtooth Flounder	44.16	50.35	6.18
BSAI Kamchatka Flounder	13.15	14.99	1.84
Greenland Turbot	8.07	9.20	1.13
Pacific Cod	2.61	2.98	0.37
Snails	2.38	2.72	0.33
Misc crabs	2.02	2.30	0.28
Shark	0.97	1.11	0.14
Other Rockfish	0.93	1.05	0.13
Rougheye Rockfish	0.61	0.70	0.09

BSAI Hook and Line	**3-year Avg (t)**	**105% effort**	**Tons Increase**
Giant Grenadier	79.62	83.60	*3.98*
BSAI Skate and GOA Skate, Other	5.31	5.57	*0.27*
Sculpin	0.39	0.41	*0.02*
Arrowtooth Flounder	0.34	0.36	*0.02*
Rougheye Rockfish	0.28	0.30	*0.01*
BSAI Other Flatfish	0.20	0.21	*0.01*
Sea anemone unidentified	0.18	0.19	*0.01*
BSAI Kamchatka Flounder	0.13	0.14	*0.01*
Pacific Cod	0.12	0.12	*0.01*
Corals Bryozoans	0.11	0.12	*0.01*

GOA Pots	3-year Avg	107% effort	Tons Increase
Arrowtooth Flounder	215.55	230.63	15.09
Giant Grenadier	55.54	59.43	3.89
Grenadier - Rattail Grenadier Unidentified	18.19	19.47	1.27
GOA Deep Water Flatfish	11.01	11.78	0.77
Shark	10.47	11.21	0.73
Snails	7.53	8.06	0.53
Rougheye Rockfish	4.63	4.96	0.32
GOA Shallow Water Flatfish	3.99	4.27	0.28
Pacific Cod	3.80	4.06	0.27
Sea star	2.60	2.78	0.18

GOA Hook and Line	3-year Avg	103% effort	Tons Increase
Shark	452.60	466.18	13.58
Giant Grenadier	430.03	442.93	12.90
GOA Skate, Longnose	160.48	165.29	4.81
Grenadier - Rattail Grenadier Unidentified	104.37	107.50	3.13
BSAI Skate and GOA Skate, Other	68.64	70.70	2.06
Shortraker Rockfish	50.40	51.91	1.51
Misc fish	44.07	45.39	1.32
GOA Skate, Big	29.74	30.64	0.89
Arrowtooth Flounder	29.69	30.58	0.89
Rougheye Rockfish	28.49	29.34	0.85

While fishing effort could increase as a result of this action, the sablefish IFQ/CDQ fisheries are still constrained by spatial and total catch limits. If actions under Alternative 2 were to result in greater incidental catch of groundfish, the fishery would still be closed once existing limits were reached, preventing any impact on groundfish stocks beyond those that have already been evaluated in the Groundfish PSEIS (NOAA 2004) and the Harvest Specifications Environmental Assessment (NMFS 2007). Therefore, impacts to non-target species as a result of the action are expected to be not significant.

Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions on Non-target Species

Beyond the effects of the alternatives that have been discussed, the federal sablefish fishery is expected to continue changing in terms of the gear used to target sablefish, as boats have switched from H&L gear to pot gear. This change could result in associated changes in composition of non-target catch, as identified in previous Council documents (NPFMC 2021b) and NMFS inseason management reports.[11] We have not identified any other reasonably foreseeable actions beyond climate change expected to result in changes to non-target species. Climate change, as discussed in other sections of this EA, may result in substantial changes to the composition and distribution of fish assemblages in the North Pacific (Cheung and Frölicher 2020; Yati et al. 2020). However, there is a high degree of uncertainty pertaining to the timing

[11] https://www.fisheries.noaa.gov/resource/document/alaska-inseason-management-annual-reports-north-pacific-fishery-management

of these climate-induced changes, the future composition of fish species in Alaska, and how non-target species in the sablefish IFQ/CDQ fisheries may be impacted as a result. Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable actions listed above, the aggregate impacts of the proposed action are determined to be not significant.

4.4 Prohibited Species

Certain species are designated as “prohibited species” in the FMPs because they are the target of other, fully utilized domestic fisheries. Prohibited species catch (PSC) include Pacific halibut, Pacific herring, Pacific salmon, steelhead trout, king crab, and Tanner crab, and must be immediately returned to the sea if caught in the sablefish fisheries (unless there is halibut IFQ on board the vessel, in which case legal halibut must be retained). The sablefish fisheries are not subject to PSC limits. Only golden king crab and halibut are analyzed here because the sablefish fisheries do not experience significant catch of other PSC.

Golden King Crab

The predominant PSC in sablefish IFQ/CDQ fisheries is golden king crab (GKC). Golden king crab are caught in the waters surrounding the Aleutian Islands. Significant populations occur in pockets off the Pribilof and Shumagin Islands, Shelikof Strait, Prince William Sound and at least as far south as lower Chatham Strait in Southeast Alaska, where an annual commercial fishery exists. GKC occur in deeper water than the red king crab, often in depths exceeding 300 fathoms (1,800 ft; 550 m). Throughout their Alaskan range, golden king crab are one of the most abundant species of crab.

Table 4-5 shows estimates of GKC PSC in the sablefish IFQ/CDQ fisheries by year, gear type, and subarea. Crab catches in the sablefish IFQ/CDQ fisheries are highly variable from year to year, probably as a result of relatively low observer sampling effort in sablefish fisheries and the low number of crabs caught each year (see anomalous high catches of golden king crab in 2015 and 2018). The majority of GKC are caught in pot gear in the BSAI. On average, these fisheries have caught 8,675 crabs/year in the BSAI and 319 crabs/year in the GOA.

Table 4-5 Golden King Crab PSC estimates (in numbers of crab) by year and subarea for the sablefish fishery, 2013-2023. Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

	AI	BS	CG	SE	WG	WY	Total
H&L							
2013	563	14	74	2	13	4	671
2014	557	28	43	2	17	1	648
2015	132	24	40	2	5	3	205
2016	42	0	31	3	9	2	86
2017	0	0	60	1	7	3	72
2018	0	0	51	9	32	4	96
2019	8	0	66	1	10	1	87
2020	0	0	41	0	2	3	47
2021	2	0	0	5	12	0	19
2022	0	2	14	8	4	5	33
2023	0	0	0	0	5	0	6
Annual avg	**119**	**6**	**38**	**3**	**11**	**2**	**179**
POT							
	AI	**BS**	**CG**	**SE**	**WG**	**WY**	**Total**
2013	261	485					745
2014	1,979	1,082					3,061
2015	16,104	12,905					29,009
2016	6,811	4,827					11,638
2017	5,647	466	0	0	0	0	6,113
2018	5,693	16,654	0	0	0	0	22,347
2019	3,786	192	50	4	6	36	4,073
2020	1,750	370	20	2	12	5	2,159
2021	4,309	423	57	0	5	1	4,796
2022	1,169	7,699	54	0	90	44	9,056
2023	1,368	74	52	4	1,402	11	2,912
Annual avg	**4,443**	**4,107**	**33**	**2**	**217**	**14**	**8,719**
Annual avg, both gears	**4,562**	**4,113**	**59**	**4**	**1,632**	**123**	**8,898**

Crab PSC data are not stock specific, but the BSAI King and Tanner Crab FMP includes two stocks of GKC; Aleutian Islands (AIGKC) and Pribilof Islands (PIGKC). AIGKC are assessed annually in the Aleutian Islands Golden King Crab Stock Assessment. Total mortality of AIGKC has ranged from 2,506 t in 2005/06 to 3,729 t in 2022/23 (Siddeek et al. 2023). This stock has not been declared overfished.

PIGKC are assessed every three years in the Pribilof Islands Golden King Crab Stock Assessment which describe recent stock trends, sources of mortality, life history, and management performance. Total mortality of PIBKC for 2020 and 2021 were 52.3 t and 21.6 t, respectively. Prior to 2020, participation in the directed PIBKC fishery has been sporadic, with zero vessels participating in the fishery in several years, and a couple of years (2003 and 2004) the directed fishery was closed. Therefore, consistent estimates of total PIBKC mortality are not presented here due to confidentiality requirements and lack of a consistent time series. As a data-poor stock, no overfished determination (i.e., MSST) has been made for PIGKC. According to the most recent assessment, overfishing did not occur in 2020, 2021, or 2022 (Jackson and Daly 2023).

Pacific Halibut

Table 4-6 shows estimates of halibut PSC in the sablefish IFQ/CDQ fisheries by year, gear type, and subarea. Estimates of Pacific halibut in Table 4-6 are only for halibut PSC caught on sablefish IFQ sets (defined as those sets where sablefish had the greatest weight), with no halibut IFQ on board. Estimated halibut PSC mortality in H&L gear has decreased from 101.28 t in 2020 to a low of 3.84 t in 2023, while a mortality in pot gear has seen an increase (1.03 t in 2020 to a high of 24.86 in 2022) (Table 4-6).

Table 4-6 Halibut PSC estimates (tons of mortality) by year and subarea for the sablefish fishery, 2013-2023. Source: NMFS Alaska Region Catch Accounting System, data compiled by AKFIN in Comprehensive_PSC.

	H&L						
	AI	**BS**	**CG**	**SE**	**WG**	**WY**	**Total**
2013	4.01	0.15	14.45	5.88	4.41	0.62	29.52
2014	1.53	0.16	9.47	4.92	8.65	1.57	26.29
2015	0.68	0.12	18.66	2.09	4.83	0.74	27.11
2016	0.41	0.03	10.23	6.76	3.99	4.27	25.70
2017	0.03	0.06	20.99	6.41	4.95	3.32	35.74
2018	0.09	0.26	32.96	21.35	4.52	8.85	68.02
2019	0.03	0.07	54.42	27.66	16.26	2.84	101.28
2020	0	0.26	5.47	8.36	1.00	2.88	17.97
2021	0.46	0.02	2.90	11.88	0.98	0.67	16.92
2022	0	0.01	1.81	14.65	0.34	0.16	16.97
2023	0	0.02	0.85	1.89	0.96	0.12	3.84
Annual avg	**0.90**	**0.10**	**15.65**	**10.17**	**4.63**	**2.37**	**33.58**
	POT						
	AI	**BS**	**CG**	**SE**	**WG**	**WY**	**Total**
2013	0.22	0.99					1.22
2014	0.21	0.19					0.40
2015	0.01	0.06					0.07
2016	0.04	0.05					0.10
2017	0.10	0.19	0.19	0.02	0.29	0.02	0.80
2018	0.18	0.30	0.17	0.05	0.18	0.00	0.90
2019	0.35	0.58	0.16	0.01	0.05	0.00	1.16
2020	0.68	0.35	0.00	0.00	0.00	0.00	1.03
2021	0.18	1.62	3.92	2.20	0.70	0.50	9.12
2022	0.26	2.07	17.20	3.84	0.93	0.56	24.86
2023	0.12	0.64	4.41	2.67	1.85	0.70	10.40
Annual avg	**0.21**	**0.64**	**3.72**	**1.26**	**0.57**	**0.26**	**4.55**
Annual avg, both gears	**0.87**	**0.74**	**18.02**	**10.97**	**4.99**	**2.53**	**38.13**

Pacific halibut is a flatfish which inhabits the continental shelf of the United States and Canada, ranging from California to the Bering Sea, and extends into Russia and Japan (IPHC 1998). The depth range for halibut is up to 250 fathoms (457 m) for most of the year and up to 500 fathoms (914 m) during the winter spawning months. Halibut also move seasonally between shallow waters and deep waters. Mature fish move to deeper offshore areas in the fall to spawn and return to nearshore feeding areas in early summer. Halibut feed on plankton during their first year of life. Young halibut (1 to 3 years old) feed on euphausiids (small shrimp-like crustaceans) and small fish. As halibut grow, fish make up a larger part of their diet. Larger halibut eat other fish, such as herring, sand lance, capelin, smelt, pollock, sablefish, cod, and rockfish. They also consume octopus, crabs, and clams.

Pacific halibut fisheries are regulated by the IPHC (in compliance with the terms of the Northern Pacific Halibut Act between the United States and Canada) and the Council. The range of Pacific halibut that the IPHC manages covers the continental shelf from northern California to the Aleutian Islands and throughout the Bering Sea. In practice, the IPHC establishes total annual catch limits and other conservation measures by regulatory area, and the Council develops regulations to govern the fishery including limited access and allocation decisions. The Pacific halibut IFQ fishery in Alaska (together with the sablefish IFQ fishery) has been managed under an IFQ Program since 1995.

The IPHC conducts an annual stock assessment using data from the Fishery-Independent Setline Survey (FISS), the commercial Pacific halibut and other fisheries, as well biological information from its research program. Data sources are updated each year to reflect the most recent scientific information available for use in management decision making. The IPHC's interim management procedure uses a relative spawning biomass (SB) of 30% as a fishery trigger, reducing the reference fishing intensity if relative spawning biomass decreases further toward a limit reference point at 20%, where directed fishing is halted due to the critically low biomass condition. According to the most recent assessment, the relative spawning biomass at the beginning of 2024 was estimated to be 42% (credible interval: 20-56%), slightly higher than the estimate for 2023 (41%). The probability that the stock is below SB30% is estimated to be 26% at the beginning of 2023, with a 1% chance that the stock is below SB20% (Stewart and Hicks, 2024).

4.4.1 Effects on PSC

Alternative 1

Prohibited species catch limits for halibut were analyzed in the EA/RIR for Amendment 111 BSAI FMP (81 FR 24714, April 27, 2016) and Amendment 85 GOA FMP (79 FR 9625, February 20, 2014). Further, annual halibut and crab PSC limits are evaluated annually through the Council's harvest specifications process. These analyses concluded that the status quo fishery does not have a significant impact on these species. Further, the annual assessments for these stocks both conclude that these species are at sustainable population levels and are unlikely to be subject to overfishing under the current, risk-averse management program. As a result, impacts on these species under Alternative 1 are not significant.

Alternative 2

Alternative 2 proposes an FMP amendment and regulatory change to allow vessels participating in the sablefish IFQ/CDQ fisheries to discard small sablefish in the BSAI and GOA. This could result in an increase in fishing effort, such as length of fishing trips or amount of gear deployed, since vessels that choose to discard will need to increase effort to achieve the same amount of quota.

Table 5-17 in Section 5.4.1 provides an approach for estimating changes to fishing effort under Alternative 2, Option 2. While it is not possible to project how fishing effort may change from year to year under Alternative 2, we apply the estimated fishing effort from the methods described in Sections 4.1 and 5.4.1 to the recent catch of GKC and halibut in each subarea. These levels of effort are then applied to the 3-year average of GKC PSC (# of crab) and halibut mortality (t) from 2021-2023. The results of this exercise are shown in Table 4-7 and Table 4-8. This provides a reasonable but likely high prediction of expected interactions with GKC and halibut PSC under Alternative 2. This prediction is likely high because of the assumption that all sablefish under 22” would be discarded.

Table 4-7 Predicted change in GKC PSC (number of crab) based on estimated change in effort.

	3-year avg GKC PSC (2021-2023)	Estimated effort associated with harvesting all sablefish IFQ 2+ (1/retention rate) (from Table 5-17)	#GKC PSC with predicted effort applied	Increased PSC (change in #crab)
	H&L			
AI	0.84	106%	0.89	0.05
BS	0.80	102%	0.81	0.02
CG	4.72	106%	5.01	0.28
SE	4.41	102%	4.50	0.09
WG	6.98	105%	7.33	0.35
WY	1.66	102%	1.69	0.03
Alaska-wide H&L	19.41		20.23	0.82
	POT			
AI	2,282	132%	3,012	730
BS	2,732	113%	3,087	355
CG	54	109%	59	5
SE	2	103%	2	0
WG	499	107%	534	35
WY	19	105%	20	1
Alaska-wide POT	5,588		6,714	1,126
AK total (both gears)	5,607		**6,735**	1,127

Table 4-8 Predicted change in halibut PSC (mortality in tons) based on estimated change in effort

	3-year avg halibut mortality in tons (2021-2023)	Estimated effort associated with harvesting all sablefish IFQ 2+ (1/retention rate) (from Table 5-17)	Halibut mortality (t) with predicted effort applied	Increased halibut PSC (t) (sum of change in mortality)
	H&L			
AI	0.15	106%	0.16	0.01
BS	0.02	102%	0.02	0.00
CG	1.85	106%	1.96	0.11
SE	9.48	102%	9.67	0.19
WG	0.76	105%	0.80	0.04
WY	0.32	102%	0.32	0.01
Alaska-wide H&L	12.58		12.93	0.35
	POT			
AI	0.19	132%	0.25	0.06
BS	1.44	113%	1.63	0.19
CG	8.51	109%	9.27	0.77
SE	2.91	103%	2.99	0.09
WG	1.16	107%	1.24	0.08
WY	0.59	105%	0.62	0.03
Alaska-wide POT	14.79		16.00	1.21
AK total (both gears)	27.37		**28.93**	1.57

While there are no PSC limits in the sablefish IFQ/CDQ fisheries, even if the increase in fishing effort as a result of Alternative 2 were to result in increases in catch of GKC and halibut PSC as shown above, the PSC estimates under Alternative 2 (6,735 GKC and 29 t of halibut mortality) are below the corresponding average over the past ten years (8,898 GKC and 38 t). In general, the potential changes in sablefish discarding as a result of the alternatives are not expected to significantly impact PSC because changes in effort as a result of this action are expected to result in minimal changes in PSC, and existing spatial and total catch limits would continue under the action alternative.

Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions on Prohibited Species

Beyond the effects of the alternatives that have been discussed, the federal sablefish fishery is expected to continue changing in terms of the gear used to target sablefish, as boats have switched from H&L gear to pot gear. This change could result in associated changes in composition of prohibited species catch, as identified in previous Council documents (NPFMC 2021b) and NMFS inseason management reports.12 We have not identified any other reasonably foreseeable actions beyond climate change expected to result in changes to prohibited species. Climatological shifts are linked to changes in the distribution and abundance of fish and crab stocks. However, there is a high degree of uncertainty pertaining to the timing of these climate-induced changes, the future composition of marine species in Alaska, and how PSC species in the sablefish IFQ/CDQ fisheries may be impacted as a result. Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously

[12] https://www.fisheries.noaa.gov/resource/document/alaska-inseason-management-annual-reports-north-pacific-fishery-management

analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable actions listed above, the aggregate impacts of the proposed action are determined to be not significant.

4.5 Marine Mammals

This section evaluates the potentially affected environment and the degree of the effects of the alternatives on marine mammals together with relevant past, present, and reasonably foreseeable actions (40 C.F.R. 1501.3(b)). The Alaska Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement (PSEIS) (NMFS 2004) provides descriptions of the range, habitat, and diet for marine mammals found in waters off Alaska. The 2015 PSEIS Supplemental Information Report (NMFS 2015) provides updates on changes to marine mammal stock or species-related management and status, as well as new information regarding impacts on marine mammal stocks and updated methods to assess impacts. The information from the PSEIS and the SARs is incorporated by reference. Additionally, the Alaska Groundfish Harvest Specifications EIS provides information on the effects of the groundfish fisheries on marine mammals (NMFS 2007), and has been updated with SIRs (NMFS 2024). These documents are also incorporated by reference.

Marine mammal stocks, including those currently listed as endangered or threatened under the ESA or depleted or strategic under the MMPA that may be present in the action area can be found in Table 4-9 and Table 4-10. ESA section 7 formal and informal consultations with respect to the actions of the Federal groundfish fisheries have been completed for all of the ESA-listed species, either individually or in groups (NMFS 2010 and NMFS 2014).

Not all species listed in Table 4-9 and Table 4-10 are likely to be affected by this action, and any potential impacts that do occur are expected to be minimal due to the anticipated magnitude of increased effort in the sablefish fishery because of this action. Many of these species are not known to directly interact with H&L or pot gear or to rely on sablefish as their primary prey. Additionally, the effects of this action expected on certain marine mammal species from Table 4-9 and Table 4-10 have been considered in previous NEPA analyses, which are incorporated by reference (e.g., NMFS 2007).

This discussion focuses on those marine mammals that may interact with or be affected by the sablefish IFQ/CDQ fisheries in the GOA and BSAI. The MMPA requires NOAA Fisheries to publish an annual list of commercial fisheries and classify each fishery based on whether it has frequent (Category I), occasional (Category II), or remote likelihood (Category III) of incidental mortality and serious injury (M/SI) of marine mammals. The annual List of Fisheries (LOF) reflects new information on interactions between commercial fisheries and marine mammals.[13] According to the 2024 LOF (89 FR 12257, February 16, 2024), the sablefish IFQ fishery has a history of interaction with the following marine mammal species: Steller sea lions and sperm whales. Due to the potential range overlap and entanglement record in other H&L and pot fisheries in Alaska, humpback whales will also be analyzed, as will killer whales due to their increased risk of entanglement from engagement in depredation events with the fishery.

[13] 89 FR 12257; February 16, 2024, https://www.fisheries.noaa.gov/national/marine-mammal-protection/list-fisheries-summary-tables#table-1---commercial-fisheries-in-the-pacific-ocean

Table 4-9. Marine mammals that are known to occur in the Gulf of Alaska

Infraorder or Superfamily	Species	MMPA Stock	ESA or MMPA Status	ZMRG Status (all fisheries)
Pinnipedia	Steller sea lion *(Eumatopias jubatus)*	Western	Endangered, Depleted, Strategic	Not Met
		Eastern U.S.	None	Met
	Northern fur seal *(Callorhinus ursinus)*	Eastern Pacific	Depleted, Strategic	Met
	Harbor seal *(Phoca vitulina)*	Northern Kodiak	None	Met
		Southern Kodiak	None	Met
		Prince William Sound	None	Met
		Cook Inlet/Shelikof Strait	None	Met
		Glacier Bay/Icy Strait	None	Met
		Lynn Canal/Stephens Passage	None	Met
		Sitka/Chatham Strait	None	Met
		Dixon/Cape Decision	None	Met
		Clarence Strait	None	Met
	Ribbon seal *(Phoca fasciata)*	Alaska	None	Met
	Northern elephant seal *(Mirounga angustirostris)*	California, breeding	None	Met
Cetacea	Beluga whale (*Delphinapterus leucas*)	Cook Inlet (includes Yakutat Bay animals)	Endangered, Depleted, Strategic	Unknown***
	Killer whale *(Orcinus orca)*	Eastern North Pacific Northern Resident	None	Met
		Eastern North Pacific Alaska Resident	None	Met
		Eastern North Pacific GOA, Aleutian Islands, and Bering Sea Transient	None	Not Met
		AT1 Transient	Depleted, Strategic	Met
		West Coast Transient	None	Met
		Eastern North Pacific Offshore	None	Met
	Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)	North Pacific	None	Unknown*
	Harbor porpoise *(Phocoena phocoena)*	Southeast Alaska: Northern SE Alaska Inland Waters, Southern Alaska Inland Waters, Yakutat/SE Alaska Offshore Waters	None	Not Met or Unknown*
		Gulf of Alaska	None	Unknown*
	Dall's porpoise (*Phocoenoides dalli*)	Alaska	None	Unknown*
	Sperm whale (*Physeter macrocephalus*)	North Pacific	Endangered, Depleted, Strategic	Unknown*
	Baird's beaked whale (*Berardius bairdii*)	Alaska	None	Unknown*
	Cuvier's beaked whale (*Ziphius cavirostris)*	Alaska	None	Unknown*
	Stejneger's beaked whale (*Mesoplodon stejnegeri*)	Alaska	None	Unknown*
	Gray whale *(Eschrichtius robustus)*	Eastern North Pacific***	None	Met
	Humpback whale *(Megaptera novaeangliae)*	Western North Pacific DPS	Endangered, Depleted, Strategic	Not Met
		Hawaii	None	Met
		Mexico-North Pacific	Threatened, Depleted, Strategic	Not Met
	Fin whale *(Balaenoptera physalus*)	Northeast Pacific	Endangered, Depleted, Strategic	Met
	Minke whale *(Balaenoptera acutorostrata)*	Alaska	None	Unknown*
	North Pacific right whale *(Eubalaena japonica)*	Eastern North Pacific	Endangered, Depleted, Strategic	Unknown*
	Blue whale *(Balaenoptera musculus)*	Eastern North Pacific***	Endangered, Depleted, Strategic	Met
	Sei whale *(Balaenoptera borealis)*	Eastern North Pacific***	Endangered, Depleted, Strategic	Met
Mustelidae	Northern sea otter *(Enhydra lutris)*	Southeast Alaska	None	Unknown*
		Southcentral Alaska	None	Unknown*

Sources: Young et al 2023; Carretta et al. 2023; List of Fisheries for 2023 (March 21, 2023, 88 FR 16899).
*Unknown due to unknown abundance estimate and PBR.
**Unknown due to inadequate observer coverage,
***Unknown due to lack of data on cause of death

Table 4-10. Marine mammals known to occur in the Bering Sea and Aleutian Islands.

Infraorder or Superfamily	Species	MMPA Stock	ESA or MMPA Status	ZMRG Status (all fisheries)
Pinnipedia	Steller sea lion *(Eumatopias jubatus)*	Western U.S	Endangered, Depleted, Strategic	Not Met
	Northern fur seal *(Callorhinus ursinus)*	Eastern Pacific	Depleted, Strategic	Met
	Harbor seal *(Phoca vitulina)*	Pribilof Islands	None	Met
		Bristol Bay	None	Met
	Ribbon seal *(Phoca fasciata)*	Alaska	None	Met
	Bearded seal *(Erignathus barbatus nauticus)*	Beringia	Threatened, Depleted, Strategic	Met
	Spotted seal *(Phoca largha)*	Alaska	None	Met
	Ringed seal *(Phoca hispida)*	Arctic	Threatened, Depleted, Strategic	Met
	Northern elephant seal *(Mirounga angustirostris)*	California, breeding	None	Met
	Pacific Walrus *(Odobenus rosmarus divergens)*	Alaska	None	Met
Cetacea	Killer whale *(Orcinus orca)*	Eastern North Pacific Alaska Resident	None	Met
		Eastern North Pacific GOA, Aleutian Islands, and Bering Sea transient	None	Not Met
		Offshore	None	Met
	Pacific White-sided dolphin (*Lagenorhynchus obliquidens*)	North Pacific	None	Unknown*
	Harbor porpoise *(Phocoena phoecena)*	Bering Sea	None	Unknown*
	Dall's porpoise (*Phocoenoides dalli*)	Alaska	None	Unknown*
	Beluga whale *(Delphinapterus leucas)*	Beaufort Sea	None	Met
		Eastern Chukchi Sea	None	Met
		Eastern Bering Sea	None	Met
		Bristol Bay	None	Met
	Baird's beaked whale (*Berardius bairdii*)	Alaska	None	Unknown*
	Cuvier's beaked whale (*Ziphius cavirostris)*	Alaska	None	Unknown*
	Stejneger's beaked whale (*Mesoplodon stejnegeri*)	Alaska	None	Unknown*
	Sperm whale (*Physeter macrocephalus*)	North Pacific	Endangered, Depleted, Strategic	Unknown*
	Bowhead whale *(Balaena mysticetus)*	Western Arctic	Endangered, Depleted, Strategic	Met
	Gray whale *(Eschrichtius robustus)* ***	Eastern North Pacific***	None	Met
	Humpback whale *(Megaptera novaeangliae)*	Western North Pacific	Endangered, Depleted, Strategic	Not Met
		Hawaii	None	Met
		Mexico-North Pacific	Threatened, Depleted, Strategic	Unknown*
	Fin whale *(Balaenoptera physalus)*	Northeast Pacific	Endangered, Depleted, Strategic	Met
	Minke whale *(Balaenoptera acutorostrata)*	Alaska	None	Unknown*
	North Pacific right whale *(Eubalaena japonica)*	Eastern North Pacific	Endangered, Depleted, Strategic	Unknown*
	Sei whale *(Balaenoptera borealis)*	Eastern North Pacific***	Endangered, Depleted, Strategic	Met
	Blue whale *(Balaenoptera musculus)*	Eastern North Pacific***	Endangered, Depleted, Strategic	Met
Mustelidae	Northern sea otter *(Enhydra lutris)*	Southwest Alaska	Threatened, Depleted, Strategic	Unknown**
Ursoidea	Polar Bear *(Ursus maritimus)*	Chukchi/Bering Sea	Threatened, Depleted, Strategic	Unknown*

Sources: Young et al 2023; Carretta et al. 2023; List of Fisheries for 2023 (March 21, 2023, 88 FR 16899).
*Unknown due to unknown abundance estimate and PBR.
**Unknown due to inadequate observer coverage,
***Unknown due to lack of data on cause of death

The MMPA also established a requirement for commercial fishing operations to reduce incidental mortalities and serious injuries (M/SI) of marine mammals to insignificant levels approaching a zero rate, commonly referred to as the Zero Mortality Rate Goal (ZMRG). The insignificance threshold was established as 10 percent of the Potential Biological Removal (PBR) of a stock of marine mammals.[14] Therefore, ZMRG is considered to be met for a marine mammal stock when the M/SI level from all commercial fisheries is at or below 10% PBR of that marine mammal stock (69 FR 43338, July 20, 2004). The reported mortalities and significant injuries (M/SI) between the sablefish IFQ/CDQ fishery

[14] The Potential Biological Removal level is defined in the MMPA as "the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while still allowing that stock to reach or maintain its optimum sustainable population." For each stock, this level is determined using the product of three factors: 1) the minimum population estimate, 2) one-half the maximum theoretical or estimated net productivity rate of the stock at a small population size, and 3) a recovery factor ranging between 0.1 and 1.

and marine mammals are shown in Table 4-11. Impacts of the proposed action are analyzed in relation to PBR for each stock.

Table 4-11 Observed and estimated mortalities/significant injuries (M/SI) between the sablefish IFQ fishery in GOA and BSAI and marine mammals from 2017-2021 (2014-2018 for sperm whales; 2016-2020 for killer whales).

Marine Mammal	Year	Observed M/SI in that year	Extrapolated M/SI in that year	Estimated Mean annual M/SI
Steller sea lion, Western	2019	2	9.4	1.9
Steller sea lion, Eastern	2017	1	15	3.0
Humpback whale	2018	None	None	None
Sperm whale	2018	0(+1)[a]	0(+1)[b]	0 (+0.2)[c]
Killer whale	None	None	None	None

Source: 2024 List of Fisheries, Young et al. 2023, and Young et al. DRAFT 2023 SAR
[a] Total mortality and serious injury observed in 2018: 0 whales in sampled hauls + 1 whale in an unsampled haul
[b]Total estimate of mortality and serious injury in 2018: 0 whales (extrapolated estimate from 0 whales observed in sampled hauls) +1 whale (1 whale observed in an unsampled haul).
[c]Mean annual mortality and serious injury for fishery: 0 whales (mean of extrapolated estimate from 0 whales observed in sampled hauls) + 0.2 whales (mean of number observed in unsampled hauls)

4.5.1 Status of the Stocks

The most recent marine mammal SARs provide the most up to date information on stock status for steller sea lions, humpback whales, sperm whales, and killer whales (Young et al. DRAFT 2023 SAR; Young et al. 2022). Summary information is included below.

Steller Sea Lions (Western stock): ESA-listed

The WDPS of Steller sea lions includes animals born west of Cape Suckling, Alaska (144° W; 62 FR 24345). However, individuals move between rookeries and haul out sites regularly, even over long distances between eastern and western DPS locations (Jemison et al. 2013, Jemison et al. 2018, Hastings et al. 2019). Steller sea lions are predatory and consume a wide range of prey, foraging and feeding primarily at night on over a hundred species of fish and cephalopods. Their diet varies in different parts of their range and at different times of the year, depending on the abundance and distribution of prey species (Gende and Sigler 2006, Womble and Sigler 2006, Womble et al. 2009). Steller sea lions prey on Pacific herring during winter, forage fish spawning aggregations during spring, and migrating salmon species during summer and fall (Womble et al. 2009, Lander et al. 2020).

The current minimum population estimate of the Western stock of Steller sea lions is 49,320 Steller sea lions; 11,987 pups (95% credible interval of 11,291 – 12,703) and 37,333 non-pups (95% credible interval of 34,274 – 40,245), respectively (Sweeney et al. 2023). The PBR level is 299 Steller sea lions (Young et al. DRAFT 2023 SAR).

Steller sea lions are susceptible to a variety of threats including direct interactions with fishery operations and competition with fisheries for preferred prey items. Steller sea lions were the most commonly reported marine mammal with human-caused injuries and mortalities with 476 interactions, resulting in 429 mortalities/serious injuries (Freed et al. 2023). The minimum estimated mean annual level of human caused M/SI for the U.S. Steller sea lions between 2017 and 2021 is 39 Steller sea lions (Young et al. DRAFT 2023 SAR).

Steller Sea Lions (Eastern stock)

The Eastern stock includes animals born east of Cape Suckling, Alaska (144°W), and the stock extends from southeast Alaska, south through Canada, and down the west coast of the U.S. into California. The Young et al. DRAFT 2023 SAR indicates that while the Eastern stock of Steller sea lions has been increasing in most regions from 1990 to 2022, the most significant continued growth has been observed in British Columbia, Canada. The Southeast Alaska region was increasing from 1990 to 2017 but has appeared to level out since 2017. An abrupt decline of adult female Steller sea lion survival occurred in Southeast Alaska, Prince William Sound, and Chiswell Island during and following the severe North Pacific marine heatwave of 2014-2017 (Hastings et al. 2023). Southeast Alaska and British Columbia comprise almost 87% of the total Eastern stock count.

The PBR for the U.S. portion of the Eastern stock of Steller sea lions is 2,178.

Additional information on Steller sea lion biology, status, and threats is available at: Steller Sea Lion Species Description; Marine Mammal Stock Assessment Reports: Pinnipeds- Otariids:

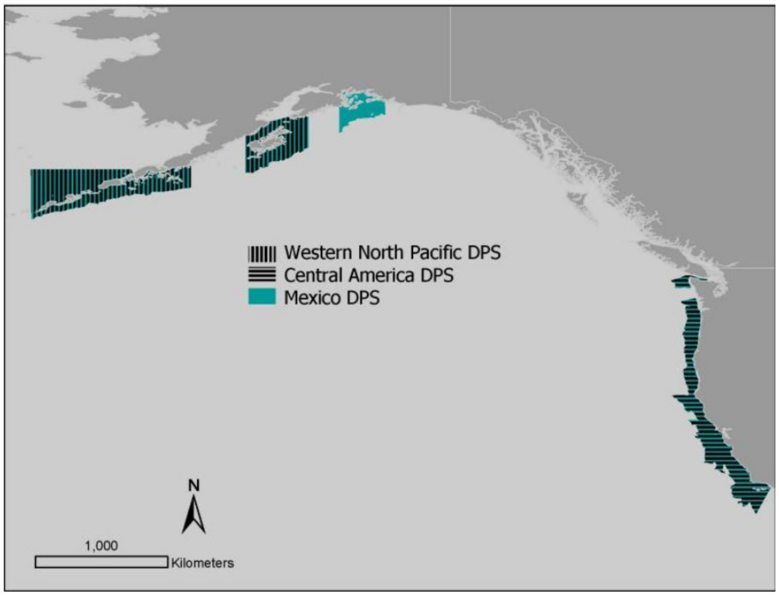
Humpback whales: Multiple stocks ESA listed

Humpback whales occur worldwide and migrate seasonally from high latitude, subarctic and temperate summering areas to low latitude, subtropical and tropical overwintering areas. Despite their vast migrations, humpback whales exhibit strong maternal site fidelity and therefore maintain genetically distinct population structure. Based on an analysis of migration between winter mating/calving areas and summer feeding areas using photo-identification, it was concluded that whales feeding in Alaskan waters belong primarily to the Hawaii DPS (not listed), with small numbers from the Western North Pacific DPS (endangered) and Mexico DPS (threatened) (Wade et al. 2016). However, as there is overlap in the feeding range for these three stocks of humpbacks, and it is nearly impossible to distinguish an individual from one stock from another.

The most recent SAR lists the Western North Pacific and Mexico DPSs as "endangered" and "threatened" under the ESA, respectively. Between 2004 and 2006, a basin-wide study took place to estimate humpback whale populations. The study, known as SPLASH (Structure, Population Levels, And Status of Humpbacks), delivered abundance estimates of 1,340 for Russia, 7,758 for the Bering Sea and Aleutian Islands, 2,129 for the Gulf of Alaska, 5,890 for Southeast Alaska and northern British Columbia, and 347 for southern British Columbia (Wade et al. 2016, Wade 2021). These estimates are based solely on geography and do not distinguish between the stocks. This survey is now more than 15 years old and is a poor determinant of present population abundances, however, all humpback whale stocks that range into Alaska have increasing populations (Muto et al. 2019). PBRs for the Western North Pacific DPS and Hawaii DPS are 0.2 and 127, respectively. The PBR for the Mexico DPS is unknown.

In 2021, NMFS designated critical habitat for the Western North Pacific, Central America, and Mexico DPS of humpback whales pursuant to section 4 of the ESA (86 FR 21082, April 21, 2021; Figure 4-4).

Figure 4-4 Humpback whale critical habitat



Source: NMFS Office of Protected Resources

Humpback whales' primary threats are entanglement in fishing gear and vessel strikes. Additional information on humpback whale biology, status, and threats is available at: Humpback Whale Species Description; Marine Mammal Stock Assessment Reports: Cetaceans-Large Whales; Humpback Whale Critical Habitat.

Sperm whales

Sperm whales feed primarily on medium-sized to large-sized squids but also consume substantial quantities of large demersal and mesopelagic sharks, skates, and fishes (Rice 1989). The North Pacific stock is the stock found in Alaska.

The data used in estimating the abundance of sperm whales in the entire North Pacific are more than 8 years old, therefore reliable estimate of abundance for the entire North Pacific stock is considered unavailable. However, these are the best available data with which to calculate PBR. PBR is calculated to be 0.5 sperm whales ($244 \times 0.02 \times 0.1$), though it is not a reliable index for the entire stock. A minimum estimate of the mean annual level of human-caused M/SI for North Pacific sperm whales between 2014 and 2018 (the most recent time period available) is 3.5 whales: 3.3 in U.S. commercial fisheries and 0.2 due to ship strikes. Sperm whales have been observed depredating both halibut and sablefish longline fisheries in the GOA and this is particularly common in sablefish longline fisheries in the central and eastern GOA; this depredation can lead to mortality or serious injury if hooking or entanglement occurs. Potential threats most likely to result in direct human-caused mortality or serious injury of this stock include entanglement in fishing gear and ship strikes due to increased vessel traffic (from increased shipping in higher latitudes).

Additional information on sperm whales can be found at Sperm Whale Species Description; Marine Mammal Stock Assessment Reports: Cetaceans-large whales.

Killer whales

NMFS recognizes six stocks of killer whales occurring in Alaska waters: 1) the Eastern North Pacific Alaska Resident; 2) the Eastern North Pacific Northern Resident; 3) the Eastern North Pacific Gulf of

Alaska, Aleutian Islands, and Bering Sea Transient, 4) AT1 Transient; 5) West Coast Transient; and 6) Eastern North Pacific Offshore. The most recent SAR acknowledges that NMFS has genetic information suggesting that the current stock structure in Alaska needs to be reassessed (Parsons et al. 2013). This genetic information is under ongoing evaluation, along with other available data to inform whether a stock structure revision is necessary and how that would be implemented. Population estimates for killer whale stocks in Alaska rely largely on counts on photographically identifiable whales.

The minimum population estimates across the stocks are as follows: 1) 1,920 whales in the Eastern North Pacific Alaska Resident stock; 2) 587 whales in the Eastern North Pacific Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock, and 3) 302 whales in the Eastern North Pacific Northern Resident stock. No reliable trend data is available for the Alaska Resident stock or the transient stock. Eastern North Pacific Northern Resident killer whale population growth rates have slowed over the past five census years, from 5.1% in 2014 to -0.3% in 2018 (Fisheries and Oceans Canada 2019). The PBR for the Northern Resident stock is the most sensitive (2.2 whales) while the Alaska Resident stock is the most robust (19 whales). The transient stock PBR is 5.9 whales.

Killer whales occur in a wide range of habitats, in both open seas and coastal waters. Killer whales are highly social, and most live in social groups called pods (groups of maternally related individuals seen together more than half the time). Individual whales tend to stay in their natal pods. Pods typically consist of a few to 20 or more animals, and larger groups sometimes form for temporary social interactions, mating, or seasonal concentrations of prey. Killer whales rely on underwater sound to feed, communicate, and navigate. Pod members communicate with each other through clicks, whistles, and pulsed calls. Each pod in the eastern North Pacific possesses a unique set of calls that are learned and culturally transmitted among individuals. These calls maintain group cohesion and serve as family badges. Although the diet of killer whales depends to some extent on what is available where they live, it is primarily determined by the culture (i.e., learned hunting tactics) of each ecotype. For example, one ecotype of killer whales in the U.S. Pacific Northwest (called Residents) exclusively eats fish, mainly salmon, and another ecotype in the same area (Transients or Bigg's killer whales) primarily eat marine mammals and squid. Killer whales often use a coordinated hunting strategy and work as a team to catch prey. They are considered an apex predator, eating at the top of the food web.

Killer whales are vulnerable to entanglement in fishing gear and prey limitations due to habitat loss and overfishing, among other anthropogenic threats.

Additional information on killer whale biology, status, and threats is available at: Killer Whale Species Description; Marine Mammal Stock Assessment Reports: Cetaceans-small whales.

4.5.2 Effects on Marine Mammals

No beneficial impacts to marine mammals are likely with fishery harvest. Generally, changes to the fisheries do not benefit marine mammals in relation to incidental take, prey availability, and disturbances; changes increase or decrease potential adverse impacts. The only exception to this may be in instances when marine mammals target prey from fishing gear, or prey upon discarded fish. In this case, the prey availability is enhanced for these animals because they need less energy for foraging. However, that benefit may be offset by adverse effects from an increased potential for entanglement in the gear or other unknown risks from modified foraging behavior.

The following discussion focuses on the potential interaction of marine mammals with fixed gear currently used in the sablefish IFQ fishery. This analysis focuses largely on sperm and killer whales, which are known to depredate fish caught in the sablefish IFQ fisheries in the BSAI and GOA. These latter interactions reduce the efficiency of the fishery and may increase the likelihood of entanglement of these whales in fishing gear and fishing-related ship strikes.

4.5.2.1 Alternative 1

Maintaining the prohibition on discarding sablefish in the IFQ/CDQ fisheries is the status quo or no action alternative. Under Alternative 1, there would be no expected changes in incidental take, prey availability, or disturbance effects.

Incidental Take Effects

The primary concern for marine mammal incidental take under Alternative 1 is entanglement with fishing gear, although M/SI can also occur due to vessel strikes. Marine mammal entanglements generally occur when whales encounter vertical lines that extend from a pot or trap or string of traps set on the ocean bottom to a buoy at the surface (sometimes referred to as "float lines"), or when marine mammals interact with a net. The likelihood of entanglement in any one vertical line is the same, regardless of whether the line is part of a H&L longline or attached to a pot. However, due to the weight of pots, lines with pots attached are potentially more likely to lead to serious injury or mortality as they make it more difficult for an entangled animal to swim/feed/breathe than a non-weighted, single line (Andersen et al. 2008). Large whales, including humpback whales, are particularly susceptible to becoming entangled in trap or pot gear due to spatial overlap with fisheries and their feeding behavior. Overall, fewer killer, sperm, or other toothed whales have been entangled in all gear types, including pot gear. The amount of slack line used and the profile of the lines in the water column can influence the potential for entanglement. Generally, lines that remain relatively tight are less likely to lead to entanglement as opposed to lines that create larger profiles in the water if they are relatively loose and/or winding around in loops.

Under the status quo, sperm whales and killer whales interfere with fishing operations when they prey upon fish that are hooked on H&L gear. As mentioned in Section 3.1.3, there have also been instances of killer whales attacking pot gear to reach sablefish caught inside (personal communication, K. Milani, May 2023). Due to this behavior, these species may be at greater risk of vessel strike and/or entanglement than marine mammals that do not interfere with these fishing operations. However, cetacean entanglements in longline fishing gear are rare.

Most of the gear types harvesting IFQ/CDQ sablefish in the BSAI and GOA are listed in the List of Fisheries for 2024 as Category III, with a remote likelihood of or no known interaction with any marine mammal species. No marine mammal/fishery interactions have been documented in the BSAI sablefish H&L or GOA sablefish pot fisheries. Few sperm whale interactions have been documented in the BSAI sablefish pot fishery, and this fishery is still listed under Category III. As of 2024, the GOA sablefish H&L fishery is listed as a Category II fishery, based on serious injuries and mortalities of the North Pacific sperm whale stock, which are greater than 1 percent and less than 50 percent of the stock's PBR of 0.5 whales, despite the PBR for this stock being considered unreliable. This fishery has also had instances of M/SI of Eastern and Western U.S. Steller sea lions.

Steller Sea Lions

The minimum estimated mean annual U.S. commercial fishery-related M/SI rate for the Western stock (39 sea lions) is more than 10% of the PBR (10% of PBR = 30) and therefore cannot be considered insignificant and approaching a zero M/SI rate as defined by implementing regulations for the MMPA. While the PBR for Western SSL cannot be considered insignificant and approaching a zero M/SI rate, serious injury and mortality in the sablefish IFQ fisheries equates to <1% of the PBR from 2017-2021.

The minimum estimated mean annual U.S. commercial fishery-related M/SI rate for the Eastern stock (21 sea lions) is less than 10% of the PBR (10% of PBR= 218) and therefore is considered insignificant and approaching a zero M/SI rate (Young et al. DRAFT 2023 SAR).

While there have been two observed instances of M/SI of Western SSL and one observed instance of M/SI of Eastern SSL in the GOA sablefish H&L fishery from 2017-2021, M/SI in the sablefish IFQ fisheries equates to <1% of the PBR (Western) and the Eastern PBR is approaching zero. As such, the status quo alternative is not likely to lead to significant population-level impacts.

Humpback whales

Critical habitat for humpback whales overlaps with the sablefish IFQ fishery (Figure 4-4).

Between 2017 and 2021, M/SI of humpback whales occurred with BSAI commercial pot gear (1) and Alaska State-managed commercial cod pot gear (parallel fishery) (1) (Young et al. DRAFT 2023 SAR). The minimum estimate of the mean annual and serious injury rate of humpback whales incidental to U.S. commercial fisheries in Alaska for the WNP stock from 2017-2021 is 0.012. The PBR for whales that use U.S. waters is 0.2. The PBR for the Mexico-North Pacific stock is undetermined, and the minimum estimated mean annual level of human-caused M/SI for the Mexico-North Pacific stock of humpback whales incidental to U.S. commercial fisheries between 2016 and 2020 was 0.36 whales. For humpback whales, the minimum estimate of the total annual level of human-caused M/SI is not known to exceed the PBR for either stock, and the status quo alternative is not likely to impact this total serious injury or mortality; therefore, we do not expect population-level impacts as a result of Alternative 1.

Sperm Whales

The most updated information on North Pacific sperm whales indicates that the minimum estimate of the mean annual U.S. commercial fishery-related M/SI rate is 3.3 whales (Young et al. DRAFT 2023 SAR). This is more than 10% of the PBR (10% of PBR = 0.05) calculated from the 2015 abundance estimate (Rone et al. 2017) for a small portion of the stock's range. While this exceeds the PBR for a portion of the North Pacific sperm whale stock, because the calculated PBR level is based on a minimum population estimate which is known to be an underestimate of the abundance of the population, the PBR level is considered unreliable. There are key uncertainties in the assessment of the North Pacific stock of sperm whales, and little current information about the broad-scale distribution of sperm whales in Alaska waters (Young et al. DRAFT 2023 SAR).

Despite these uncertainties, the estimated serious injury and mortality rate of sperm whales in the sablefish IFQ/CDQ fisheries from the most recent five year period available (2014-2018) (Young et al. 2022) is 0.2 whales (if including the mean of number whales observed in unsampled hauls). A minimum estimate of the mean annual level of human-caused mortality and serious injury for North Pacific sperm whales between 2014 and 2018 is 3.5 whales: 3.3 in U.S. commercial fisheries and 0.2 due to ship strikes. Sperm whale depredation is particularly common in sablefish longline fisheries in the central and eastern GOA; this depredation can lead to mortality or serious injury if hooking or entanglement occurs. Alternative 1 is not likely to impact this total serious injury or mortality beyond the status quo and we do not expect any significant population-level impacts because of Alternative 1.

Killer whales

Resident killer whales are those most likely to be involved in fishery interactions since these whales are known to be fish eaters. Transient killer whales generally feed on marine mammals and as such are not considered further in this analysis due to lack of association with the sablefish IFQ fishery. While there have been no observed SI/M of killer whales in the sablefish IFQ/CDQ fisheries (Table 4-11), the 2024 LOF reports interactions between killer whales and other commercial H&L gear fisheries in the BSAI.

Based on the most recent five-year period of data (2016-2020), the minimum estimate of the mean annual M/SI rate due to U.S. commercial fisheries for the Eastern North Pacific Alaska Resident stock of killer whales (1.1) is less than 10% of the PBR (10% of PBR = 1.9) and, therefore, is considered to be insignificant and approaching zero M/SI. Likewise for the Eastern North Pacific Northern Resident stock, the minimum estimated mean annual U.S. commercial fishery-related M/SI rate 0.2, which does not exceed 10% of the PBR (10% of PBR = 0.22) and, therefore, is considered to be insignificant and approaching a zero M/SI rate (Young et al. DRAFT 2023 SAR).

For killer whales, the minimum estimate of the total annual level of human-caused M/SI is not known to exceed the PBR, and the status quo alternative is not likely to impact this total serious injury or mortality; therefore, we do not expect any significant population-level impacts as a result of Alternative 1.

<u>Prey Availability Effects</u>

Harvest of marine mammal prey species in the BSAI and GOA IFQ/CDQ fisheries may limit foraging success through localized depletion, overall reduction in prey biomass, and dispersion of prey, making it more difficult for foraging marine mammals to obtain necessary prey. Overall reduction in prey biomass may be caused by removal of prey or disturbance of prey habitat. The timing and location of fisheries relative to foraging patterns of marine mammals and the abundance of prey species may be a more relevant management concern than total prey removals.

Diet data suggest that sablefish are a main prey item of sperm whales, whereas killer whales are not known to naturally forage for sablefish, likely due to the depth range of sablefish (Rice 1989; Ford and Ellis 2006; Wild et al. 2020). The impacts of altered foraging behavior, such as removing hooked fish from longline gear or preying upon fish discarded from fishing vessels, are unknown. Optimal foraging theory states that an animal wants to gain the most benefit (energy) for the lowest cost during foraging, so that it can maximize its fitness. Obtaining food provides the animal with energy, while searching for and capturing food requires both energy and time. Depredation of fishing gear enables decreased energy expenditure required to forage for prey. Under Alternative 1, whale depredation is expected to continue as the status quo.

Steller sea lions do not target sablefish as prey and humpback whales have never been documented consuming sablefish. Therefore, the sablefish IFQ fishery would not have any impact on prey availability for Steller sea lions and humpback whales.

Overall, effects of Alternative 1 on prey availability for marine mammals are not likely to cause population level effects and are therefore not significant.

<u>Disturbance Effects</u>

Disturbance effects from the groundfish fisheries described in the 2010 Biological Opinion include: disruption of normal foraging patterns by the presence and movements of vessels and gear in the water, abandonment of prime foraging areas because of fishing activities, and disruption of prey schools in a manner that reduces the effectiveness of marine mammals' foraging. The interaction of the BSAI and GOA groundfish fisheries with Steller sea lions, which potentially compete for prey, is comprehensively addressed in the Steller Sea Lion Protection Measures EIS and the 2010 Biological Opinion (NMFS 2014; NMFS 2010). The EISs concluded that the status quo fishery does not cause disturbance to marine mammals at a level that may cause population level effects. Fishery closures limit the potential interaction between fishing vessels and marine mammals (e.g., 3-nm no groundfish fishing areas around Steller sea lion rookeries and walrus protection areas). Because disturbances to marine mammals under the status quo fishery are not likely to cause population level effects, the impacts of Alternative 1 are not significant.

4.5.2.2 Alternative 2

Alternative 2, option 2 proposes an FMP amendment and regulatory change to allow vessels participating in the sablefish IFQ fishery to discard small sablefish in the BSAI and GOA. This could result in an increase in fishing effort, such as length of fishing trips or amount of gear deployed, since vessels that choose to discard will need to increase effort to achieve the same amount of quota. Compared to the status quo (Alternative 1), a slight negative effect may be expected from allowing the IFQ fleet to discard sablefish in the BSAI and GOA. Under Alternative 2, while fishing effort could marginally increase as compared to the status quo, the sablefish IFQ fishery is still constrained by existing regulations concerning the location and timing of the fishery, and overall catch limits.

When analyzing possible effects of Alternative 2 on marine mammals, there are two main causes of potential impacts. The first is the increase in fishing effort and resulting increase in the amount of gear (hooks, pots, fishing lines, buoys, etc.) that will be deployed as a result. The second is the potential for killer and sperm whales to be attracted to vessels that are discarding sablefish, increasing potential risk of M/SI.

Table 5-17 in Section 5.4.1 provides an approach for estimating changes to fishing effort under Alternative 2, Option 2. While it is not possible to project how fishing effort may change from year to year under Alternative 2, we apply the weighted average of estimated fishing effort from the methods described in Sections 4.1 and 5.4.1 (Table 5-17) to the most recent catch M/SI of steller sea lions, humpback whales, sperm whales, and killer whales. This provides a reasonable but likely high prediction of expected interactions marine mammals under Alternative 2. This prediction is likely high because of the assumption that all sablefish under 22” would be discarded.

Changes likely to occur are expected to be minimal; with potential increases in direct interactions due to associated increased fishing effort and potential changes in the indirect effects of increased fishing effort through possible increases in availability of discarded sablefish. Any potential impacts (incidental take, prey competition, or disturbance) that do occur are expected to be minimal and not significant due to the limited magnitude of the potential increase in fishing effort due to the action alternative.

<u>Incidental Take Effects</u>

The analysts assume that increases in fishing effort (generally expected to be in terms of additional time per vessel, not number of vessels) could have commensurate increases in direct interactions with marine mammals. As discussed in section 5.4.1, Alternative 2, Option 2, and using the weighted average of GOA subareas for H&L gear, this result in a 3% increase in fishing effort as compared to 2021-2023 effort. These increases may also represent maximum increases in fishing effort across areas due to less than full utilization of discards, however, increasing margins could move the fleet towards increased TAC utilization which would further increase effort.

Steller Sea Lions

From 2017 to 2021 were two observed instances of M/SI of Western SSL and one observed instance of M/SI of Eastern SSL in the GOA sablefish H&L fishery and none for all other fixed gear sablefish fisheries (Table 4-11). The low encounter rate of Steller sea lions with the sablefish IFQ fishery is likely to do with the fact that the sablefish IFQ fishery primarily fishes along the continental slope, whereas Steller sea lions primarily forage closer to land at shallower depths (Sinclair and Zeppelin 2002; Pitcher et al. 2005; Womble and Sigler 2006). Using the methods described above for GOA sablefish H&L fishery, a potential effect to Western Steller sea lions over a five year period (2017-2021) could be calculated as the existing effect of the sablefish IFQ fishery (the estimated annual serious injury and mortality rate for is 1.9), plus a 3% increase of the current effect (1.9 + (1.9* 0.03) =1.96). Over 5 years, this equates to <1 take of Western SSLs per year. Using the same method, this equates to <1 take of Eastern SSLs per year

((3 + (3*0.03)) / 5). Both levels of mortality in the sablefish IFQ fisheries equates to <1% of the PBRs for both species from 2017-2021.

As there is little likelihood that the sablefish IFQ/CDQ fishery would contribute significantly to the incidental take for Steller sea lions even if effort increases as described above, Alternative 2, Option 2 is not likely to have population level effects on Steller sea lions.

Humpback whales

There have been no reported interactions between humpback whales and the sablefish IFQ/CDQ fishery (Table 4-11). This is likely do to the fact that the fixed gear sablefish IFQ/CDQ fishery primarily fishes along the continental slope, whereas humpbacks primarily forage closer to shore at shallower depths (Goldbogen et al. 2008; Witteveen et al. 2008). However, the timing of the sablefish IFQ fishery overlaps with the foraging season of humpback whales and there is the possibility of humpbacks interacting with sablefish gear transiting to and from foraging locations, although such interactions have not been documented. Using the methods described above for the sablefish fishery, the calculated effect to humpback whales would be the existing effect of the sablefish IFQ/CDQ fisheries (0 documented interactions), plus an extreme upper bound of a 32% increase of the current effect (0 + (0* 0.32) = 0). Thirty-two percent is the highest estimated increase for any subarea/gear combination in Table 5-17 (pot gear in the AI). Therefore, as there have been no documented interactions with the sablefish IFQ/CDQ fisheries and humpback whales and considering the best scientific information available, an increase in effort is not likely to have population level effects on humpback whales.

Sperm whales and killer whales

Sperm and killer whales that depredate on fishing gear could be negatively impacted under Alternative 2. Diet data suggests the sablefish naturally comprises a portion of the sperm whale diet in Alaska (Rice 1989; Wild et al. 2020), but that killer whales do not naturally forage for sablefish, likely due to the depth range of sablefish (Ford et al. 2010; Peterson et al. 2014). Removing hooked sablefish from longline gear does not represent natural foraging for either sperm nor killer whales. Similar to "trash bears," there are risks associated with modifying marine mammal foraging behavior towards unnaturally available and unreliable prey resources such as hooked sablefish (Roche et al. 2007). Whales that specialize in the depredation behavior could be at greater risk of negative impacts associated with the unnatural foraging behavior. Killer whales in particular exist in highly complex social groupings, and the effect that the depredation behavior could have on natural killer whale social structure is unknown. This effect could be even more pronounced if certain pods or individuals specialize in the depredation behavior as a primary foraging strategy during certain parts of the year. Under Alternative 2, with greater effort and more gear in the water there could be an increased risk of modifying marine mammal foraging behavior towards an unnaturally available and unreliable prey resource (Roche et al. 2007).

Whales that depredate on fishing gear may be at greater risk of vessel strike and/or entanglement in fishing gear. Although cetacean entanglements in fishing gear are relatively rare, there are reports of sperm whales becoming entangled in longline fishing gear in Alaska (Muto et al. 2019). There was one sperm mortality observed in 2018 and no others in the sablefish IFQ/CDQ fisheries over the most recent time period of data available. Applying the estimated effort from Table 5-17, Alternative 2 could result in an increase in fishing effort equal to 32% for pot gear in the AI. Therefore a potential maximum effect to sperm whales over a five year period would be the existing effect of the sablefish IFQ/CDQ fisheries (using 0.2 whales (mean of number observed in unsampled hauls) from Table 4-11)), plus a 32% increase of the current effect (0.2 + (0.2* 0.32) = 0.26). While this potential additional impact is above the estimated PBR for the population, NMFS considers the PBR set for sperm whales to be unreliable, as described above. This potential increase in effort could result in additional takes for the sperm whales, but given the conservative minimum estimate for PBR for only a small portion of the stock's range and demographics, the increase is not expected to have a population level impacts on sperm whales. Additionally, this is considered a maximum for any potential additional effect, since entanglement is thought to be primarily due to depredation right off the H&L gear, and impacts from depredating on discards may not translate as directly to entanglement.

There were 0 observed M/SI with killer whales in the sablefish IFQ/CDQ fishery from 2017-2021. Using the methods described above for the sablefish fishery, the calculated effect to killer whales would be the existing effect of the sablefish IFQ/CDQ fisheries, plus an extreme upper bound of a 32% increase of the current effect (0 + (0* 0.32) = 0). Thirty-two percent is the highest estimated increase for any subarea/gear combination in Table 5-17 (pot gear in the AI).

It should be noted that there is the potential for an increased chance of ship strikes, in addition to entanglement events, as small sablefish are discarded and killer whales trail sablefish IFQ vessels, however it is impossible to quantify what this chance may be. Therefore, as there have been no documented M/SI with the sablefish IFQ fishery and killer whales, and considering the best scientific information available, an increase in effort is not likely to have population level effects on killer whales.

No information in this analysis suggests that a temporal or seasonal shift in sablefish IFQ fishing is expected to occur under Alternative 2. However, this option would likely lead to increased effort and more gear in the water, increasing the possibility of entanglements and resulting serious injury and mortality. Overall, Alternative 2 has some potential expected to result in increased interactions with killer whales, sperm whales, and potentially humpback whales compared with the status quo, however none are expected to have population level effects and are therefore not significant.

Prey Availability Effects

Harvest of marine mammal prey species in the BSAI and GOA fisheries may limit foraging success through localized depletion, overall reduction in prey biomass, and dispersion of prey, making it more difficult for foraging marine mammals to obtain necessary prey. Overall reduction in prey biomass may be caused by removal of prey or disturbance of prey habitat. The timing and location of fisheries relative to foraging patterns of marine mammals and the abundance of prey species may be a more relevant management concern than total prey removals.

The impacts of altered foraging behavior, such as removing hooked fish from longline gear or preying upon fish discarded from fishing vessels, are unknown. Optimal foraging theory states that an animal wants to gain the most benefit (energy) for the lowest cost during foraging, so that it can maximize its fitness. Obtaining food provides the animal with energy, while searching for and capturing food requires both energy and time. Depredation of fishing gear enables decreased energy expenditure required to forage for prey. It is likely that a 32% increase in effort combined with discarded small sablefish would likely increase the amount of sablefish easily accessed by sperm whales and killer whales. Thus, Alternative 2 may increase the amount of sablefish available to sperm whales and killer whales.

Steller sea lions do not target sablefish as primary prey and humpback whales have never been documented consuming sablefish. Therefore, the sablefish IFQ fishery would not have any impact on prey availability for Steller sea lions and humpback whales.

Overall, effects of Alternative 2 on prey availability for marine mammals are not likely to cause population level effects and are therefore not significant.

Disturbance Effects

Disturbance effects from the groundfish fisheries described in the 2010 Biological Opinion include: disruption of normal foraging patterns by the presence and movements of vessels and gear in the water, abandonment of prime foraging areas because of fishing activities, and disruption of prey schools in a manner that reduces the effectiveness of marine mammals' foraging. The interaction of the BSAI and GOA groundfish fisheries with Steller sea lions, which potentially compete for prey, is comprehensively addressed in the Steller Sea Lion Protection Measures EIS and the 2010 Biological Opinion (NMFS 2014; NMFS 2010). The EISs concluded that the status quo fishery does not cause disturbance to marine mammals at a level that may cause population level effects. Fishery closures limit the potential interaction between fishing vessels and some marine mammals (e.g., 3-nm no groundfish fishing areas around Steller sea lion rookeries and walrus protection areas). Overall, Alternative 2 is expected to result in no significant population-level impacts to marine mammals.

Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions on Marine Mammals

The following RFAs are identified as likely to have an impact on marine mammals within the action area and timeframe.

An amendment to allow the Bering Sea Greenland turbot H&L fishery to use longline pot gear has been recommended by the Council.[15] While switching the turbot fishery to longline pot gear is motivated by prolific whale depredation of baited hooks, marine mammals are rarely taken in the fishery; from 2017 to 2021, no (M/SI) events were reported (Freed et al. 2023). The analysis indicated that any potential impacts that do occur are expected to be minimal (NPFMC 2023e). Additionally, as more fisheries change to pot gear it is expected that there will be a slight reduction in the number of marine mammals taken in fisheries as marine mammals interact less with pot gear than H&L gear (Tide and Eich 2022).

Climate change, as discussed in other sections of this EA, may result in substantial changes to the composition and distribution of fish assemblages in the North Pacific (Cheung and Frölicher 2020; Yati et al. 2020), which could impact marine mammal prey species. However, there is a high degree of uncertainty pertaining to the timing of these climate-induced changes, and the future composition of fish species in Alaska. Future warming may negatively affect marine mammals that rely on fish and invertebrates that do not respond well to warming temperatures.

Potential threats likely to result in direct human-caused mortality or serious injury of some of these stocks, particularly sperm whales, include entanglement in fishing gear and ship strikes due to increased vessel traffic (from increased shipping in higher latitudes).

Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable actions listed above, the aggregate impacts of the proposed action are determined to be not significant.

4.6 Seabirds

Alaska's waters support extremely large concentrations of seabirds. Over 80 million seabirds are estimated to occur in Alaska annually, including 40 million to 50 million individuals from the numerous species that breed in Alaska (Table 4-12; USFWS 2009). An additional 40 million to 50 million individuals do not breed in Alaska but spend part of their life cycle there. These include short-tailed and sooty shearwaters and three albatross species: the black-footed albatross, the Laysan albatross, and the endangered short-tailed albatross (Table 4-12; USFWS 2009).

As noted in the PSEIS (NMFS 2004), seabird life history includes low reproductive rates, low adult mortality rates, long life span, and delayed sexual maturity. These traits make seabird populations

[15] Council motion for final action, April 2023

extremely sensitive to changes in adult survival and less sensitive to fluctuations in reproductive effort. The problem with attributing population changes to specific impacts is that, because seabirds are long-lived animals, it may take years or decades before relatively small changes in survival rates result in observable impacts on the breeding population.

Table 4-12 Seabird species in Alaska

Type	Common name	Status
Albatrosses	Black-footed	
	Short-tailed	Endangered
	Laysan	
Fulmars	Northern fulmar	
Shearwaters	Short-tailed	
	Sooty	
Storm petrels	Leach's	
	Fork-tailed	
	Pelagic	
	Red-faced	
	Double-crested	
Gulls	Glaucous-winged	
	Glaucous	
	Herring	
	Mew	
	Bonaparte's	
	Slaty-backed	
Murres	Common	
	Thick-billed	
Jaegers	Long-tailed	
	Parasitic	
	Pomarine	

Type	Common name	Status
Guillemots	Black	
	Pigeon	
Eiders	Common	
	King	
	Spectacled	Threatened
	Steller's	Threatened
Murrelets	Marbled	
	Kittlitz's	
	Ancient	
Kittiwakes	Black-legged	
	Red-legged	
Auklets	Cassin's	
	Parakeet	
	Least	
	Whiskered	
	Crested	
Terns	Arctic	
Puffins	Horned	
	Tufted	

4.6.1 Effects on Seabirds

The PSEIS identifies how the BSAI and GOA groundfish fisheries activities may directly or indirectly affect seabird populations (NMFS 2004 and 2015). Direct effects may include incidental take (lethal) in fishing gear and vessel strikes. Indirect effects may include reductions in prey (forage fish) abundance and availability.

The impacts of the Alaska groundfish fisheries on seabirds were analyzed in the Harvest Specifications EIS (NMFS 2007) which evaluated the impacts of the alternative harvest strategies on seabird takes, prey availability, and seabird ability to exploit benthic habitat. The focus of this analysis is similar, as any changes to the sablefish fisheries in the BSAI or GOA could change the potential for direct take (death) of seabirds. Potential changes in prey availability (seabird prey species caught in the fisheries) and disruption of bottom habitat from fishing gear under different levels of harvest are examples of indirect effects on seabirds and are discussed in NMFS (2007).

4.6.1.1 Alternative 1

Alternative 1, the status quo alternative, would maintain the prohibition on discarding sablefish in the IFQ/CDQ fisheries in the BSAI and GOA.

<u>Incidental Take</u>

Several seabird species are caught incidental to the Alaska groundfish fisheries. Of particular concern is the impact on seabirds listed under the ESA. Three species of seabirds are currently listed as either threatened or endangered; the short-tailed albatross *Phoebastria albatrus* (endangered), Alaska-breeding population of Steller's eider *Polysticta stelleri* (threatened), and Spectacled eider *Somateria fischeri* (threatened). Two other populations of Steller's eider occur in waters off Alaska but only the Alaska-breeding population is listed under the ESA.

Occasionally, endangered short-tailed albatross are taken incidental to the Alaska groundfish fisheries. From 1999 through 2019, six short-tailed albatross were observed to be killed in the BSAI groundfish H&L fisheries. NMFS reported no takes of short-tailed albatross in the groundfish and halibut fisheries from 2007 through 2009, from 2012 through 2013, 2015 through 2019, and 2021. One take of a short-tailed albatross occurred in the GOA Pacific cod H&L fishery in December 2023. This is the first recorded take of a short-tailed albatross by any fisheries operating in the BSAI or GOA since 2020.

The USFWS consulted with NOAA Fisheries Alaska Region under section 7 of the ESA on the effects of the groundfish fisheries on the endangered short-tailed albatross, threatened spectacled eider, and threatened Alaska-breeding population of Steller's eider. In its 2021 biological opinion, the USFWS determined the groundfish fisheries off Alaska are likely to adversely affect short-tailed albatross, spectacled eider, and the Alaska-breeding population of Steller's eider, but they are not likely to jeopardize their continued existence (USFWS 2021). It was also determined that the groundfish fisheries off Alaska are not likely to adversely affect designated critical habitat of the Alaska-breeding population of Steller's eider and Spectacled eider. USFWS provides the following incidental take statements for short-tailed albatross, spectacled eider, and threatened Alaska-breeding population of Steller's eider:

- The reported take should not exceed six short-tailed albatrosses in a 2-year period.
- The reported take should not exceed 25 spectacled eiders in a floating 4-year period.
- The reported take should not exceed three Steller's eiders from the Alaska breeding population in the BSAI and GOA using H&L or trawl gear (combined) in a floating 4-year period.

These incidental take limits apply starting in 2021. The 2021 Biological Opinion left in place most of the conservation measures that were specified in the previous 2015 Biological Opinion but did add new recommendations for vessel lighting. The 2021 Biological Opinion stipulates that NMFS will recommend that 1) to the maximum extent practicable vessels will minimize the use of external lighting at night and avoid the use of sodium lighting and other high-wattage light sources, except when necessary for vessel and crew safety and 2) all lights should be angled or shielded downward toward the surface of the water, except when necessary for safe vessel operation.

NMFS annually updates estimates of seabirds caught as bycatch in commercial groundfish and halibut fisheries operating in waters off Alaska. The 2022 report details seabird bycatch estimates by gear type for the years 2011 through 2021 (Tide and Eich 2022). All Alaska region seabird bycatch data are based on extrapolations from observer data.

The total estimated seabird bycatch continues to be substantially lower than prior to 2009, when NMFS implemented revised regulations on the use of seabird avoidance measures for the H&L groundfish and halibut fisheries in International Pacific Halibut Commission Area 4E (74 FR 13355, March 27, 2009). According to the Seabird Bycatch Estimates for Alaskan Groundfish Fisheries 2021, an estimated 4,509 seabirds were caught in H&L, trawl, and pot fisheries in the BSAI and GOA in 2021. Specifically, an estimated 2,447 shearwaters and 1,120 northern fulmars were taken incidentally in the BSAI and GOA H&L fisheries, which continue to have the highest seabird bycatch among gear groups.

Pot gear remains the gear type with the least amount of estimated seabird bycatch, representing an average of 2.8 percent of the total seabird bycatch from all gear types from 2011 through 2021 (range 0 to 13.4 percent) (Tide and Eich 2022). In 2021, there was no estimated seabird bycatch from pot gear. This was the lowest estimate in the 2011 through 2021 time series (next lowest was 0.4 percent in 2011, 2012, and 2019) (Tide and Eich 2022).

Table 4-13 shows estimates of seabird bycatch in the BSAI and GOA sablefish IFQ/CDQ fisheries, respectively, by gear type from 2011 through 2021. In the BSAI, estimated seabird bycatch has historically been predominantly made up of Laysan albatross, and Northern fulmar. However, since 2016, very few seabirds are estimated to have been taken in the BSAI by the sablefish IFQ/CDQ fisheries. Spectacled and Steller's eiders have not been observed in the sablefish fisheries during this time period.

Albatross habitat overlaps with the continental shelf break and slope habitat which is most commonly associated with the sablefish fishery (Fischer et al. 2009; Suryan et al. 2007). However, takes of short-tailed albatross have not been observed in the sablefish fishery since the mid-1990s. The two other species of albatross that forage off Alaska (black-footed (*Phoebastria nigripes*) and Laysan (*P. immutabilis*) albatross) are listed as birds of conservation concern by the USFWS (USFWS 2021b). This means that without additional conservation efforts, they are likely to become candidates for listing under the ESA (USFWS 2021b). In 2021, 343 black-footed albatross and 57 Laysan albatross were estimated as bycatch in H&L fisheries in the BSAI and GOA; the majority (261) of the black-footed albatross bycatch was from the GOA sablefish H&L fishery (Tide and Eich 2022). While seabird bycatch levels and rates are highly variable among years, sablefish has higher estimated albatross bycatch relative to other fisheries. Therefore, future conservation efforts for mitigating albatross bycatch should focus on the sablefish fleet for maximum benefit.

Table 4-13 Estimated seabird bycatch in the BSAI and GOA sablefish fisheries by gear type 2011-2021.

BSAI H&L	**Species/ Species group**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Grand total**	**Annual Average**
	Unidentified Albatross	0	0	0	25	0	0	0	0	0	0	0	25	2
	Laysan Albatross	9	84	102	47	96	57	0	1	0	0	0	396	36
	Black-footed Albatross	7	0	10	0	18	0	0	0	0	0	0	35	3
	Northern Fulmar	21	0	30	60	78	0	0	20	0	0	0	209	19
	Shearwaters	34	0	0	60	22	0	0	0	0	0	0	117	11
	Gull	27	12	11	0	34	0	0	0	0	0	0	84	8
	Unidentified Birds	0	0	3	0	0	0	0	0	0	0	0	3	0
	Total	**97**	**96**	**155**	**192**	**249**	**57**	**0**	**21**	**0**	**0**	**0**	**868**	**79**
BSAI Pot	Northern Fulmar	0	0	0	0	0	0	12	0	0	0	0	12	1
	Total	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**0**	**0**	**0**	**0**	**12**	**1**
GOA H&L	Unidentified Albatross	0	0	32	0	0	0	0	51	19	0	0	102	9
	Laysan Albatross	164	17	69	23	21	43	25	21	33	21	0	438	40
	Black-footed Albatross	212	82	381	221	337	165	381	232	218	81	261	2,571	234
	Northern Fulmar	811	0	108	0	35	18	64	129	80	0	12	1,257	114
	Shearwaters	62	0	0	0	5	19	23	0	39	8	0	157	14
	Gull	549	27	34	8	111	89	249	54	18	22	0	1,160	105
	Cormorant	0	0	0	0	27	0	0	0	0	0	0	27	2
	Unidentified Birds	9	0	0	0	28	18	14	0	0	17	0	86	8
	Total	**1,807**	**125**	**624**	**252**	**564**	**353**	**755**	**487**	**408**	**150**	**273**	**5,796**	**527**
GOA pot	Northern Fulmar	0	0	0	0	0	0	0	0	0	9	0	9	1
	Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**0**	**9**	**1**

Source: Tide and Eich, 2022

Incidental take of seabirds in the sablefish IFQ fishery is generally far greater in the GOA, however, with the transition from H&L to pot gear since 2017, incidental take of seabirds has substantially declined. As described in the 2024 Seabird Report to the NPFMC, this continued shift away from H&L gear may partially explain the low seabird bycatch estimates in 2023 relative to the 2014-2023 average and especially compared to 2014 to 2019 (NMFS 2024b). In 2023, the entire sablefish IFQ fishery had just one reported take of a black-footed albatross, and only 14 reported takes of Northern fulmars (NMFS 2024b; personal communication A. Kingham, May 2024). Seabird takes by pot gear are relatively rare compared to takes by H&L gear. If the sablefish IFQ fishery continues to increase its use of pot gear over H&L gear moving forward, we expect reduced takes of seabirds in this fishery to continue.

The three incidental take statements mentioned above for the ESA-listed seabirds have not been exceeded as of April 2024 (NMFS 2024b).

Prey Availability

A description of the effects of prey abundance and availability on seabirds is found in the PSEIS (NMFS 2004, NMFS 2015) and the Harvest Specifications EIS (NMFS 2007). Detailed conclusions or predictions cannot be made regarding the effects of forage fish bycatch on seabird populations or colonies. NMFS (2007) found that the potential impact of the entire groundfish fisheries on seabird prey availability was limited due to little or no overlap between the fisheries and foraging seabirds based on either prey size, dispersed foraging locations, or different prey. The status quo sablefish IFQ/CDQ fisheries do not harvest seabird prey species in an amount that would decrease food availability enough to impact survival rates or reproductive success. Under the status quo alternative, no substantive changes to seabird prey availability are expected, and impacts are expected to be negligible.

4.6.1.2 Alternative 2

Alternative 2 proposes an FMP amendment and regulatory change to allow vessels participating in the sablefish IFQ fishery to discard small sablefish in the BSAI and GOA. This could result in an increase in fishing effort, such as length of fishing trips or amount of gear deployed, since vessels that choose to discard will need to increase effort to achieve the same amount of quota. However, any increase in effort could potentially be offset by the concurrent decrease in seabird bycatch due to the shift from H&L to pot gear in the sablefish IFQ/CDQ fisheries.

Similar to other sections of this EA, we applied the estimated increase in fishing effort (based on average retention rates of grade 2+ sablefish from 2021-2023, described in Section 5.4.1) for each area and gear type to 3-year average of seabird bycatch data in Table 4-13. However, because the most recent seabird data does not allow for a three-year average from 2021-2023, using the most recent three-year average for seabird bycatch represents the best information available (2019-2021). Because estimated seabird bycatch in the BSAI was zero for 2019-2021 (Table 4-13), predicted bycatch remains at zero and is therefore not included below. We use a weighted average for the expected increase in effort when combining effort increases across subareas. Results of this exercise are shown in Table 4-14.

Table 4-14 Predicted change in seabird bycatch based on estimated change in effort

		3-year avg seabird bycatch (2019-2021)	# seabirds with effort applied
GOA H&L (103% effort)	Unidentified Albatross	6.33	6.52
	Laysan Albatross	18.00	18.54
	Black-footed Albatross	186.67	192.27
	Northern Fulmar	30.67	31.59
	Shearwaters	15.67	16.14
	Gull	13.33	13.73
	Unidentified Birds	5.67	5.84
GOA POT (107% effort)	Northern Fulmar	3.00	3.21

While it is not possible to project how fishing effort may change from year to year under Alternative 2, based on the methods used in other sections of the analysis, it is reasonable to assume that effort is not likely to increase to a level that would have significant impacts on seabirds because the sablefish IFQ/CDQ fisheries would be constrained by existing regulations concerning the location and timing of the fishery as well as overall catch limits.

Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions on Seabirds

The following RFAs are identified as likely to have an impact on seabirds within the action area and timeframe.

An amendment to allow the Bering Sea Greenland turbot H&L fishery to use longline pot gear has been recommended by the Council.[16] As discussed above, H&L gear is known to be a problematic gear type for seabirds. By allowing longline pot gear in the non-trawl component of the BS Greenland turbot fishery, there is likely to be minimal take of seabirds compared to the historical H&L fishery. The analysis indicated that any potential impacts that do occur are expected to be minimal (NPFMC 2023e).

Climate change, as discussed in other sections of this EA, may result in substantial changes to the composition and distribution of fish assemblages in the North Pacific (Cheung and Frölicher 2020; Yati et al. 2020), which could impact seabird prey species. Future warming may negatively affect seabirds that rely on prey that do not respond well to warming temperatures. However, there is a high degree of uncertainty pertaining to the timing of these climate-induced changes, and the future composition of fish species in Alaska.

Any action by other entities that may impact seabirds will likely be offset by additional protective measures for the federal fisheries to ensure ESA-listed seabirds are not likely to experience jeopardy or adverse modification of critical habitat. Direct mortality by subsistence harvest is likely to continue, but these harvests are tracked and considered in the assessment of seabirds.

Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable actions listed above, the aggregate impacts of the proposed action are determined to be not significant.

4.7 Habitat

Fishing operations may change the abundance or availability of certain habitat features used by managed fish species to spawn, breed, feed, and grow to maturity. These changes may reduce or alter the abundance, distribution, or productivity of species. The effects of fishing on habitat depend on the intensity of fishing, the distribution of fishing with different gears across habitats, and the sensitivity and recovery rates of specific habitat features.

Essential Fish Habitat (EFH) is defined in the Magnuson-Stevens Act as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (50 CFR 600.10). For the purpose of interpreting the definition of essential fish habitat: “waters” includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; “substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities; “necessary” means the habitat required to support a sustainable fishery and a healthy ecosystem; and “spawning, breeding, feeding, or growth to maturity” covers a species’ full life cycle.

In 2005, NMFS and the Council completed the EIS for EFH Identification and Conservation in Alaska (NMFS 2005b). The EFH EIS evaluated the long-term effects of fishing on benthic habitat features, as well as the likely consequences of those habitat changes for each managed stock, based on the best available scientific information. The EFH EIS also described the importance of benthic habitat to different groundfish species and the past and present effects of different types of fishing gear on EFH. Based on the best available scientific information, the EIS analysis concluded that despite persistent disturbance to certain habitats, the effects on EFH are minimal because the analysis finds no indication

[16] Council motion for final action, April 2023

that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term. The EIS concluded that no Council managed fishing activities have more than minimal and temporary adverse effects on EFH for any FMP species, which is the regulatory standard requiring action to minimize adverse effects under the Magnuson-Stevens Act (50 CFR 600.815(a)(2)(ii)). Additionally, the analysis indicated that all fishing activities combined have minimal, but not necessarily temporary, effects on EFH.

The Council and NMFS have updated available habitat information, and their understanding of the impacts of fishing on habitat, in periodic 5-year reviews of the EFH components in the Council fishery management plans (NPFMC and NMFS 2010; NPFMC and NMFS 2016; NPFMC 2023b, NPFMC 2023c, NPFMC 2023d). These 5-year reviews have not indicated findings different from those in the 2005 EFH EIS with respect to fishing effects on habitat, although new and more recent information has led to the refinement of EFH for a subset of Council-managed species. Maps and descriptions of EFH for groundfish species are available in the applicable FMPs. The updates from the 2023 EFH 5-year Review are summarized in the Essential Fish Habitat 2023 5-year Review Summary Report (Harrington et al. In prep) and apply to the GOA and BSAI Groundfish FMPs.

During the 2023 EFH 5-year Review, the fishing effects evaluation modeled habitat disturbance from bottom contact by fishing gear from federally managed fisheries (Zaleski et al. In prep). Gear parameters were included in the model to incorporate the nominal width and bottom contact adjustments for different gear types (Appendix 2, Zaleski et al. In prep). Model results representing the estimated disturbance of species core EFH areas were provided to stock assessment authors to compare with life history parameters. None of the authors concluded that fishing effects on their species were more than minimal and not temporary, and none of the authors recommended any change in management with regards to fishing within EFH at the time of the fishing effects evaluation, and the Council reviewed these results in February 2023 (NPFMC 2023b).

4.7.1 Effects on Habitat

Neither of the alternatives would change current EFH conservation and protection measures including restrictions or prohibiting bottom contact gears.[17] IFQ is assigned to a specific regulatory area in which it must be fished and may be fished only within set fishing seasons. None of the alternatives would change TAC amounts, methods, seasons, or current habitat protections.

Pot and longline gears tend to have the least effect on habitat due to the smaller footprint of the gears.[18] While it is possible that longlines could move small boulders it is unlikely fishing would persist where this would often occur. Relative to other gear types, a significant effect of longline gear on bedrock, cobbles, or sand is unlikely. Any change in effort in the pot fishery is likely to be minimal and impacts on habitat due to potential changes in effort are likely to be incremental, but the full extent of impacts is unknown. Any increase in pot fishing, under either of the alternatives, is not likely to disturb deep sea corals or sponges, particularly due to the low concentrations of deep-sea corals (Goddard et al. 2016; MacLean, Rooper & Sigler 2017). The effects on coral from H&L and longline pot gear are reported to be similar, although no side-by-side comparisons have been done (NPFMC 2016).

4.7.1.1 Alternative 1

The analysis in the EFH EIS and periodic reviews concluded that fisheries do have long term effects on habitat, but these impacts were determined to be minimal and not detrimental to fish populations or their habitats. The analysis in the EFH EIS concludes that current fishing practices in the sablefish IFQ fishery

[17] The use of bottom contact gear is prohibited in the Gulf of Alaska Coral and Alaska Seamount Habitat Protection Areas year-round.
[18] Personal communication with John Olson, formerly NMFS Habitat Conservation Division.

have minimal or temporary effects on benthic habitat and essential fish habitat. These effects are likely to continue under Alternative 1 but are not considered to be significant.

4.7.1.2 Alternative 2

Alternative 2 proposes an FMP amendment and regulatory change to allow vessels participating in the sablefish IFQ fishery to discard small sablefish in the BSAI and GOA. This could result in an increase in fishing effort, such as length of fishing trips or amount of gear deployed, since vessels that choose to discard will need to increase effort to achieve the same amount of quota.

Under Alternative 2, while fishing effort may increase, the sablefish IFQ/CDQ fisheries are still constrained by existing regulations concerning the location and timing of the fisheries, as well as overall catch limits. While it is not possible to project how fishing effort may change from year to year under Alternative 2, any changes in fishing effort may lead to incremental but unknown effects on EFH or habitat, however, given the minimal increase in effort expected from this action and the best available information, it is unlikely that this action would have significant impacts on EFH beyond the status quo. As such, the potential increase in fishing effort because of changes under Alternative 2 are not likely to have impacts on habitat beyond those previously considered. As a result, impacts on habitat under Alternative 2 are determined not to be significant.

Effects of Aggregate Past, Present, and Reasonably Foreseeable Actions on Habitat

The other RFA identified as likely to have an impact on habitat within the action area is the Essential Fish Habitat Omnibus FMP Amendments (89 FR 30318). These amendments, for which the proposed rule comments are due June 24, 2024, would revise the FMPs by updating the description and identification of essential fish habitat (EFH) and updating information on adverse impacts to EFH based on the best scientific information available.

Considering the direct and indirect impacts of the proposed action when added to the impacts of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of the reasonably foreseeable actions listed above, the aggregate impacts of the proposed action are determined to be not significant. This is because the estimated benthic habitat disturbance little to none depending on the gear type.

4.8 NEPA Summary

One of the purposes of an environmental assessment is to provide the evidence and analysis necessary to decide whether an agency must prepare an environmental impact statement (EIS). The Finding of No Significant Impact (FONSI) is the decision maker's determination that the action will not result in significant impacts to the human environment, and therefore, further analysis in an EIS is not needed. The Council on Environmental Quality regulations at 40 CFR 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." An action must be evaluated at different spatial scales and settings to determine the context of the action. Intensity is evaluated with respect to the nature of impacts and the resources or environmental components affected by the action. These factors form the basis of the analysis presented in this Environmental Assessment/Regulatory Impact Review.

This section will be completed for the final action draft.

5 Economic and Social Impacts

This section describes the economic and distributional effects that might be expected to occur as a result of authorizing the voluntary release of sablefish in the sablefish IFQ fishery. The intent of this action is to allow limited operational flexibility to carefully release sablefish that may increase the value of the commercial harvest and allow small sablefish to contribute to the overall biomass.

Assessing the effects of the alternatives, options, and elements involves some degree of speculation. In general, the effects arise from the actions of individual participants in the fishery, under the incentives created by different alternatives and options. Predicting these individual actions and their effects is constrained by incomplete information concerning the fisheries, including the absence of complete economic information and well-tested models of behavior under different institution structures. In addition, exogenous factors, such as stock fluctuations, market dynamics, and macro conditions in the global economy, will influence the response of the participants under each of the alternatives, options, and elements.

This section provides the analysis of Alternative 1 (status quo) and Alternative 2 which would authorize the voluntary release of sablefish caught by sablefish IFQ vessels on directly regulated harvesters. In addition, this section will provide impacts of the alternatives on shore processors and communities that are engaged in or dependent on the sablefish IFQ fishery.

5.1 Methods for the Cost and Benefit Impact Analysis

The costs and benefits of this action are described in the sections that follow, comparing the no action Alternative 1 with the action alternative. The analysis then provides a qualitative assessment of the net benefit to the Nation of each alternative, with “no action” as a baseline.

This analysis was prepared using data from Alaska Department of Fish and Game (ADF&G), which is the best available data to estimate sablefish IFQ catch and ex-vessel prices by market grades. The eLandings system is supported by ADF&G to document commercial harvest from a public resource. The eLandings system provides a method to accurately report commercial fishing activity and comply with the Alaska Fish and Game Laws and Regulations.

Fishery data are provided through the Alaska Fisheries Information Network (AKFIN). AKFIN has access to ADF&G eLandings, NMFS Catch Accounting System (CAS), and Alaska Department of Fish and Game (ADFG) Commercial Operators Annual Report (COAR) data from which it can supply catch and discard records, as well as estimates of gross ex-vessel and first wholesale revenues.

The impact analyses are predicated on the reasoning that the expected impacts are dependent on the extent to which the flexibilities from the proposed action encourages fixed gear IFQ/CDQ harvesters to discard sablefish provided through the elements under Alternative 2 (e.g., vessels that voluntary discard sablefish IFQ under Option 1 or vessels that voluntary discard sablefish IFQ under 22 inches total body length under Option 2). Noting that fishing behavior is difficult to predict, many of the potential impacts are described qualitatively. It is through this framing that the effects on socioeconomic have been analyzed, and these factors are discussed throughout the impact analyses.

5.2 Social Impact Assessment of the Sablefish IFQ Fishery

5.2.1 Methodology

The approach utilized provides tables based on existing quantitative fishery information were developed and are presented in to identify patterns of engagement in and dependency on the sablefish IFQ fishery based on the distribution across communities of the sector most likely to be directly affected by one or more of the proposed alternatives. This is consistent with the National Standard 8 guidelines.

To address the sustained participation of fishing communities that will be affected by management measures, the analysis first identifies affected fishing communities and then assesses their differing levels of dependence on and engagement in the fishery being regulated (50 CFRF 600.345).

This approach provides context for the subsequent analysis of potential community impacts that may occur due to the discarding of sablefish IFQ alternatives selected by the Council. The characterization of the relevant communities, appearing in section 5.2.1 incorporates existing and easily accessible community descriptive information by reference to the extent feasible, which has been supplemented with limited phone and email contacts with individuals and entities to update existing information where needed.

5.2.2 Quantitative Indicators of Community Fishery Engagement and Dependency

A series of tables based on existing quantitative fishery information from 2013 through 2022 were developed to identify patterns of engagement (or participation) in the sablefish IFQ fishery. The distribution and relative magnitude of community engagement in the sablefish IFQ fishery for vessels was measured by IFQ permitted vessel's ownership address information, which is listed in the Alaska Commercial Fisheries Entry Commission (CFEC) vessel registration files.

Some caution in how this information is interpreted is warranted because it is not unusual for vessels to have complex ownership structures that involve more than one entity in more than one community or region. Additionally, the community identified by ownership address may not directly indicate where a vessel spends most of its time, purchases services, or hires its crew from. However, what community ownership address information does provide is an approximate indicator of the distribution and magnitude of ownership ties to a particular community and region. In this way, it is a proxy for some economic activity in the community that is associated with the fishery. The listed ownership address was also used in this section as a way to connect vessels to communities rather than other indicators, such as vessel homeport information, because other SIAs conducted for FMP amendment analysis for the Council have indicated the problematic nature of the existing vessel homeport data.

To understand the distribution and relative magnitude of community engagement in the sablefish IFQ fishery through the shorebased processing component, shorebased processors were identified in data provided by the AFKIN using the intent to operate shorebased processor codes. This approach provides information based on the operating location of the plant, rather than other indicators such as company ownership address, a relative indicator of the local volume of fishery-related activity, and a rough proxy for the relative level of associated employment and local government revenues.

It is important to note, however, that there are some considerable limitations on the scope of quantitative information that can be provided for the shorebased processing component because of confidentiality restrictions. For example, sablefish IFQ vessel gross revenues for Aleutian Islands volume and value of landings for this region cannot be disclosed. This limits the quantitative information that can be provided as well as subsequent discussions of the potential impacts of the management alternatives being considered.

The portion of the review focusing on communities linked to the sablefish IFQ fishery also includes a series of tables based on existing quantitative fishery information to identify patterns of economic dependence on the fishery for communities affiliated with the various sectors by ownership address and those Alaska communities where shorebased processing occurs. "Dependence" is a complex concept with economic and social dimensions, and it can be measured in multiple ways. This portion of the section addresses the economic dimension of communities' dependence on the sablefish IFQ fishery. For communities affiliated with the fishery by vessel ownership address, economic dependence is characterized by comparing the gross ex-vessel or first wholesale revenues earned from the sablefish IFQ fishery to the total revenues generated by the same vessels in all other fisheries (species, gear, and areas). The same general procedure is used for the shorebased processing component.

5.2.2.1 Sablefish IFQ Vessels

The following tables provide a series of quantitative indicators of sector engagement in and dependency on the sablefish IFQ fishery, by community and/or regional geography depending on data confidentiality restrictions, for sablefish IFQ CVs and CPs with local ownership addresses, as noted in the following paragraphs. Overall community vessel fleet dependency is also shown to the extent possible within data confidentiality restrictions. Where appropriate, ex-vessel gross revenue and first wholesale gross revenue from harvesting and processing of 20 percent CDQ sablefish fixed-gear allocations are included in the vessel harvesting tables and shore-based processor tables.

Table 5-1 and Table 5-2 provide a count, by community of historical ownership address and year (2013-2022), of sablefish IFQ/CDQ CVs and CPs for all Alaska communities with any vessels active in the fishery in any given year during this time, as well as for the Seattle metropolitan area, as defined by the Seattle Metropolitan Statistical Area (Seattle MSA); Washington communities outside of the Seattle MSA combined; and Oregon/other states combined. For each geography, annual average counts and percentages of the grand total are also provided, along with a count of unique vessels, which may be indicative of continuity of participation (or lack thereof) at the vessel level. As shown, vessel ownership for CVs among states is concentrated in Alaska, specifically within the Central Gulf of Alaska and Southeast Alaska. Communities within these Alaska regions with large concentrations of sablefish IFQ vessel ownership include Homer, Seward, Kodiak, Juneau, Petersburg, and Sitka. These six communities account for 55.3 percent of the annual average percent of sablefish IFQ/CDQ CVs from 2013 through 2022. Ownership by address for sablefish IFQ/CDQ for CPs is also concentrated in Alaska at approximately 69.91 percent of the total CPs while Washington accounted for 29.79 percent of the CPs. Of the Alaska communities, Sitka had the highest percentage of sablefish IFQ/CDQ CP ownership address at 32.83 percent.

Table 5-1 Sablefish IFQ/CDQ vessels by community of vessel historic ownership address, 2013 through 2022 (number of vessels)

Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual average 2013-2022 (number)	Annual average 2013-2022 (percent)	Unique vessels 2013-2022 (number)
Adak	1	0	0	0	0	0	1	1	0	1	0.4	0.14%	2
Dutch Harbor/Unalaska	3	2	2	1	1	1	1	1	2	1	1.5	0.51%	4
Sand Point	0	0	0	0	0	0	0	0	0	1	0.1	0.03%	1
Aleutian Islands	**4**	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**3**	**2.0**	0.69%	7
Anchorage Metropolitan Area (MSA)*	**9**	**8**	**7**	**9**	**5**	**7**	**8**	**5**	**8**	**7**	**7.3**	2.51%	21
Anchor Point	3	3	3	1	1	0	0	0	0	0	1.1	0.38%	4
Fritz Creek	2	2	1	1	1	2	1	0	0	0	1.0	0.34%	2
Homer	36	37	38	41	44	43	35	31	39	38	38.2	13.11%	76
Kenai	1	0	0	0	0	0	0	0	0	0	0.1	0.03%	1
Kodiak	23	21	22	20	20	20	19	17	14	16	19.2	6.59%	38
Nikolaevsk	1	1	1	0	1	0	0	0	0	1	0.5	0.17%	2
Port Lions	0	0	0	0	0	0	0	0	1	0	0.1	0.03%	1
Seldovia	3	3	2	2	2	1	1	1	1	1	1.7	0.58%	4
Seward	7	5	6	6	7	7	4	6	8	7	6.3	2.16%	11
Soldotna	0	2	2	2	1		2	2	2	2	1.7	0.57%	4
Sterling	1	2	2	2	2	2	2	1	1	1	1.6	0.55%	2
Central Gulf	**77**	**76**	**77**	**75**	**79**	**75**	**64**	**58**	**66**	**66**	**71.3**	24.48%	133
Delta Junction	5	3	3	4	4	5	5	5	5	5	4.4	1.51%	5
Fairbanks	0	0	1	0	1	0	0	0	0	0	0.2	0.07%	1
Interior	**5**	**3**	**4**	**4**	**5**	**5**	**5**	**5**	**5**	**5**	**4.6**	1.58%	6
Auke Bay	3	2	1	1	1	1	2	1	1	1	1.4	0.48%	4
Cordova	5	5	4	4	4	5	5	5	6	6	4.9	1.68%	8
Craig	4	3	4	5	4	4	4	3	3	2	3.6	1.24%	7
Douglas	7	6	6	5	6	6	4	2	2	2	4.6	1.58%	7
Elfin Cove	2	1	1	1	1	2	2	1	1	1	1.3	0.45%	3
Gustavus	1	1	0	0	0	1	0	0	0	0	0.3	0.10%	2
Haines	4	5	4	3	4	4	2	4	4	3	3.7	1.27%	9
Hoonah	3	2	2	2	2	1	1	1	0	1	1.5	0.51%	3
Juneau	14	14	16	18	12	10	9	9	9	10	12.1	4.15%	30
Ketchikan	3	3	3	4	5	4	4	4	5	6	4.1	1.41%	8
Pelican	1	1	1	1	1	1	2	2	1	1	1.2	0.41%	2
Petersburg	30	30	28	28	27	30	27	28	26	27	28.1	9.65%	46
Port Alexander	1	1	0	0	0	0	0	1	1	1	0.5	0.17%	2
Sitka	58	57	57	56	56	57	59	62	54	56	57.2	19.64%	102
Tenakee	0	0	0	0	0	0	0	1	0	0	0.1	0.03%	1
Valdez	0	0	0	1	1	1	1	0	1	0	0.5	0.17%	1
Ward Cove	0	0	0	0	0	0	1	0	2	2	0.5	0.17%	3
Wrangell	4	4	3	3	3	4	4	3	3	3	3.4	1.17%	7
Yakutat	0	0	1	0	1	2	2	1	2	2	1.1	0.38%	3
Southeast	**140**	**135**	**131**	**132**	**128**	**133**	**129**	**128**	**120**	**124**	**130.0**	**44.63%**	**228**
AK	**235**	**224**	**221**	**221**	**218**	**221**	**208**	**198**	**201**	**205**	**215.2**	**73.88%**	**382**
OR	**10**	**9**	**7**	**8**	**4**	**6**	**5**	**6**	**7**	**6**	**6.8**	**2.33%**	**18**
Seattle Metropolitan Area (MSA)	50	48	46	45	40	41	37	32	31	30	40.0	13.73%	68
Other WA**	22	24	25	21	20	21	20	21	22	25	22.1	7.59%	46
WA	**72**	**72**	**71**	**66**	**60**	**62**	**57**	**53**	**53**	**55**	**62.1**	**21.32%**	**107**
Other state* **	**8**	**7**	**7**	**8**	**8**	**6**	**7**	**7**	**7**	**7**	**7.2**	**2.47%**	**19**
Grand total	**325**	**312**	**306**	**303**	**290**	**295**	**277**	**264**	**268**	**273**	**291.3**	**100.00%**	**495**

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

*Includes: Anchorage, Eagle River, Girdwood, Palmer and Wasilla

**30 Communities represented

***18 Communities represented

Table 5-2 Sablefish IFQ/CDQ catcher processors by community of vessel historic ownership address, 2013 through 2022 (number of vessels)

Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual average 2013-2022 (number)	Annual average 2013-2022 (percent)	Unique vessels 2013-2022 (number)
Adak	1	0	0	0	0	0	0	0	0	0	0.1	0.30%	1
Aleutian Islands	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.1**	0.30%	1
Anchorage Metropolitan Area (MSA)	**2**	**3**	**2**	**2**	**1**	**2**	**3**	**0**	**1**	**1**	**1.7**	5.17%	5
Homer	1	0	1	0	0	2	4	1	0	0	0.9	2.74%	6
Kodiak	0	0	0	1	0	2	0	0	0	0	0.3	0.91%	3
Seward	1	1	1	1	1	1	1	1	1	1	1.0	3.04%	1
Central Gulf	**2**	**1**	**2**	**2**	**1**	**5**	**5**	**2**	**1**	**1**	**2.2**	6.69%	10
Delta Junction	0	0	0	1	1	2	0	1	1	0	0.6	1.82%	2
Interior	**0**	**0**	**0**	**1**	**1**	**2**	**0**	**1**	**1**	**0**	**0.6**	1.82%	2
Auke Bay	1	0	0	0	0	0	0	0	0	0	0.1	0.30%	1
Craig	1	1	1	1	1	1	1	1	1	0	0.9	2.74%	2
Douglas	1	1	2	0	0	1	0	0	0	0	0.5	1.52%	3
Haines	1	0	1	0	0	0	0	0	1	0	0.3	0.91%	3
Juneau	0	0	1	3	2	1	3	0	0	0	1.0	3.04%	4
Ketchikan	2	2	2	2	2	2	2	3	3	0	2.0	6.08%	4
Petersburg	0	0	0	1	0	1	1	2	0	1	0.6	1.82%	4
Port Alexander	1	1	0	0	0	0	0	0	0	0	0.2	0.61%	1
Sitka	9	9	9	12	13	10	13	12	12	9	10.8	32.83%	24
Ward Cove	0	0	0	0	0	0	1	0	0	0	0.1	0.30%	1
Wrangell	3	3	2	2	2	2	2	1	1	1	1.9	5.78%	3
Southeast	**19**	**17**	**18**	**21**	**20**	**18**	**23**	**19**	**18**	**11**	**18.4**	**55.93%**	**46**
AK	**24**	**21**	**22**	**26**	**23**	**27**	**31**	**22**	**21**	**13**	**23.0**	**69.91%**	**64**
Seattle Metropolitan Area (MSA)	9	8	9	8	8	8	8	5	7	7	7.7	23.40%	20
Other WA**	2	3	2	2	1	2	3	2	2	2	2.1	6.38%	7
WA	**11**	**11**	**11**	**10**	**9**	**10**	**11**	**7**	**9**	**9**	**9.8**	**29.79%**	**26**
Other state	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0.1**	**0.30%**	**1**
Grand Total	**35**	**32**	**33**	**37**	**32**	**37**	**42**	**29**	**30**	**22**	**32.9**	**100.00%**	**90**

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

*Includes: Anchorage, Eagle River, Girdwood, Palmer and Wasilla

**6 Communities represented

Table 5-3 provides sablefish IFQ/CDQ ex-vessel gross revenue by ownership address at the community and year (2013-2022) level to the extent possible within data confidentiality restrictions, along with annual averages in terms of inflation-adjusted dollars and percentages of the grand total for all geographies combined. The overall pattern of distribution of revenue is clear with Alaska ownership address vessels accounting for about 63 percent of the total of annual average ex-vessel gross revenue, Washington at 32 percent, and Oregon\other states at 5 percent, respectively. Of the Alaska communities, Petersburg at 19 percent and Sitka at 14 percent, respectively contributed to the largest portion of annual average ex-vessel gross revenue by ownership address during the 2013 through 2022 period.

Table 5-3 Sablefish IFQ/CDQ vessels ex-vessel gross revenues by community of vessel historic ownership address, 2013 through 2022 (millions of 2022 real dollars)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual average 2013-2022 ($ millions)	Annual average 2013-2022 (percent)
Aleutian Islands	$0.49	*	*	*	*	*	*	*	*	$0.11	$0.13	0.1%
Anchorage MSA	$3.33	$2.79	$1.36	$1.39	$3.50	$1.65	$2.08	$1.59	$4.17	$6.08	$2.79	2.8%
Homer	$5.13	$6.21	$6.66	$7.57	$9.74	$8.36	$5.71	$4.68	$9.60	$10.96	$7.46	7.4%
Kodiak	$7.20	$7.32	$7.31	$6.95	$8.88	$7.21	$5.04	$3.21	$5.43	$5.51	$6.41	6.3%
Seward	$3.26	$3.19	$3.30	$3.27	$3.93	$2.68	$2.37	$1.68	$3.35	$6.47	$3.35	3.3%
Other CG	$1.50	$1.17	$0.92	$0.98	$0.94	$1.00	$1.13	$0.91	$1.75	$2.17	$1.25	1.2%
Central Gulf	$17.08	$17.90	$18.19	$18.77	$23.49	$19.23	$14.26	$10.47	$20.12	$25.10	$18.46	18.2%
Interior	$0.56	*	*	*	*	*	*	*	*	$1.48	$0.67	0.7%
Cordova	$1.39	$1.44	$1.38	$1.11	$1.94	$2.02	$1.64	$1.42	$2.39	$2.82	$1.76	1.7%
Craig	$0.30	$0.30	$0.33	$0.29	$0.41	$0.34	$0.30	$0.25	$0.19	$0.32	$0.30	0.3%
Haines	$0.65	$0.83	$0.58	$0.10	$0.12	$0.07	$0.14	$0.17	$0.44	$0.65	$0.38	0.4%
Juneau/Douglas	$2.37	$2.39	$2.42	$2.34	$2.59	$1.56	$1.68	$1.60	$1.95	$3.59	$2.25	2.2%
Ketchikan	$0.41	$0.43	$0.46	$0.54	$1.07	$0.35	$0.54	$0.78	$1.11	$1.33	$0.70	0.7%
Petersburg	$17.10	$19.11	$19.18	$19.15	$24.29	$18.04	$13.63	$13.95	$18.16	$30.11	$19.27	19.0%
Sitka	$9.78	$11.39	$12.20	$12.55	$17.82	$18.06	$17.84	$11.44	$14.93	$19.51	$14.55	14.4%
Wrangell	$0.44	$0.49	$0.54	$0.52	$0.75	$0.53	$0.13	$0.12	$0.07	$0.11	$0.37	0.4%
Other SE	$1.26	$1.15	$0.88	$1.20	$1.66	$2.07	$1.73	$1.34	$2.98	$4.21	$1.85	1.8%
Southeast	$33.71	$37.53	$37.97	$37.81	$50.65	$43.04	$37.64	$31.08	$42.23	$62.66	$41.43	40.9%
AK	$55.18	$59.05	$58.36	$58.60	$78.78	$64.57	$54.45	$43.46	$67.06	$95.43	$63.49	62.7%
OR	$2.67	$2.62	$2.10	$2.43	$3.41	$2.29	$1.59	$1.87	$4.26	$3.27	$2.65	2.6%
Seattle Metro	$27.55	$29.95	$27.13	$24.18	$29.77	$25.44	$18.92	$11.11	$16.18	$25.42	$23.56	23.3%
Other Wa	$7.80	$8.37	$8.83	$8.35	$10.23	$7.65	$6.80	$5.31	$9.88	$15.03	$8.82	8.7%
WA	$35.28	$38.32	$35.90	$32.46	$39.91	$33.09	$25.71	$16.42	$26.06	$40.45	$32.39	32.0%
Other State	$3.70	$3.08	$3.35	$3.43	$4.22	$2.16	$1.80	$1.11	$2.12	$2.74	$2.77	2.7%
Grand total	$96.84	$103.07	$99.71	$96.91	$126.32	$102.11	$83.56	$62.86	$99.49	$141.89	$101.28	100.0%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

Table 5-4 provides information on sablefish IFQ/CDQ vessel dependency on sablefish IFQ/CDQ compared to all areas, gear types, and species fished by those same vessels, as measured by percentage contribution to annual average ex-vessel gross revenue. As shown, dependency on sablefish IFQ/CDQ is relatively important for Alaska address vessels with sablefish IFQ/CDQ contributing generally between 21 percent to 58 percent of the annual average total ex-vessel gross revenue from all areas, gear types, and species fished.

Table 5-4 Sablefish IFQ/CDQ ex-vessel gross revenue diversification by community of vessel historic ownership address, 2013 through 2022 (millions of 2022 real dollars)

Geography	Annual average number of sablefish IFQ vessels 2013-2022	Sablefish IFQ vessels annual average ex-vessel gross revenues from sablefish IFQ Only 2013-2022 ($ millions)	Sablefish IFQ vessels annual average total ex-vessel gross revenues from all area, gear, and species fisheries 2013 2022 ($ millions)	Sablefish IFQ ex-vessel value as a percentage of total ex-vessel gross revenue annual average 2013-2022
Aleutian Islands	2.0	$0.1	$1.9	7.2%
Anchorage MSA	7.3	$2.8	$12.5	22.3%
Homer	38.2	$7.5	$27.9	26.7%
Kodiak	19.2	$6.4	$25.8	24.8%
Seward	6.3	$3.3	$10.1	33.3%
Other CG	7.6	$1.2	$5.9	21.3%
Central Gulf	71.3	$18.5	$69.6	26.5%
Interior	4.6	$0.7	$3.2	21.2%
Cordova	4.9	$1.8	$4.3	40.9%
Craig	3.6	$0.3	$1.2	25.1%
Haines	3.7	$0.4	$1.4	27.7%
Juneau/Douglas	16.7	$2.2	$9.7	23.2%
Ketchikan	4.1	$0.7	$3.0	23.3%
Petersburg	28.1	$19.3	$33.4	57.7%
Sitka	57.2	$14.6	$35.8	40.7%
Wrangell	3.4	$0.4	$1.2	31.2%
Other SE	8.3	$1.8	$6.8	27.1%
Southeast	130.0	$41.4	$96.7	42.8%
AK	**215.2**	**$63.5**	**$183.9**	**34.5%**
OR	**6.8**	**$2.7**	**$8.9**	**29.7%**
Seattle MSA	40.0	$23.6	$113.0	20.8%
Other Wa	22.1	$8.8	$43.6	20.2%
WA	**62.1**	**$32.4**	**$138.3**	**23.4%**
Other State	**7.2**	**$2.8**	**$13.1**	**21.2%**
Grand Total	**291.3**	**$101.3**	**$344.2**	**29.4%**

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

Table 5-5 provides information on overall community vessel dependency on sablefish IFQ/CDQ. This table includes all commercial fishing vessels, not just vessels that participate in the sablefish IFQ/CDQ fishery for those communities that had at least local ownership address sablefish IFQ/CDQ vessel participating in the fishery in any year 2013-2022. It compares the ex-vessel revenue from vessel caught sablefish IFQ/CDQ to ex-vessel revenue from all other areas, gear types, and species fished by all commercial fishing vessels with ownership addresses in that same community. As shown, several Alaska communities are relatively dependent on the sablefish IFQ/CDQ fishery, as measured by contribution to total ex-vessel gross revenues. These Alaska communities include Sitka at 23 percent, Seward at 22 percent, and Petersburg at 12 percent. Other Alaska communities include Juneau/Douglas at 7 percent and Homer at 6 percent.

Table 5-5 Sablefish and all vessels ex-vessel gross revenue diversification by community of vessel historic ownership address, 2013 through 2022 (millions of 2022 real dollars)

Geography	Annual average number of sablefish IFQ vessels 2013-2022	All commercial fishing vessels annual average ex-vessel gross ex-vessel revenues from sablefish IFQ only 2013-2022 ($ millions)	Annual average number of all commercial fishing vessels in those same communities (the "community fleet") 2013-2022	All commercial fishing CVs annual average total ex-vessel gross ex-vessel revenues from all areas, gears, and species fisheries 2013-2022 ($ millions)	Sablefish IFQ annual average ex-vessel gross revenue as a percentage of total community annual average ex-vessel gross revenue 2013-2022
Aleutian Islands	2.0	$0.1	73.6	$23.0	0.6%
Anchorage MSA	7.3	$2.8	342.0	$117.7	2.4%
Homer	38.2	$7.5	393.3	$123.7	6.0%
Kodiak	19.2	$6.4	236.0	$141.8	4.5%
Seward	6.3	$3.3	35.3	$15.1	22.1%
Other CG	7.6	$1.2	189.5	$28.1	4.4%
Central Gulf	71.3	$18.5	854.1	$308.8	6.0%
Interior	4.6	$0.7	28.5	$7.5	9.0%
Cordova	4.9	$1.8	318.1	$43.4	4.0%
Craig	3.6	$0.3	104.7	$12.4	2.4%
Haines	3.7	$0.4	78.6	$9.7	3.9%
Juneau/Douglas	16.7	$2.2	202.0	$32.3	7.0%
Ketchikan	4.1	$0.7	175.2	$23.4	3.0%
Petersburg	28.1	$19.3	291.8	$166.4	11.6%
Sitka	57.2	$14.6	367.6	$62.8	23.2%
Wrangell	3.4	$0.4	140.9	$16.2	2.3%
Other SE	8.3	$1.8	232.2	$25.5	7.3%
Southeast	130.0	$41.4	1911.1	$392.2	10.6%
AK	**215.2**	**$63.5**	**3209.3**	**$849.2**	**7.5%**
OR	**6.8**	**$2.7**	**82.9**	**$27.4**	**9.7%**
Seattle MSA	40.0	$23.6	392.3	$791.7	3.0%
Other Wa	22.1	$8.8	314.8	$138.0	6.4%
WA	**62.1**	**$32.4**	**707.1**	**$929.7**	**3.5%**
Other State	**7.2**	**$2.8**	**24.4**	**$16.2**	**17.1%**
Grand Total	**291.3**	**$101.3**	**4023.7**	**$1,824.4**	**5.6%**

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

Table 5-6 provides information on annual sablefish IFQ/CDQ vessel dependency on the sablefish IFQ/CDQ fishery relative to the total gross ex-vessel revenue from all other areas, gear types, and species fished by these vessels. In general, the distribution of sablefish IFQ/CDQ vessels between 2013 and 2022 has shifted from vessels that received a smaller proportion of their total revenue from the sablefish IFQ/CDQ fishery to vessels that received a higher proportion of their total revenue from the sablefish IFQ/CDQ fishery.

Table 5-7 provides the number of sablefish IFQ/CDQ vessels by ex-vessel revenue as a percent of total ex-vessel revenue from sablefish IFQ/CDQ, halibut, Pacific cod, and salmon. In general, the largest number of sablefish IFQ/CDQ vessels receive most of their ex-vessel revenue from the sablefish IFQ/CDQ and halibut fisheries, while ex-vessel revenue from the salmon and Pacific cod fisheries are less important for most sablefish IFQ/CDQ vessels.

Table 5-6 Sablefish IFQ/CDQ vessels by sablefish IFQ/CDQ ex-vessel revenue as a percent of total ex-vessel revenue, 2013 through 2022 (number of vessels)

Sablefish IFQ/CDQ revenue as a % of total	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual average 2013-2022
<1%	2	5	6	4	2	3	1	0	0	3	3
1-10%	75	56	60	54	42	49	49	46	47	34	51
10-20%	61	36	28	36	22	30	37	36	36	31	35
20-30%	38	50	47	48	39	42	33	28	43	29	40
30-40%	51	57	52	49	43	37	32	44	43	41	45
40-50%	27	34	34	41	50	45	40	37	31	38	38
50-60%	32	33	40	34	30	31	38	30	32	37	34
60-70%	21	25	29	22	35	36	24	23	16	25	26
70-80%	9	9	6	8	17	10	14	8	8	10	10
80-90%	3	2	1	3	7	7	2	6	6	11	5
90-100%	6	5	3	4	3	5	7	6	6	14	6
Grand total	325	312	306	303	290	295	277	264	268	273	291

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

Table 5-7 Sablefish IFQ/CDQ vessels ex-vessel revenue as a percent of total ex-vessel revenue by fishery, 2013 through 2022 (number of vessels)

Rev as a % of total	Sablefish IFQ/CDQ	Halibut	Pacific cod	Salmon
<.1%	3	29	206	143
.1-10%	51	25	37	20
10-20%	35	39	14	24
20-30%	40	50	9	28
30-40%	45	46	7	26
40-50%	38	39	7	17
50-60%	34	24	5	15
60-70%	26	15	3	9
70-80%	10	10	2	6
80-90%	5	7	1	2
90-100%	6	8	1	1

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

Table 5-8 provides information on the number of crew harvesting IFQ sablefish by vessel size from 2011 through 2022. As shown, the largest number of crew harvesting IFQ sablefish work on vessels less than 60’ which ranged from a low of 546 in 2020 to a high of 713 in 2011. For sablefish IFQ vessels greater than 60’, crew numbers ranged from a low of 265 in 2020 to a high of 504 in 2011. In total, the number of crew on sablefish IFQ vessels ranged from a low of 1,057 in 2020 to a high of 1,584 in 2011.

Table 5-8 Crew harvesting sablefish IFQ by vessel size, 2011 through 2022

Year	Vessel size				Total
	<40	<50	<60	>60	
2011	66	300	713	504	1,584
2012	67	304	711	452	1,534
2013	58	294	668	336	1,356
2014	69	265	664	371	1,370
2015	53	276	657	322	1,307
2016	72	258	657	304	1,291
2017	62	289	628	298	1,277
2018	59	264	652	311	1,286
2019	51	252	588	313	1,205
2020	31	215	546	265	1,057
2021	41	213	568	300	1,122
2022	34	232	579	312	1,157

Source: AKFIN; source file is Sablefish_Crew (3-27-24)

5.2.2.2 Sablefish Quota Share Owners

Table 5-9 provides information on sablefish quota share owners by community based on the owner's address from 2013 through 2024. The community with the largest number of sablefish quota owners is Sitka at an annual average of 123 sablefish quota share owners. The number of sablefish quota share owners reporting Sitka as their address has ranged from a low 118 in 2018 to high of 129 in both 2023 and 2024. Other communities with a high concentration of sablefish quota share owners included Kodiak at annual average of 68 sablefish quota share owners, Petersburg at 59 sablefish quota share owners, and Seward at 57 sablefish quota share owners.

Table 5-9 Sablefish quota share owners by owner's address, 2013 through 2024 (number of persons)

Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Annual average 2013-2024 (number)	Annual average 2014-2022 (percent)	Unique vessels 2013-2022 (number)
Bering Sea and Aleutian Islands Total*	**9**	**9**	**9**	**12**	**12**	**14**	**14**	**13**	**12**	**11**	**11**	**10**	**11.3**	1.39%	16
Anchorage Metropolitan Area	31	35	34	33	33	28	34	33	37	37	35	35	33.8	4.15%	63
Homer	28	26	24	22	20	20	21	21	19	18	18	17	21.2	2.60%	37
Kodiak	60	58	60	65	70	69	71	72	73	73	72	72	67.9	8.35%	107
Seward	61	60	60	57	58	55	55	55	57	54	55	55	56.8	6.98%	79
Other Central Gulf	17	18	18	18	16	16	15	15	15	15	16	16	16.3	2.00%	22
Central Gulf Total	**197**	**197**	**196**	**195**	**197**	**188**	**196**	**196**	**201**	**197**	**196**	**195**	**195.9**	24.08%	296
Interior Total	**8**	**8**	**9**	**9**	**8**	**10**	**9**	**10**	**11**	**13**	**13**	**13**	**10.1**	1.24%	18
Cordova	10	10	11	10	12	15	18	18	21	21	21	21	15.7	1.93%	27
Craig	10	9	10	10	8	8	9	8	9	9	9	9	9.0	1.11%	13
Douglas	8	7	5	6	6	5	5	5	5	5	5	4	5.5	0.68%	11
Haines	12	11	9	8	7	8	7	8	8	6	5	5	7.8	0.96%	17
Juneau	26	26	25	22	22	21	23	22	22	23	23	23	23.2	2.85%	44
Ketchikan	8	8	9	9	10	10	11	11	11	12	12	11	10.2	1.25%	14
Petersburg	59	57	60	58	55	60	59	59	60	59	61	61	59.0	7.25%	91
Sitka	120	119	120	120	119	118	122	126	128	128	129	129	123.2	15.14%	186
Other Southeast	33	30	28	28	25	25	25	26	25	26	28	28	27.3	3.35%	45
Southeast Total	**286**	**277**	**277**	**271**	**264**	**270**	**279**	**283**	**289**	**289**	**293**	**291**	**280.8**	**34.50%**	**430**
Western Gulf Total	**4**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**4**	**4**	**4**	**4**	**3.3**	**0.40%**	**6**
AK	**504**	**494**	**493**	**489**	**484**	**485**	**501**	**505**	**517**	**514**	**517**	**513**	**501.3**	**61.61%**	**755**
OR	**38**	**38**	**34**	**32**	**34**	**35**	**36**	**39**	**38**	**36**	**34**	**32**	**35.5**	**4.36%**	**59**
Seattle Metropolitan Area	160	159	160	152	149	152	153	145	143	138	138	136	148.8	18.28%	222
Other WA	77	70	73	75	73	69	65	66	60	61	57	57	66.9	8.22%	115
WA	**237**	**229**	**233**	**227**	**222**	**221**	**218**	**211**	**203**	**199**	**195**	**193**	**215.7**	**26.50%**	**312**
Other States	**57**	**58**	**59**	**61**	**55**	**56**	**58**	**66**	**62**	**63**	**67**	**73**	**61.3**	**7.53%**	**120**
Grand Total	**836**	**819**	**819**	**809**	**795**	**797**	**813**	**821**	**820**	**812**	**813**	**811**	**813.8**	**100.00%**	**1145**

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

*Includes Adak, Akutan, Dillingham, Dutch Harbor/Unalaska, Naknek, St Paul Island

Table 5-10 provides information on sablefish quota share by community from 2013 through 2024. The region with the largest concentration of sablefish quota share is the Southeast 106.46 million shares which accounts for 31 percent of all sablefish quota shares followed by the Central Gulf of Alaska region at 55.39 million shares accounting for 16 percent of the total sablefish quota shares. Southeast communities with the largest concentration of sablefish quota shares include Petersburg at an annual average of 52.82 million quota shares followed by Sitka at 30.85 million quota shares. Of the Central Gulf of Alaska communities, Kodiak at 17.57 million quota shares and the Anchorage metropolitan area at 16.83 million quota shares have the highest concentration of quota shares in this region.

Table 5-10 Sablefish quota by community of owner's address, 2013 through 2024 (millions of shares)

Community	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Annual average 2013-2024 (millions)	Annual average 2013-2024 (percent)
Bering Sea and Aleutian Islands Total*	**4.72**	**4.91**	**4.74**	**5.38**	**5.44**	**9.21**	**9.16**	**5.99**	**9.55**	**10.15**	**10.21**	**10.21**	**7.47**	2.17%
Anchorage Metropolitan Area	13.72	13.87	14.09	18.06	20.88	15.68	13.61	15.75	18.70	19.33	19.15	19.15	16.83	4.89%
Homer	8.25	7.87	8.59	8.97	10.65	10.97	12.04	12.45	11.24	11.00	10.63	10.63	10.27	2.98%
Kodiak	19.91	19.44	19.26	15.67	19.28	16.44	15.78	16.05	18.81	17.43	17.37	17.57	17.75	5.16%
Seward	6.63	6.97	7.41	7.50	6.97	7.07	7.09	7.37	9.44	9.48	9.98	9.98	7.99	2.32%
Other Central Gulf	3.50	2.87	2.71	2.72	2.66	2.41	2.64	2.66	2.37	1.98	1.98	1.98	2.54	0.74%
Central Gulf Total	**52.01**	**51.02**	**52.07**	**52.93**	**60.43**	**52.57**	**51.16**	**54.28**	**60.56**	**59.22**	**59.11**	**59.30**	**55.39**	16.09%
Interior Total	**0.53**	**0.53**	**	**	**0.62**	**0.73**	**0.97**	**1.00**	**0.93**	**1.47**	**1.52**	**1.52**	**0.98**	0.29%
Cordova	3.39	3.39	3.39	3.27	4.27	5.56	5.73	6.19	6.54	6.83	6.83	6.83	5.18	1.51%
Craig	0.75	0.73	0.74	0.74	0.83	0.83	0.90	0.68	0.73	0.73	0.73	0.73	0.76	0.22%
Douglas	2.37	2.31	2.32	2.21	2.23	2.20	2.14	2.14	2.07	2.44	2.44	2.39	2.27	0.66%
Haines	0.73	0.71	0.56	0.50	0.50	0.77	0.65	0.69	0.80	0.76	0.44	0.44	0.63	0.18%
Juneau	7.97	8.13	6.71	6.28	5.91	5.33	6.39	6.24	5.38	5.86	5.97	6.02	6.35	1.84%
Ketchikan	1.30	1.30	1.39	1.39	1.39	1.53	1.57	1.57	1.68	2.56	2.49	2.49	1.72	0.50%
Petersburg	52.21	52.92	54.07	54.71	49.95	53.68	53.04	52.92	54.28	51.78	52.14	52.14	52.82	15.35%
Sitka	30.39	30.91	29.48	30.27	30.63	30.75	31.09	31.35	31.93	31.73	30.84	30.84	30.85	8.96%
Other Southeast	5.39	4.79	6.11	6.88	6.29	4.78	6.10	5.79	5.39	5.53	6.72	6.72	5.87	1.71%
Southeast Total	**104.48**	**105.20**	**104.77**	**106.26**	**101.98**	**105.43**	**107.61**	**107.56**	**108.80**	**108.21**	**108.61**	**108.61**	**106.46**	**30.93%**
Western Gulf Total	**0.09**	**0.06**	**	**	**0.02**	**0.02**	**0.02**	**0.02**	**0.09**	**0.09**	**0.09**	**0.09**	**0.06**	**0.02%**
AK	**161.95**	**161.74**	**162.20**	**165.25**	**168.56**	**168.02**	**169.00**	**168.93**	**180.00**	**179.20**	**179.59**	**179.79**	**170.35**	**49.49%**
OR	**11.56**	**12.23**	**11.60**	**10.42**	**10.36**	**10.40**	**10.92**	**16.56**	**16.99**	**19.27**	**18.83**	**15.66**	**13.73**	**3.99%**
Seattle Metropolitan Area	26.56	22.33	26.99	27.94	27.13	25.12	25.53	23.28	19.43	20.65	18.31	18.31	23.47	6.82%
Other WA*	122.38	125.03	120.30	117.43	115.15	117.43	113.28	107.94	103.01	99.84	99.06	102.00	111.90	32.51%
WA	**148.94**	**147.36**	**147.29**	**145.37**	**142.28**	**142.54**	**138.81**	**131.22**	**122.45**	**120.50**	**117.37**	**120.31**	**135.37**	**39.33%**
Other States	**21.45**	**22.93**	**23.75**	**24.11**	**21.57**	**23.68**	**25.59**	**27.55**	**25.51**	**24.72**	**28.08**	**28.12**	**24.76**	**7.19%**
Grand Total	**343.90**	**344.26**	**344.84**	**345.16**	**342.78**	**344.64**	**344.32**	**344.26**	**344.94**	**343.69**	**343.87**	**343.87**	**344.21**	**100.00%**

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

*Includes Adak, Akutan, Dillingham, Dutch Harbor/Unalaska, Naknek, St Paul Island

**Confidential

5.2.2.3 Shore-based Processors Accepting Sablefish

The following tables provide a series of quantitative indicators of sector engagement in and dependency on the IFQ/CDQ sablefish fishery. Engagement is shown through participation by community and/or regional geography depending on data confidentiality constraints, for shore-based processors operating in Alaska and Washington, as noted in the following paragraphs. Overall community shore-based processor dependency (as measured in percentage of total ex-vessel value paid for all deliveries from all fisheries made to the relevant processors) is also shown to the extent possible within confidentiality constraints. Table 5-11 provides information on the distribution of relevant shore-based processors in Alaska and Washington communities active in the period 2013 through 2022. For the purpose of this portion of the analysis, relevant shore-based processors are defined as those shore-based entities accepting IFQ/CDQ sablefish deliveries. As shown, 62 Alaska communities were the locations of relevant shore-based processing over this period accepting IFQ/CDQ sablefish deliveries in each year included in the data, with multiple communities having multiple processors accepting IFQ/CDQ sablefish deliveries in each year.

Table 5-11 Shore-based processors and floating processors in Alaska accepting sablefish IFQ/CDQ deliveries by community of operation, 2013 through 2022 (number of processors)

Port area	City	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual average 2013-2022 (number)	Annual average 2013-2022 (percent)	Total unique SBPRs 2013-2022 (number)
BSAI	Adak	1	1	1	1	2	1	1	1	0	0	0.9	2.65%	2
	Akutan	1	1	1	1	1	1	1	1	1	1	1.0	2.94%	1
	Atka	1	1	1	1	1	0	0	0	0	0	0.6	1.63%	1
	Dillingham	0	0	0	0	0	0	0	0	1	0	0.1	0.29%	1
	Dutch Harbor	2	1	1	1	1	2	2	1	1	1	1.3	3.92%	2
	St Paul	1	1	1	1	1	0	1	0	0	0	0.7	1.96%	1
BSAI Total		**6**	**5**	**5**	**5**	**6**	**4**	**5**	**3**	**3**	**2**	**4.7**	**13.73%**	**8**
Central Gulf	Anchorage	3	4	1	2	1	2	2	2	2	2	2.1	6.21%	4
	Homer	3	2	2	1	1	1	1	0	0	1	1.2	3.59%	4
	Kenai	1	1	2	1	2	1	1	1	1	1	1.2	3.59%	3
	Kodiak	6	5	5	6	5	6	5	6	6	5	5.6	16.34%	10
	Seward	2	2	2	2	1	2	3	2	3	4	2.1	6.21%	5
CG Total		**15**	**14**	**12**	**12**	**10**	**12**	**12**	**11**	**12**	**13**	**12.2**	**35.95%**	**26**
Southeast	Cordova	1	1	1	1	1	2	2	2	2	2	1.4	4.25%	2
	Craig	0	0	0	0	0	0	1	0	1	0	0.2	0.59%	1
	Haines	0	0	0	0	1	1	1	0	0	0	0.3	0.88%	2
	Juneau	3	2	2	2	2	2	2	3	2	2	2.2	6.54%	4
	Ketchikan	3	2	3	3	3	3	3	3	2	3	2.8	8.17%	3
	Pelican	0	0	0	0	0	1	1	1	1	0	0.4	1.18%	1
	Petersburg	2	2	2	2	2	2	3	2	2	2	2.1	6.21%	3
	Sitka	2	2	2	2	3	3	3	4	3	3	2.7	7.84%	4
	Valdez	1	1	1	1	0	0	0	0	0	0	0.4	1.18%	1
	Wrangell	1	1	1	1	1	1	1	1	1	1	1.0	2.94%	1
	Yakutat	1	1	1	1	1	1	1	1	1	1	1.0	2.94%	2
SE Total		**14**	**12**	**13**	**13**	**14**	**16**	**18**	**17**	**15**	**14**	**14.7**	**43.14%**	**22**
WG	False Pass	1	1	1	1	1	0	0	0	0	0	0.5	1.47%	1
	King Cove	1	1	1	1	1	1	1	0	1	1	0.9	2.61%	2
	Sand Point	1	1	1	1	1	1	1	1	1	1	1.0	2.94%	1
WG Total		**3**	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**2.4**	**7.19%**	**4**
Grand Total		38	34	33	33	33	34	37	32	32	31	34.0	100.00%	62

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

*Includes Floating Processors

Table 5-12 provides information on the first wholesale gross revenue for IFQ/CDQ sablefish by shore-based processors associated with IFQ/CDQ sablefish deliveries by community and year (2013 through 2022) to the extent possible within data confidentiality constraints. As shown, Sitka, Seward, Kodiak, and Petersburg combined account for approximately 67 percent of the average annual first wholesale gross revenue of IFQ/CDQ sablefish delivered to shore-based processors from 2013 through 2022. The remaining 33 percent of the average annual first wholesale gross revenue from CDQ/IFQ sablefish is included in other communities.

Table 5-12 Wholesale values of sablefish IFQ/CDQ deliveries to shore-based processors in Alaska by community of operation, 2013 through 2022 (millions of 2022 dollars)

Port Area	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Annual average 2011-2019 ($ millions)	Annual average 2011-2019 (percent)
BSAI	$13.41	$11.48	$8.56	$7.45	$12.29	$7.68	$6.85	$8.08	$15.21	$22.82	$11.38	9.06%
Anchorage	$2.46	$2.13	$.85	$.74	$.19	$1.91	$2.65	$1.56	$2.30	$1.71	$1.65	1.31%
Homer	$.58	$.41	$.33	$.10	$.08	$.00	$.00	$.00	$.00	$.00	$.15	0.12%
Kenai	$3.17	$2.11	$2.16	$.71	$.62	$.38	$1.20	$.14	$.41	$1.79	$1.27	1.01%
Kodiak	$19.23	$18.27	$16.40	$19.01	$24.69	$18.97	$16.70	$12.47	$20.24	$20.83	$18.68	14.86%
Seward	$21.51	$25.43	$24.89	$28.13	$14.72	$18.44	$13.15	$14.72	$22.83	$26.07	$20.99	16.70%
Central Gulf	$46.95	$48.35	$44.63	$48.69	$40.30	$39.70	$33.71	$28.90	$45.78	$50.41	$42.74	34.00%
Juneau	$8.62	$6.80	$8.06	$6.39	$6.59	$4.25	$4.19	$5.24	$5.51	$5.71	$6.14	4.88%
Ketchikan	$.35	$.17	$.30	$.98	$.98	$.60	$.36	$.38	$.33	$.55	$.50	0.40%
Petersburg	$14.94	$15.70	$14.34	$15.96	$19.96	$19.08	$18.81	$14.71	$11.86	$10.24	$15.56	12.38%
Sitka	$30.62	$34.11	$32.43	$32.81	$39.47	$32.94	$16.11	$16.01	$25.19	$29.31	$28.90	22.99%
Other Southeast	$11.39	$10.77	$10.09	$10.07	$11.35	$11.45	$10.30	$8.37	$14.61	$19.75	$11.82	9.40%
Southeast	$65.91	$67.56	$65.22	$66.21	$78.34	$68.33	$49.77	$44.71	$57.50	$65.55	$62.91	50.05%
Western Gulf	$9.22	$8.14	$6.03	$5.73	$7.70	$6.45	$5.22	$2.77	$15.68	$19.79	$8.67	6.90%
Grand Total	$135.49	$135.53	$124.44	$128.09	$138.63	$122.16	$95.55	$84.46	$134.17	$158.57	$125.71	100.00%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

*Includes Inshore Floating Processors

Table 5-13 provides information on average annual shore-based processor dependency on deliveries of IFQ/CDQ sablefish compared to all area and species fisheries landings processed by those same processors for the years 2013 through 2022, as measured in percentage of first wholesale gross revenue associated with deliveries made to these processors. For Sitka, Seward, and Juneau shore-based processors receiving IFQ/CDQ sablefish deliveries, the first wholesale gross revenue of landings associated with those IFQ/CDQ sablefish deliveries over 2013 through 2022 were significant relative to the total first wholesale revenue of landings of all species. For those processors receiving IFQ/CDQ sablefish in Sitka and Seward, first wholesale gross revenue of landings associated with those IFQ/CDQ sablefish deliveries contributed 36 percent and 25 percent of the total first wholesale gross revenue of landings of all species for those processors in those communities, respectively. For Juneau processors receiving deliveries of IFQ/CDQ sablefish deliveries, 14 percent of the total first wholesale gross revenues of landings of all species were associated with IFQ/CDQ sablefish deliveries.

Table 5-13 Wholesale values of sablefish IFQ/CDQ to shore-based processors in Alaska by community of operation and total processor activity, 2013 through 2022 (millions of 2022 dollars)

Port area	Annual average number of sablefish IFQ/CDQ SBPRs 2013-2022	SBPRs annual average wholesale value of sablefish IFQ/CDQ 2013-2022 ($ millions)	SBPRs annual average total wholesale value of all area, gear, and species fisheries 2013 2022 ($ millions)	Wholesale values for sablefish IFQ as a percentage of total wholesale values
BSAI	4.7	$11.38	$623.64	1.8%
Anchorage	2.1	$1.65	$45.10	3.7%
Homer	1.2	$.15	$8.15	1.8%
Kenai	1.2	$1.27	$34.75	3.7%
Kodiak	5.6	$18.68	$351.21	5.3%
Seward	2.1	$20.99	$82.63	25.4%
Central Gulf	12.2	$42.74	$521.85	8.2%
Juneau	2.2	$6.14	$44.64	13.7%
Ketchikan	2.8	$.50	$112.81	0.4%
Petersburg	2.1	$15.56	$208.63	7.5%
Sitka	2.7	$28.90	$80.20	36.0%
Other Southeast	4.9	$11.82	$58.37	20.2%
Southeast	14.7	$62.91	$504.65	12.5%
Western Gulf	2.4	$8.67	$238.00	3.6%
Grand Total	34.0	$125.71	$1888.14	6.7%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

Table 5-14 provides information on average annual total shore-based processor dependency on IFQ/CDQ sablefish (all shore-based processors in the communities that had at least one shore-based processor that accepted IFQ/CDQ sablefish deliveries, not just the shore-based processors that participate in that fishery) compared to all area and species fishery landings processed by all processors in the community(ies) for the years 2013-2022, within the constraints of confidentiality restrictions, as measured by first wholesale gross revenue associated with those landings. As shown, for the span of years provided, IFQ/CDQ sablefish first wholesale gross revenue of landings accounted for about 24 percent and 17 percent of all shore-based processor first wholesale gross revenue of landings for Seward and Sitka, respectively.

Table 5-14 Wholesale values of sablefish IFQ/CDQ for shore-based processors in Alaska by community of operation and total community processing, 2013-2022 (millions of 2022 dollars)

Port area	Annual average number of sablefish IFQ/CDQ SBPRs 2013-2022	SBPRs annual average wholesale value of sablefish IFQ/CDQ 2013-2022 ($ millions)	Annual average number of all SBPRs in those same communities (the "community SBPR sector") 2013-2022	SBPRs annual average total wholesale values of all area, gear, and ¯species fisheries 2013 2022 ($ millions)	Wholesale value of sablefish IFQ/CDQ as a percentage of total wholesale value for the community
BSAI	4.7	$11.38	14.9	$1103.50	1.0%
Anchorage	2.1	$1.65	10.8	$131.37	1.3%
Homer	1.2	$.15	5.4	$13.04	1.2%
Kenai	1.2	$1.27	5.8	$65.40	1.9%
Kodiak	5.6	$18.68	10.5	$415.26	4.5%
Seward	2.1	$20.99	4.3	$88.44	23.7%
Central Gulf	12.2	$42.74	36.8	$713.51	6.0%
Juneau	2.2	$6.14	9.1	$87.37	7.0%
Ketchikan	2.8	$.50	6.3	$141.30	0.4%
Petersburg	2.1	$15.56	5.9	$212.98	7.3%
Sitka	2.7	$28.90	6.6	$171.62	16.8%
Other Southeast	4.9	$11.82	22.5	$316.80	3.7%
Southeast	14.7	$62.91	50.4	$930.06	6.8%
Western Gulf	2.4	$8.67	3.4	$248.24	3.5%
Grand Total	34.0	$125.71	105.5	$2995.31	4.2%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

5.3 Economic Impacts of Alternative 1, No Action

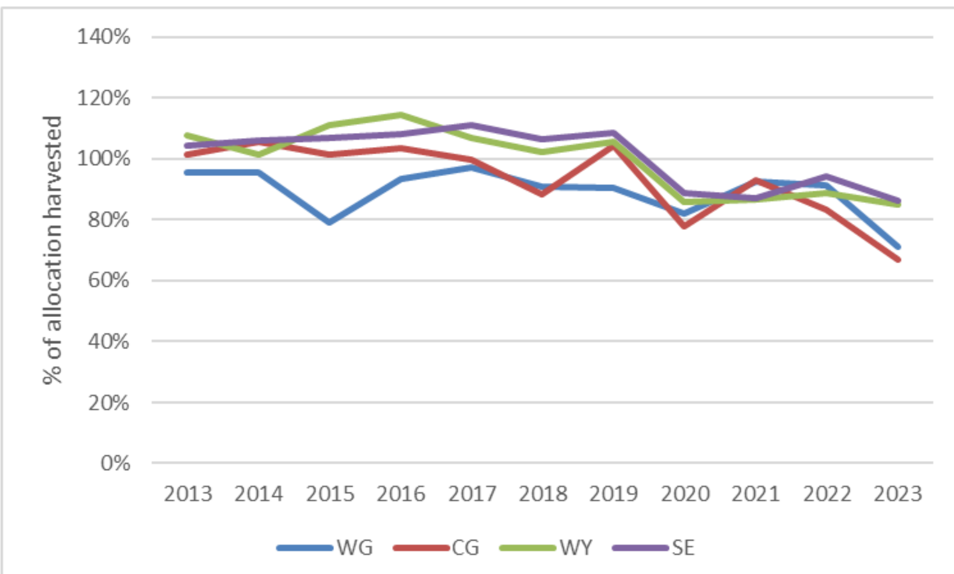
Selecting Alternative 1 (no action) would leave in place the existing regulatory restrictions that prohibit release of any sablefish caught by sablefish IFQ vessels, either when directing on sablefish, or when anyone onboard has unused IFQ in their account. Under Alternative 1, harvest participation and fishing behavior in the sablefish IFQ fishery are likely to be similar to the current participation and fishing practices given the numerous factors impacting the sablefish IFQ fishery. As noted in Table 5-15 and Figure 5-1, in the GOA regulatory area, harvesters from 2013 through 2018 landed all or nearly all their sablefish IFQ allocation. However, starting in 2019, allocations of sablefish IFQ started to increase significantly while at the same time the percentage of sablefish IFQ allocations harvested declined for all regulatory areas except WY which started its decline in 2016 and the BS which started to decline following the 2020 season. As of the end of the 2023 fishing season, each of the regulatory areas harvested less than 90%of their allocation and the overall combined harvest of sablefish IFQ allocations for all regulatory areas was 63%.

Table 5-15 Percent of sablefish IFQ allocations harvested by regulatory area, 2013 through 2023

Year	AI	BS	WG	CG	WY	SE	Total
2013	60%	57%	96%	102%	108%	105%	96%
2014	49%	36%	95%	106%	102%	106%	95%
2015	38%	26%	79%	101%	111%	107%	91%
2016	33%	38%	93%	104%	115%	108%	95%
2017	30%	54%	97%	100%	107%	111%	94%
2018	27%	46%	91%	88%	102%	107%	87%
2019	32%	67%	90%	104%	106%	109%	95%
2020	25%	66%	82%	78%	86%	89%	77%
2021	18%	74%	93%	93%	87%	87%	79%
2022	15%	88%	91%	84%	89%	94%	77%
2023	11%	63%	71%	67%	85%	86%	63%

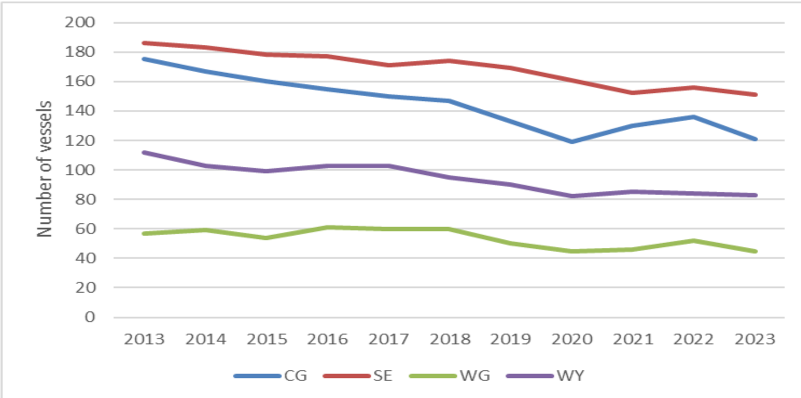
Source: AKFIN; source file is sablefish_removals(2-27-24)

Figure 5-1 Percent of GOA sablefish IFQ allocations harvested by regulatory area, 2013 through 2023



In addition, the number of vessels participating in the sablefish IFQ fishery would likely follow similar trends. As noted in Figure 5-2, starting in 2013, the number of vessels participating in the GOA sablefish IFQ fishery has generally been diminishing. The number of vessels did increase for a brief period during the 2020 and 2022 seasons, but once again declined during the 2023 season.

Figure 5-2 Number of vessels participating in the GOA sablefish IFQ fisheries by regulatory area, 2013 through 2023



Despite the reduced utilization of sablefish IFQ allocations in recent years and the reduced number of vessels participating in the sablefish IFQ fishery since 2013, Figure 5-3 indicates that the overall number of fishing days has increased during this same period. In 2014, the number of days fished (summed across all vessels) was 9,070 while in 2022 the number of days was 12,363. The number of fishing days for the 2023 fishing season dropped to 11,093 days. Figure 5-3 provides another indication that pot gear is increasingly the gear of choice. Starting in 2017, the number of days fished using pot gear increased from 154 days to 7,943 days in 2022. During that same period, the number of days fished using H&L gear declined from a high of 9,999 days to a low of 3,778 days. This is likely accounting for some vessels switching gear types from H&L to pot gear.

Figure 5-3 Days fished for the sablefish IFQ fishery by gear, 2013 through 2023

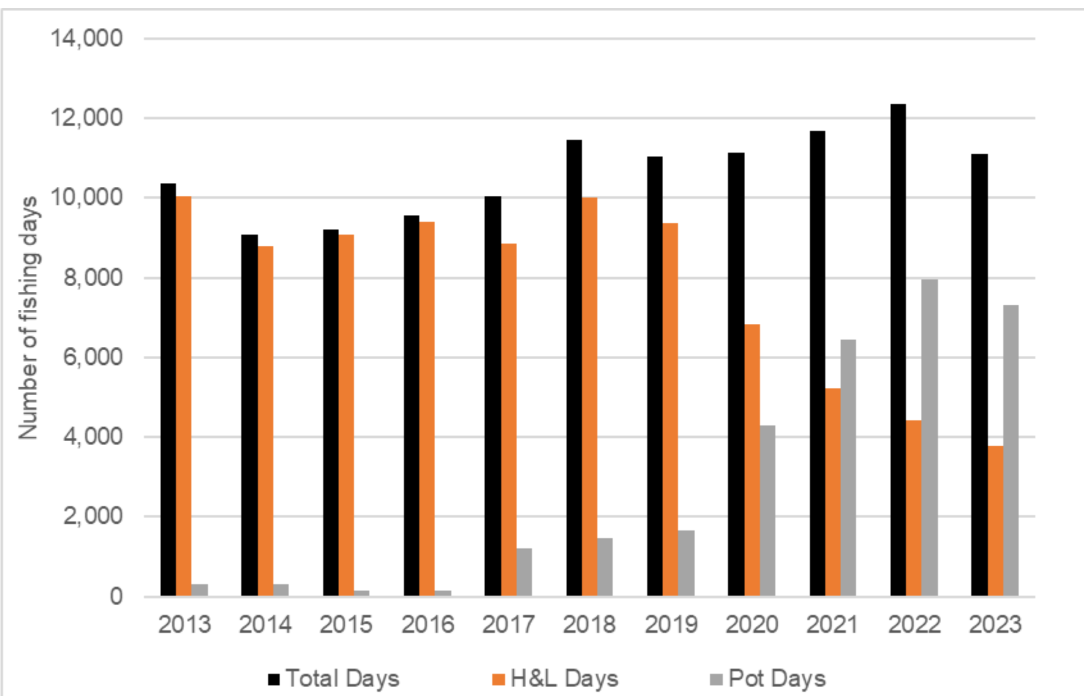


Table 5-16 and Figure 5-4 provide the number of sablefish IFQ vessels and a percent of the sablefish IFQ vessels by grouped days operated from 2012 through 2023. As indicated in the table and figure, the largest change in days operated occurred in the 0-24 days group. In 2012, there were 208 vessels or 59 percent of the sablefish IFQ fleet operated less than 24 days in the fishing season. In 2021, 79 vessels or

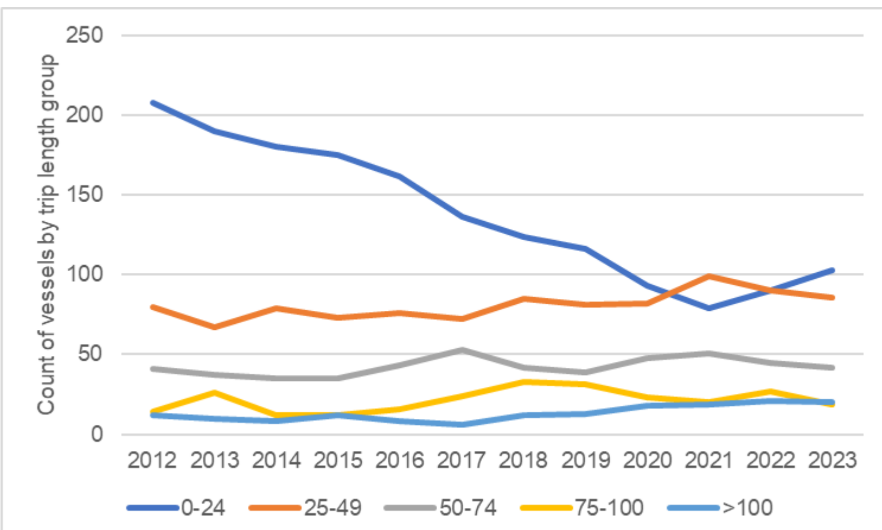
29 percent of the sablefish IFQ fleet operated for less than 24 days. Like other fisheries in the GOA and BSAI, the number of vessels in the 0-24 days operating group have been trending downwards for years, the deteriorating market for sablefish IFQ and the increasing catch of small sablefish since 2017 has also likely contributed to diminishing number of vessels in this group.

Table 5-16 Count and percent of vessels by groupings of days operated, 2012 through 2023

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Fishing days by group						**Count**						
0-24	208	190	180	175	162	136	124	116	93	79	90	103
25-49	80	67	79	73	76	72	85	81	82	99	90	86
50-74	41	37	35	35	43	53	42	39	48	51	45	42
75-100	14	26	12	12	16	24	33	31	23	20	27	19
>100	12	10	8	12	8	6	12	13	18	19	21	20
Total	355	330	314	307	305	291	296	280	264	268	273	270
Fishing days by group						**Percent**						
0-24	59%	58%	57%	57%	53%	47%	42%	41%	35%	29%	33%	38%
25-49	23%	20%	25%	24%	25%	25%	29%	29%	31%	37%	33%	32%
50-74	12%	11%	11%	11%	14%	18%	14%	14%	18%	19%	16%	16%
75-100	4%	8%	4%	4%	5%	8%	11%	11%	9%	7%	10%	7%
>100	3%	3%	3%	4%	3%	2%	4%	5%	7%	7%	8%	7%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

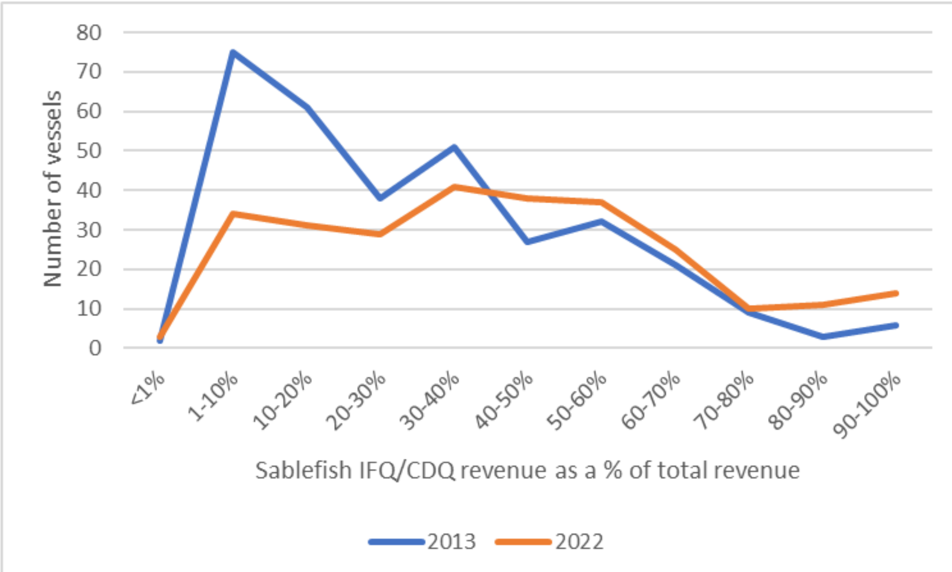
Source: AKFIN; source file is Sablefish_Days_Fished(4-16-24)

Figure 5-4 Count of vessels by groupings of days operated, 2012 through 2023



At the same time as declining utilization of sablefish IFQ allocations and declining sablefish IFQ vessels, it appears that many of these same sablefish IFQ harvesters are now more reliant on the sablefish IFQ fishery today than in the past. Table 5-6 provides information on annual sablefish IFQ vessel dependency relative to the total gross ex-vessel revenue from all other areas, gear types, and species fished. In general, the information in the table shows that the distribution of total ex-vessel revenue for sablefish IFQ vessels between 2013 and 2022 has shifted in favor of sablefish IFQ revenue relative to revenue from other sources like halibut IFQ, Pacific cod, and salmon (Figure 5-5).

Figure 5-5 Sablefish IFQ/CDQ vessels ex-vessel revenue as a percent of total ex-vessel revenue for 2013 and 2022 (number of vessels)



One of the many factors influencing sablefish IFQ harvester participation and fishing behavior is the continued population trends in the sablefish stock assessment. According to the most recent sablefish stock assessment, the age and length composition data from the fisheries (i.e., fixed gear and trawl) and surveys (i.e., longline and trawl) continue to indicate strong year classes in 2014, 2016, 2017, 2018, and now in 2019. As the 2016 year-class enters the fully selected ages for the fixed gear fishery and longline survey, it is becoming clear that the recruitment event is likely the largest on record.

The continued large recruitment events have resulted in a high proportion of small sablefish relative to larger sablefish while harvesting sablefish IFQ. This change in proportion of sablefish IFQ harvested since 2018 has likely had a negative impact on sablefish ex-vessel and first wholesale prices during the 2018 through 2020 fishing years (Figure 3-11 and through Figure 3-17). While the price gradient for the different sablefish market grades is never flat, in a more favorable market, the demand for the premium product (largest market grades) likely has a price positive effect on the smaller grades of sablefish due to the smaller grade being more affordable than the premium grades. As noted in Figure 3-11, starting in 2018, prices for all processor grades declined every year until 2021 when prices did increase. In 2022, prices for lower grade sablefish declined while prices for larger grades increased. In 2023, prices for all grade sablefish declined, and early indications show 2024 prices are continuing their downward trend.

Looking specifically at prices for smaller sablefish, price declines were even more dramatic relative to larger sablefish with 1 lbs. to 2 lbs. declining from a high of $5.07 in 2017 to $0.43 in 2023, while 2 lbs. and 3 lbs. declined from $$6.05 in 2017 to $0.95 in 2023. With significantly higher encounters and landings of smaller sablefish which has resulted in a higher catch composition of smaller sablefish relative to larger sablefish combined with a dramatic reduction in the price of these smaller sablefish has reduced ex-vessel revenue across the sablefish IFQ harvesters during the 2018 through 2020 fisheries. During the 2021 and 2022 seasons, prices improved for larger sablefish which improved total ex-vessel revenue despite the continued composition of smaller sablefish being a relative higher proportion of landings. However, in 2023, prices for all grades once again retreated which likely will result in lower ex-vessel revenue for the sablefish IFQ fishery. Absent the ability to voluntarily discard smaller sablefish under Alternative 1 combined with strong year-class recruitment events that are continuing to occur, sablefish IFQ harvesters have little ability to improve their revenue since a large portion of the harvest is composed of small sablefish that are significantly inferior in price compared to larger sablefish or even worse will not be purchased by processors at the docks.

Other factors influencing sablefish harvester participation and behavior includes the world market for sablefish. Although many complicated factors are involved, the current state of the Alaska sablefish IFQ market has softened in recent years which also coincides with the increase in large numbers of small sablefish on the fishing (Table 3-19). The interplay of these market conditions and these unusual population events for the sablefish stock have reduced the value of Alaska sablefish to an all-time low in 2020. Additionally, the Alaska seafood market, to include the sablefish, has been under pressure due to numerous geopolitical and trade inequities to include supply and demand imbalances, the potential for large harvests by overseas product competitors with low relative currency valuations, and trade conflicts with a major U.S. export receiver. Other factors impacting the sablefish market include higher operating costs due to domestic inflation for labor, materials, shipping, and storage along with high interest rates, high fuel prices, and labor supply shortfalls. All these factors have contributed to a challenging sablefish IFQ market.

Sablefish IFQ harvesters that have the ability to diversify their catch across multiple species could be more resilient to the challenges of required retention of small sablefish under Alternative 1 at least to the extent that they own fishing permits that allow access to multiple target fisheries and the markets for these other fisheries are faring better than sablefish. There is a great deal of overlap in participation in the IFQ fisheries and vessels that fish sablefish IFQ typically also fish halibut IFQ. Catcher vessels that land IFQ sablefish tend to rely on GOA fixed gear fishing for most of their fishing revenues, and sablefish IFQ, halibut IFQ and fixed-gear Pacific cod account for nearly all the gross revenues for this fleet. Vessel size is a factor among catch targets, however, and large vessels tend to split their IFQ revenue between sablefish and halibut more evenly, while smaller vessels get most of their revenues from halibut. Other fishing revenues commonly come from salmon.

From the perspective of communities that are directly engaged and dependent on the sablefish fishery, they would likely see similar trends in processing activity and expenditure patterns associated with the sablefish IFQ fishery under status quo. Section 3.2 identified those communities that are directly engaged and dependent on the sablefish IFQ fishery and the degree to which they are directly engaged and dependent on the fishery. As shown, several Alaska communities are relatively dependent, as measured by contribution to total ex-vessel gross revenues from the IFQ sablefish fishery. Some of these Alaska communities include Sitka at 23 percent, Seward at 22 percent, Petersburg at 12 percent, Juneau/Douglas at 7 percent, and Homer at 6 percent of total ex-vessel gross revenues relative to other fisheries. From the perspective of IFQ sablefish first wholesale gross revenue, sablefish IFQ landings accounted for approximately 24 percent and 17 percent of all shore-based processor first wholesale gross revenue of landings for Seward and Sitka, respectively. Other communities that are reliant on sablefish IFQ landings relative to all shore-based processor first wholesale gross revenue from all fishery landings include Petersburg and Juneau each at approximately 7 percent and Kodiak at 5 percent. These communities and others that are directly engaged and dependent on the sablefish IFQ fishery would likely experience reduced direct, indirect, and induced expenditures under Alternative 1 status quo relative to Alternative 2.

Sablefish processors and the communities that are directly engaged and dependent on the sablefish fishery would also likely also be negatively impacted under status quo alternative relative to Alternative 2. The negative impacts to harvesters and processors will most keenly be felt by those that are operating near the margins of solvency. Section 3.2 identified those communities that are directly engaged and dependent on the sablefish IFQ fishery and the degree to which they are directly engaged and dependent on the fishery. As shown, several Alaska communities are relatively dependent on the sablefish IFQ fishery, as measured by contribution to total ex-vessel gross revenues from the IFQ sablefish fishery. Some of these Alaska communities include Sitka at 23 percent, Seward at 22 percent, Petersburg at 12 percent, Juneau/Douglas at 7 percent, and Homer at 6 percent. From the perspective of IFQ sablefish first wholesale gross revenue, sablefish IFQ landings accounted for approximately 24 percent and 17 percent of all shore-based processor first wholesale gross revenue of landings for Seward and Sitka, respectively. Other communities that are reliant on sablefish IFQ landings relative to all shore-based processor first wholesale gross revenue from all fishery landings include Petersburg and Juneau each at approximately 7 percent and Kodiak at 5 percent. Likely these communities and others that are directly engaged and dependent on the sablefish IFQ fishery would likely experience reduced direct, indirect, and induced expenditures under Alternative 1 status quo relative to Alternative 2.

In summary, looking at the impacts of Alternative 1 on harvesters, crew, quota share owners, processors and communities that are directly engaged and dependent on the sablefish IFQ fishery, the limitation on discarding sablefish IFQ would likely result in continued harvest participation and fishing behavior, processing production, and expenditures in the communities. As a result, under status quo, many harvesting and processors operations that are dependent on sablefish IFQ revenue and thus these operations may have difficulty maintaining their credit and debt instruments and could be forced to refinance, which may not be possible for some entities and such a situation could lead to business sale and/or bankruptcy. The extent to which such impacts on business operations may be realized is impossible to evaluate given the proprietary nature of business finance information.

5.4 Economic Impacts of Alternative 2

Under Alternative 2, the regulatory restrictions that prohibit release of sablefish caught by sablefish IFQ vessels would be changed to allow for discarding of sablefish IFQ. Specifically, Option 1 would eliminate the regulatory restrictions that prohibit release of sablefish caught by sablefish IFQ vessels as well as the FMP provision prohibiting discarding, while Option 2 would require retention of sablefish 22 inches total body length or longer (provides for voluntary release of sablefish under 22 inches total body length). The following sections provide an assessment of the economic impacts of Option 2 with regards to the harvester effects, processor effects, and community effects. As described in Section 2.2, Alternative 2, Option 1 is not the focus of this document, however, it is expected that in general, impacts of Alternative 2, Option 1 would be similar but greater in magnitude than impacts of Option 2. This is due to the opportunity afforded to fishery participants to discard any size of sablefish under Option 1, rather than limiting sablefish discards to a narrow size range (<22”). Option 1 would allow more flexibility for harvesters to highgrade, ultimately providing harvesters with the ability to make whichever decisions about discarding is most profitable for their operation and market.

5.4.1 Harvester Effects

As noted in Appendix 5, the simulation results from the sablefish model show slight improvements in total revenue for the sablefish IFQ fleet under Alternative 2, Option 2 relative to the status quo (Table 6 in Appendix 5). The primary reason that highgrading of sablefish IFQ < 22” with sablefish IFQ ≥ 22” does not significantly increase total revenue for the IFQ fleet is due to the large number of these smaller, less valuable, sablefish relative to the low number of larger, more valuable, sablefish on the fishing grounds. In other words, the encounter rates for smaller sablefish are significantly higher than for larger sablefish. As a result, the large population of smaller sablefish is a significant impediment to the economic success of highgrading these smaller, less valuable, sablefish for larger, more valuable, sablefish due to the cost associated with increased fishing effort. Due to this dynamic, the model results demonstrate small differences in total revenue between Alternative 2, Option 2, and the status quo (full retention fishery).

However, the simulation results from model with respect to changes in gross ex-vessel revenue between full retention and the different DMRs associated with discarding less than 22” sablefish IFQ does not account for the complexity and variation of key economic inputs at the harvester level that when factored in could result in a different gross ex-vessel revenue result. For example, the model does not account for different levels of increased fishing effort from highgrading sablefish IFQ across the universe of harvesters, changes in ex-vessel prices over time, and difference in ex-vessel prices among harvesters. When factoring these additional variations in economic inputs across the fleet of sablefish IFQ harvesters, the resulting gross ex-vessel revenue could be different from the gross ex-vessel revenue depicted in the model simulations.

In general, allowing the release of smaller sablefish caught in the IFQ fishery would enhance the flexibility by the individual vessel operators to improve their gross ex-vessel revenue and to reduce use of sablefish IFQ on sablefish that has no economic value. As a result, harvest participation and fishing behavior in the sablefish IFQ fishery would likely change to when the harvesters perceive a benefit to discarding of sablefish IFQ that are less than 22” in length. Not all sablefish IFQ holders may perceive this to be a benefit for their operation, and therefore may choose to continue the retention of sablefish less than 22” in length. For instance, representatives of the H&L CPs operating in the BS have repeatedly indicated they have established markets for their < 22” sablefish IFQ landings and therefore would likely not voluntarily discard their small sablefish IFQ landings.

One of the factors that likely influences sablefish IFQ harvesters to discard their smaller sablefish IFQ is the continued population trends in the sablefish stock assessment. According to the most recent sablefish stock assessment, the age and length composition data from the fisheries (i.e., fixed gear and trawl) and surveys (i.e., longline and trawl) continue to indicate strong year classes in 2014, 2016, 2017, 2018, and now in 2019. As the 2016 year-class enters the fully selected ages for the fixed gear fishery and longline survey, it is becoming clear that the 2016 recruitment event is likely the largest on record. The continued large recruitment events have resulted in a high proportion of small sablefish relative to the larger sablefish when harvesting sablefish IFQ.

The change in the proportion of smaller sablefish IFQ for larger sablefish IFQ also impacts harvesters by increasing fishing effort (generally expected to be in terms of additional time gear is deployed, or amount of gear deployed, per vessel, not an increase in the number of vessels) beyond normal effort associated with highgrading. As noted in Table 3-19, the proportion of smaller sablefish IFQ landings (1 lbs. to 2 lbs. grade and 2 lbs. to 3 lbs. grade) relative to larger sablefish IFQ (3 lbs. + grade) landings has increased. As a result, fishing effort associated with highgrading 1 lbs. to 2 lbs. grade sablefish IFQ for 2 lbs.+ grade sablefish IFQ would likely be greater due to the higher encounter rates of small 1 lbs. to 2 lbs. grade sablefish IFQ. The increase in fishing effort from highgrading 1 lbs. to 2 lbs. sablefish IFQ combined with the greater effort associated with higher encounter rates of 1 lbs. to 2 lbs. sablefish could increase costs of fishing and potentially increase fishing effects on PSC and non-target species. Table 5-17 provides an approach for estimating changes to fishing effort under Alternative 2. This exercise uses average catch rates of sablefish IFQ of grade 1 lbs. to 2 lbs.from 2021 through 2023 by subarea to consider the maximum amount hypothetically discarded based on past catch rates. This approach assumes that all 1 lbs. – 2 lbs. sablefish IFQ will be discarded and therefore the additional effort necessary to catch 2+ lbs. sablefish IFQ is equal to one divided by the retention rate for these 2+ lbs. sablefish during 2021 through 2023. Because this approach uses knife-edge retention at age 3 (e.g., all grade 1/2 sablefish IFQ will be discarded), this approach provides a likely maximum upper bound of discarding behavior under Alternative 2, Option 2. As mentioned previously, it is unlikely that all harvesters would discard every 1-2lb (<22”) sablefish, even with the flexibility to do so afforded by the proposed action.

For example, the 2021 through 2023 average catch composition for pot vessels operating in the SE is 3 percent for 1 lbs. – 2 lbs. sablefish IFQ and 97 percent of 2+ lbs. Assuming 100 percent of the 1 lbs. – 2 lbs. sablefish IFQ is discarded, then the pot vessel with 100 lbs. of IFQ would need to catch 103 lbs. of sablefish IFQ of which 3 lbs. is 1-2 lbs. sablefish (and will be discarded) while the remaining 100 lbs. of sablefish IFQ would be 2+ lbs. sablefish IFQ. Since the average catch rate of sablefish IFQ 1 lbs. to 2 lbs. grade and retention rate of 2+ lbs. grade sablefish IFQ varies by subarea, then estimated effort will vary by subarea and would likely vary by year.

Some of the likely impacts of this potential increase in effort to harvest only 2+ lbs. sablefish IFQ could be an increase in the number of days fished relative to Alternative 1, increased costs associated with fishing operations to include higher fuel costs, bait costs, observer costs, vessel maintenance costs, and higher crew labor costs. Impacts could also be associated with additional gear on the grounds, or additional time fishing gear is deployed. Any increase in fishing effort will likely increase fishing effects on PSC and non-target species interactions (see Section 4).).

Table 5-17 Estimated fishing effort under Alternative 2 based on average retention rate for 2 lbs.+ sablefish IFQ from 2021 through 2023

Area	Average discard rate of sablefish IFQ 1 lbs. – 2 lbs. during 2021 - 2023	Retention rate of 2+ lbs. (1-discard rate)	Estimated effort associated with harvesting all sablefish IFQ 2+ (1/retention rate)
		H&L	
AI	5%	95%	106%
BS	2%	98%	102%
CG	6%	94%	106%
SE	2%	98%	102%
WG	5%	95%	105%
WY	2%	98%	102%
		Pot	
AI	24%	76%	132%
BS	11%	89%	113%
CG	8%	92%	109%
SE	3%	97%	103%
WG	6%	94%	107%
WY	4%	96%	105%

The change in proportion of sablefish IFQ processor grades harvested since 2018 has likely been a contributing factor in the lower sablefish ex-vessel and first wholesale prices during the 2018 through 2020 fishing years (Figure 3-11 and Figure 3-12 through Figure 3-17). In a more favorable market, the demand for the premium product (largest market grades) likely has had a price positive effect on the smaller grades of sablefish due to the smaller grade being more affordable than the premium grades. However, as noted in Figure 3-11, starting in 2018, prices for all processor grades declined every year until 2021 when prices increased. In 2022, prices for lower grade sablefish declined while prices for larger sablefish grades increased, while in 2023, prices for all sablefish grades declined.

The continued increases in sablefish recruitment and the recent changes in market conditions for sablefish IFQ are likely to increase the incentive for IFQ sablefish harvesters to differentiate their catch to maximize value of their sablefish IFQ harvests at the dock by discarding smaller sablefish (1 lbs. to 2 lbs. grade) to harvest larger more valuable sablefish (2+ lbs. grade). In general, harvesters without a market for smaller sablefish IFQ will likely discard these smaller sablefish if they perceive the benefit to be greater than the cost associated with harvesting larger more valuable sablefish IFQ with increased effort. In the future, if sablefish recruitment diminishes and market conditions for small sablefish improve, harvesters would likely adjust their fishing behavior to retain smaller sablefish as the value of these smaller sablefish exceed the cost associated with replacing discard smaller sablefish with larger sablefish. The times at which discarding of small sablefish will or will not occur will likely vary at the operational level according to the conditions on the specific trip, essentially balancing the perceived cost of extra effort against the prospect that it will pay off in the form of profitable returns.

In additional factor impacting the success of Alternative 2 is the relative percentage of sablefish IFQ that can be highgraded is very small and does not cover the range of sizes that currently are of little value to process. Having a cut-off point of <22" means that a small amount of highgrading, which in 2023 was 5 percent (Table 3-19), could result in required retention of slightly larger but still less valuable sablefish IFQ. For instance, if the cost and effort expended to discard small sablefish IFQ, in exchange for larger sablefish IFQ exceeds the additional value generated from a slightly higher prices, an individual harvester may not benefit in this season. This may be the case if for example, they are discarding a 20" sablefish, but catching a 23" sablefish that is required to be retained but of little added value at the processor.

From the perspective of Alternative 2 on gear usage, given the increasing use of pot gear to mitigate whale depredation of sablefish, it is likely that harvesters of sablefish IFQ will continue to use pot gear to harvest of sablefish IFQ and will continue to grow in usage despite the large recruitment events and the depressed market conditions. Since authorization of pots in 2017, there has been an increase in the use of pot gear in the sablefish IFQ fishery (see Table 3-2 through Table 3-7 and Figure 3-2 through Figure 3-7). Landings of sablefish IFQ using pot gear comprised approximately 10 percent of GOA landings in 2017, but now exceeds HAL gear in all areas except the SE which is currently at 50 percent of IFQ landings. Figure 3-18 and Figure 3-19 provide the percent composition of longline and pot sablefish IFQ landings by processor grades across all regulatory areas from 2015 through 2023. As noted in Figure 3-18, harvesters using longline gear have seen landings of smaller sablefish grades increase in proportion to the larger sablefish grades during the 2015 through 2023 period, while 7+ lbs. grade sablefish declined as proportion to other processors grades starting in 2017. For harvesters using pot gear, the proportion of sablefish IFQ landings of 7+ lbs. grade has consistently been less than all other processor grades during the 2015 through 2023 period, but starting in 2019, have increased in proportion to other processor grades through 2023. Nevertheless, sablefish IFQ harvesters in regulatory areas where whale depredation is a concern will continue to favor pot gear over HAL gear in the future.

Since discards of sablefish IFQ will be managed using an incidental catch amount (ICA) approach that will apply only to the sablefish IFQ fishery, **allocations of sablefish IFQ will be reduced to all sablefish IFQ holders to account for the ICA**, as shown in GOA.

Figure 2-1.[19] Assuming a fully utilized sablefish IFQ allocation, the reduction in sablefish IFQ allocations to accommodate the ICA could result in lower gross ex-vessel revenue for some sablefish IFQ harvesters. For example, IFQ holders who voluntarily retain all their sablefish IFQ landings could have lower ex-vessel revenue since their allocation of sablefish IFQ and thus landings are lower to accommodate the ICA while ex-vessel prices did not increase in greater proportion to the reduction in landings. For harvesters that attempt to highgrade their 1-2 lbs. sablefish IFQ landings for more valuable 2+ sablefish IFQ, the reduction of sablefish IFQ allocations to accommodate the ICA could also result in a reduction in gross ex-vessel revenue if a harvester is not successful in replacing their lower valuable 1-2 lbs. sablefish with more valuable 2+ lbs. sablefish to make up for the reduction in sablefish IFQ allocations.

In summary, sablefish IFQ harvesters are likely to face challenges capitalizing on the ability to discard smaller sablefish IFQ (1-2 lbs.) that are of less value with larger, more valuable sablefish IFQ (2+ lbs.). From a harvester's perspective, allowing the release of smaller sablefish caught in the IFQ fishery is likely to be perceived as a benefit since in would enhance their flexibility on water to improve their gross ex-vessel revenue, increased utilization of the sablefish IFQ allocation, and to reduce waste of sablefish IFQ that has no economic value. However, there are other factors that may limit the success of improving gross ex-vessel revenue for all sablefish IFQ harvesters. First, the large sablefish recruitment events have increased the encounter rates for smaller, less valuable, sablefish compared to the larger, more valuable, sablefish which will likely increase fishing effort to highgrade more valuable sablefish IFQ. This increase in effort will likely increase costs associated with fishing for sablefish IFQ to include higher fuel costs,

[19] The proposed ICA for the fixed gear sablefish IFQ would not apply to the fixed gear CDQ allocation. See Section 2.2.2 for more information on the proposed ICA for the fixed gear sablefish IFQ fishery.

bait costs, observer costs, vessel maintenance costs, and higher crew labor costs. In addition, the increase in sablefish recruitment combined with other exogenous factors like global production of sablefish from Russia have continued to put downward pressure on sablefish prices for all processor grades. Finally, the use of ICAs to accommodate discards of sablefish IFQ will reduce allocations of sablefish IFQ for all sablefish IFQ holders. Collectively, these factors could make it difficult for some harvesters to increase their gross and net ex-vessel revenue from highgrading sablefish IFQ less than 22” for larger more valuable sablefish IFQ under Alternative 2. Nevertheless, there is potential for some harvesters to increase their net gross ex-vessel revenue under Alternative 2, which could be important in maintaining their credit and debt instruments and could prevent forced refinance or business sale and/or bankruptcy.

5.4.2 Processor and Community Effects

Sablefish processors and the communities that are directly engaged and dependent on the sablefish fishery would likely face challenges in benefiting under Alternative 2 for many of the same reasons that could impact harvesters. For processors, the continued downward pressure on sablefish prices for all processor grades combined with the relatively small percentage of sablefish IFQ that harvesters could highgrade and delivered to the processors could result in less than expected gross first wholesale revenue under Alternative 2 for some processors.

From the perspective of the communities that are directly engaged and dependent on the sablefish fishery, those sablefish IFQ processors and harvesters that can increase their net first wholesale revenue and ex-vessel revenue under Alternative 2, it is likely these processors and harvesters would increase their direct expenditures in the communities which in turn would increase indirect and induced expenditures in these same communities. Section 3.2 identified those communities that are directly engaged and dependent on the sablefish IFQ fishery and the degree to which they are directly engaged and dependent on the fishery. As noted in Table 5-11, 62 Alaska communities were the locations of relevant shore-based processing from 2013 through 2022 accepting IFQ sablefish deliveries. Of these communities, Sitka, Seward, Kodiak, and Petersburg combined accounted for nearly 67 percent of the average annual first wholesale gross revenue of IFQ sablefish delivered to shore-based processors from 2013 through 2022.

As noted in Table 5-10, Sitka, Seward, and Juneau shore-based processors receiving IFQ sablefish deliveries, the first wholesale gross revenue of landings associated with those IFQ sablefish deliveries over 2013 through 2022 were significant relative to the total first wholesale revenue of landings of all species. For those processors receiving IFQ sablefish in Sitka and Seward, first wholesale gross revenue of landings associated with those IFQ sablefish deliveries contributed 36 percent and 25 percent of the total first wholesale gross revenue of landings of all species for those processors in those communities. For Juneau processors receiving deliveries of IFQ sablefish deliveries, 14 percent of the total first wholesale gross revenues of landings of all species were associated with IFQ sablefish deliveries.

As shown in Table 5-14, during the 2013 through 2022 period, total IFQ sablefish first wholesale gross revenue of landings by community accounted for about 24 percent and 17 percent of all shore-based processor first wholesale gross revenue of landings for Seward and Sitka, respectively. These two communities are likely highly dependent on the sablefish IFQ fishery. Other communities that are reliant on sablefish IFQ landings relative to all shore-based processor first wholesale gross revenue from all fishery landings include Petersburg and Juneau each at approximately 7 percent and Kodiak at 5 percent.

5.5 Affected Small Entities (Regulatory Flexibility Act Considerations)

Section 603 of the Regulatory Flexibility Act (RFA) requires that an initial regulatory flexibility analysis (IRFA) be prepared to identify whether a proposed action will result in a disproportionate and/or significant adverse economic impact on the directly regulated small entities, and to consider any alternatives that would lessen this adverse economic impact to those small entities. NMFS prepares the

IRFA in the classification section of the proposed rule for an action. Therefore, the preparation of a separate IRFA is not necessary for the Council to recommend a preferred alternative. This section provides information about the directly regulated small entities that NMFS will use to prepare the IRFA for this action if the Council recommends regulatory amendments.

This section also identifies the general nature of the potential economic impacts on directly regulated small entities, specifically addressing whether the impacts may be adverse or beneficial. The exact nature of the costs and benefits of each alternative is addressed in the impact analysis sections of the RIR and is not repeated in this section, unless the costs and benefits described elsewhere in the RIR differs between small and large entities.

Identification of Directly Regulated Entities

The entities that could be directly regulated under the action alternatives are any holders of sablefish IFQ. Table 3-10 shows the number of vessels active in the CDQ fixed gear sablefish fishery and the IFQ sablefish fishery from 2013 through 2023. For the CDQ fixed gear fishery, the number of vessels ranged from zero to five in the AI and four to seven vessels in the BS. In the IFQ fishery, the SE has the highest vessel count ranging from 151 in 2023 to a high of 186 in 2013 followed by the CG with a range of 119 vessels in 2020 to a high of 175 vessels in 2013. In total, the number of IFQ/CDQ fixed gear vessels active ranged from a low of 266 vessels in 2020 to a high of 331 vessels in 2013.

Count of Small, Directly Regulated Entities

Under the RFA, businesses that are classified as primarily engaged in commercial fishing are considered small entities if they have combined annual gross receipts not in excess of $11.0 million for all affiliated operations worldwide, regardless of the type of fishing operation (81 FR 4469; January 26, 2016). If a vessel has a known affiliation with other vessels – through a business ownership or through a cooperative – these thresholds are measured against the small entity threshold based on the total gross revenues of all affiliated vessels. As of 2022, there were 271 active vessels that had a sablefish IFQ landing from 2013-2022 of which 263 are considered small entities. There are 224 vessels that participated from 2013-2021 that were not active in 2022.

Impacts to Small, Directly Regulated Entities

Sablefish IFQ harvesters, many of which are classified as small entities, are likely to face significant challenges capitalizing on the ability to discard smaller sablefish IFQ (1-2 lbs.) that are of less value with larger, more valuable sablefish IFQ (2+ lbs.). From a harvester's perspective, allowing the release of smaller sablefish caught in the IFQ fishery is likely to be perceived as an enhancement in their flexibility on water to improve their gross ex-vessel revenue, increased utilization of the sablefish IFQ allocation, and to reduce waste of sablefish IFQ that has no economic value. However, there are many impediments that would likely limit the success of improving gross ex-vessel revenue. Nevertheless, there is potential for some harvesters, include those classified as small entities, could increase their net gross ex-vessel revenue under Alternative 2, which could be important in maintaining their credit and debt instruments and could prevent forced refinance or business sale and/or bankruptcy.

5.6 Alternatives with Respect to Net Benefit to the Nation

Net benefits to the Nation will be completed upon selection of a preliminary preferred alternative.

6 Management and Enforcement Considerations

6.1 Alternative 1

Regulations

Release of sablefish by the IFQ target fisheries is currently prohibited by regulation that include:

50 CFR § 679.7 - Prohibitions.
In addition to the general prohibitions specified in § 600.725 of this chapter, it is unlawful for any person to do any of the following:

(d) CDQ.

(4) Catch Accounting –

(ii) Fixed gear sablefish. For any person on a vessel using fixed gear that is fishing for a CDQ group with an allocation of fixed gear sablefish CDQ, to discard sablefish harvested with fixed gear unless retention of sablefish is not authorized under § 679.23(e)(4)(ii) or, in waters within the State of Alaska, discard is required by laws of the State of Alaska.

(f) IFQ fisheries.

(11) Discard halibut **or sablefish** caught with fixed gear from any catcher vessel when any IFQ permit holder aboard holds unused halibut **or sablefish** IFQ for that vessel category and the IFQ regulatory area in which the vessel is operating, unless:

(i) Discard of halibut is required as prescribed in the annual management measures published in the Federal Register pursuant to § 300.62 of chapter III of this title;

(ii) Discard of sablefish is required under § 679.20 or, in waters within the State of Alaska, discard of sablefish is required under laws of the State of Alaska; or

(iii) Discard of halibut **or sablefish** is required under other provisions.

Under Alternative 1, these regulations would remain in place and all existing management and enforcement considerations would be maintained. Under Alternative 2 Option 1 these regulations would be modified to allow the discarding of sablefish of any size, while under Option 2 only sablefish less than 22-inches may be discarded.

Currently, NMFS interfaces with the sablefish IFQ fishery through three programs: (1) Inseason Management receives daily fishing reports from the fleet and monitors sablefish harvests; (2) the North Pacific Groundfish and Halibut Fisheries Observer Program (Observer Program) monitors and samples the harvest of GOA sablefish fishery participants with observer coverage; and (3) the Office of Law Enforcement (OLE) monitors the fleet and enforces NMFS regulations.

NMFS Inseason Management monitors sablefish IFQ fisheries in several ways. NMFS requires logbooks to be completed by vessels with a Federal Fisheries Permit (FFP) that are greater than or equal to 60' (18.3 m) length overall (LOA). Therefore, only a portion of the vessels in the sablefish IFQ fishery fleet are required to submit logbook information. NMFS logbooks serve as a record of the location fished, the amount of gear set, and the harvest and discard of target and some non-target species by set. Catcher-processors that fish sablefish IFQ and have a Pacific cod endorsement are also required to report electronically. NMFS Inseason Management also monitors the sablefish fishery using landing report information (a.k.a "fish ticket") reported by the processing plant when a vessel delivers its catch. Fish tickets provide information about the gear type used, the area fished, and the amount of target and non-target species delivered. All processors that take deliveries from IFQ fishing vessels are required to submit landing reports via eLandings. Both fish tickets and logbooks are considered self-reported or industry-reported information.

The Observer Program has the authority to place an observer aboard vessels participating in the GOA sablefish IFQ fishery.

Observers record a vessel's total fishing effort (time gear was fished, location fished, and amount of gear fished), which is obtained directly from the captain's logbook. If a logbook is not required, then the observer obtains this information by asking for assistance from the captain. Regardless of the data source, observers spot check the effort information they are provided against their own observations. Observers collect species composition information from a random sample of the sets. They also collect length, weight, sex, and age structure information from various target and non-target species. When halibut are encountered in the sampled set, the observer completes halibut injury assessments from a random subset. Information from observed vessels is used to extrapolate catch and effort information to the unobserved portion of the fleet. Observers report potential violations to observer program staff; those observations are then shared with the appropriate agency (OLE) for review. Observers are also trained to inform the captain of the vessel of any potential violations that they witnessed, if it is appropriate to do so.

The Office of Law Enforcement monitors the sablefish IFQ fishery on a regular basis, conducts random dockside inspections in ports throughout the GOA, and enforces NMFS regulations. OLE does not have the vessel or fiscal resources to provide personnel to conduct regular at-sea inspections. OLE uses logbook information during vessel inspections to verify landings. OLE may make random spot checks of the gear, but this would be done dockside and not while the vessel is actively fishing. Given OLE resources and other priorities, a relatively small number of vessels are checked for gear specifications. OLE also conducts limited monitoring and enforcement activities through at-sea boarding in coordination with the U.S. Coast Guard and Alaska Wildlife Troopers.

The remainder of this section describes monitoring, management and enforcement considerations associated with Alternative 2, Options 1 and 2.

6.2 Alternative 2

6.2.1 Management Considerations

Both options under Alternative 2 allow for voluntary discarding of sablefish at any size (Option 1) or below 22 inches total body length while requiring full retention of all sablefish greater than this size (Option 2). As outlined in Section 2 of this document, the main concerns with this action from a management perspective involves the inability to accurately estimate the annual variability in number, size, and composition of sablefish and the resulting impact on the sablefish stock even with a minimum size retention requirement.

Section 2.2.2 describes catch and release mortality accounting and concerns with biases in data collection from observers and EM due to the introduction of size-selectivity under Alternative 2, Options 1 and 2 and the resulting impact on catch accounting and inseason management. This section emphasizes the need for accurate discard estimates, and introduces several challenges associated with understanding what vessels will discard, how much they will discard, and what size they will discard. That section goes on to describe how operationalizing size-selective discards without an adjustment to estimation methods would result in an overestimate of total sablefish weight since the average weight per fish used to estimate discards will incorporate the weight of larger retained fish. Additionally, discards could not be accounted for at the individual vessel level due to partial coverage monitoring of the IFQ sector, therefore discard estimates would only be based on a portion of the IFQ sector, but would apply to the entire IFQ sector when determining ICAs and the resulting TAC. While some potential solutions are presented, major compromises would occur if existing data, or at-sea observer and EM sampling methodologies were changed. Furthermore, that section describes the challenges and impacts with inseason management accounting for sablefish releases as it relates to determining incidental catch allowances (ICAs) when setting annual harvest specifications for allocations of sablefish across multiple sectors.

Section 2.2.3. describes monitoring and enforcement concerns with changing at-sea sampling methods in order to collect length and age data for discarded sablefish and associated trade-offs in sampling priorities for other species. That section goes on to describe that vessels that are discarding sablefish will need to work closely with observers by accommodating space and time in order to collect the necessary length and age data prior to discarding which may decrease operational efficiency of a vessel. Furthermore, that section describes the observer ADP and sampling allocation methods to minimize data gaps so monitoring data accurately reflects fishing activities and need for developing enforceable regulatory language on careful release requirements to reduce discard mortality of sablefish.

Appendix 3 describes utilizing gear modification of sablefish pots to improve selectivity through the use of escape mechanisms such as escape rings to reduce capture of small sablefish. That section describes current groundfish escape ring requirements for pot gear in Southeast Alaska ADF&G sablefish fisheries and other fisheries that utilize gear modifications to improve size-selectivity for a target species.

Appendix 5 provides a simulation framework which described the possible implications to the sablefish stock as a result of variable discarding scenarios. This section emphasizes the need for discarded catch to be monitored and accounted for because estimated fishing mortality (retained and discarded fish) provided by the CAS is used as an input in the sablefish stock assessment. This appendix also describes how additional uncertainty as a result of the proposed action would affect catch projections. Given this increased uncertainty, assessment authors might recommend a larger catch buffer as part of the risk table process.

NMFS is concerned about the potential for allowing voluntary discard of sablefish to impact observer and EM data collection and that those impacts of changing the monitoring program priorities could impact other fisheries. As explained in Appendix 3, gear modifications that improve size-selectivity of a target species and reduce bycatch, such as escape rings, vents, or panels, may meet the purpose and need for this action by reducing the capture of small sablefish, while also reducing uncertainty, concerns associated with data collection, stock assessment impacts, discard mortality, and potential interactions with marine mammals.

NMFS recommends the Council consider adding an Alternative for analysis that considers requiring gear modifications to improve size-selectivity of sablefish. Adding this alternative would allow analysts to prepare information about all types of potential gear modifications and allow NMFS to draft potential regulatory language that would accomplish that goal. See Appendix 3 on escape rings for additional context.

6.2.2 Cost Recovery

If the Council were to recommend Alternative 2, costs associated with implementation of this action would be billed to IFQ fisheries and may exceed what could be recoverable under this action.

Section 304(d)(2) of the MSA, obligates NMFS to recover the actual costs of management, data collection, and enforcement (direct program cost) of the IFQ fisheries. NMFS implemented a cost recovery fee program for the IFQ fisheries in 2000 (65 FR 14919). IFQ fishermen pay an annual fee based on direct program cost and the ex-vessel value of the IFQ fisheries. NMFS assess cost recovery fees only for fish that are landed and deducted from the total allowable catch in the IFQ fisheries. NMFS publishes the IFQ standard prices and fee percentage for cost recovery for the IFQ program for the halibut and sablefish fisheries in the Federal Register. The fee percentage for 2023 was 3%.

6.2.3 Paperwork Reduction Act (PRA)

If necessary, any PRA implications of the action alternatives will be assessed prior to final action.

7 Magnuson-Stevens Act and FMP Considerations

7.1 Magnuson-Stevens Act National Standards

Below are the 10 National Standards as contained in the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). In recommending a preferred alternative at final action, the Council must consider how to balance the national standards.

A brief discussion of this action with respect to each National Standard will be prepared for final action.

National Standard 1 — Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

National Standard 2 — Conservation and management measures shall be based upon the best scientific information available.

National Standard 3 — To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

National Standard 4 — Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be; (A) fair and equitable to all such fishermen, (B) reasonably calculated to promote conservation, and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

National Standard 5 — Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources, except that no such measure shall have economic allocation as its sole purpose.

National Standard 6 — Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

National Standard 7 — Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

National Standard 8 — Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirements of National Standard 2, in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

National Standard 9 — Conservation and management measures shall, to the extent practicable, (A) minimize bycatch, and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

National Standard 10 — Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

7.2 Section 303(a)(9) Fisheries Impact Statement

This section will be completed after the Council selects a Preliminary Preferred Alternative.

Section 303(a)(9) of the Magnuson-Stevens Act requires that a fishery impact statement be prepared for each FMP or FMP amendment. A fishery impact statement is required to assess, specify, and analyze the likely effects, if any, including the cumulative conservation, economic, and social impacts, of the conservation and management measures on, and possible mitigation measures for (a) participants in the fisheries and fishing communities affected by the plan amendment; (b) participants in the fisheries conducted in adjacent areas under the authority of another Council; and (c) the safety of human life at sea, including whether and to what extent such measures may affect the safety of participants in the fishery.

The proposed action affects the IFQ fisheries in the EEZ off Alaska, which are under the jurisdiction of the North Pacific Fishery Management Council. Impacts on participants in fisheries conducted in adjacent areas under the jurisdiction of other Councils are not anticipated as a result of this action.

7.3 Council's Ecosystem Vision Statement

In February 2014, the Council adopted, as Council policy, the following:

Ecosystem Approach for the North Pacific Fishery Management Council

Value Statement

The Gulf of Alaska, Bering Sea, and Aleutian Islands are some of the most biologically productive and unique marine ecosystems in the world, supporting globally significant populations of marine mammals, seabirds, fish, and shellfish. This region produces over half the nation's seafood and supports robust fishing communities, recreational fisheries, and a subsistence way of life. The Arctic ecosystem is a dynamic environment that is experiencing an unprecedented rate of loss of sea ice and other effects of climate change, resulting in elevated levels of risk and uncertainty. The North Pacific Fishery Management Council has an important stewardship responsibility for these resources, their productivity, and their sustainability for future generations.

Vision Statement

The Council envisions sustainable fisheries that provide benefits for harvesters, processors, recreational and subsistence users, and fishing communities, which (1) are maintained by healthy, productive, biodiverse, resilient marine ecosystems that support a range of services; (2) support robust populations of marine species at all trophic levels, including marine mammals and seabirds; and (3) are managed using a precautionary, transparent, and inclusive process that allows for analyses of tradeoffs, accounts for changing conditions, and mitigates threats.

Implementation Strategy

The Council intends that fishery management explicitly take into account environmental variability and uncertainty, changes and trends in climate and oceanographic conditions, fluctuations in productivity for managed species and associated ecosystem components, such as habitats and non-managed species, and relationships between marine species. Implementation will be responsive to changes in the ecosystem and our understanding of

> those dynamics, incorporate the best available science (including local and traditional knowledge), and engage scientists, managers, and the public.
>
> The vision statement shall be given effect through all of the Council's work, including long-term planning initiatives, fishery management actions, and science planning to support ecosystem-based fishery management.

A description of whether and how this action is consistent with the Council's ecosystem approach policy will be included after the Council selects a Preliminary Preferred Alternative.

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9 References

(AFSC) Alaska Fisheries Science Center. 2024 Observer Sampling Manual. Fisheries Monitoring and Analysis Division, North Pacific Groundfish Observer Program. AFSC, 7600 Sand Point Way N.E., Seattle, Washington, 98115. Available at https://www.fisheries.noaa.gov/resource/document/north-pacific-observer-sampling-manual

Alaska Fisheries Science Center/Alaska Regional Office [AFSC/AKRO]. 2023. North Pacific Observer Program 2022 Annual Report. Draft Presented to the North Pacific Fishery Management Council, May, 2023, 72 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115. https://meetings.npfmc.org/CommentReview/DownloadFile?p=36d3b65c-cd32-43fc-a423-5f36e45804d9.pdf&fileName=C2a%20Observer%20Program%20Annual%20Report%202022.pdf

Cahalan, J., and J. Gasper. 2022. The commercial size limit for the Pacific halibut fishery off Alaska and its relationship to observer-derived estimates of at-sea discard. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-432, 42 p.

Cahalan, J.A., J. Mondragon, J. Gasper. 2014. Catch Sampling and Estimation in the Federal Groundfish Fisheries off Alaska: 2015 Edition. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-286, 41 p.

Cahalan, J. and C. Faunce. 2020. Development and implementation of a fully randomized sampling design for a fishery monitoring program. Fish. Bull. 118(1): 87-99. http://dx.doi.org/10.7755/FB.118.1.8

Cheung, W.W.L., Frölicher, T.L. Marine heatwaves exacerbate climate change impacts for fisheries in the northeast Pacific. Sci Rep 10, 6678 (2020). https://doi.org/10.1038/s41598-020-63650-z

Clark, W. G., Hoag, S. H., Trumble, R. J., and Williams, G. H. 1992. Re-estimation of survival for trawl caught halibut released in different condition factors. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 1992: 197-206.

Fearnbach, H., Durban, J.W., Ellifrit, D.K., Waite, J.M., Matkin, C.O., Lunsford, C.R., Peterson, M.J., Barlow, J., and Wade, P.R. 2014. Spatial and social connectivity of fisheating "Resident" killer whales (Orcinus orca) in the northern North Pacific. International Journal on Life in Oceans and Coastal Waters. Volume 161(2), pages 459-472 DOI 10.1007/s00227-013-2351-0.

Ferriss, B.E. 2023. Ecosystem Status Report 2023: Gulf of Alaska, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management Council, 1007 West Third, Suite 400, Anchorage, Alaska 99501.

Fischer, K.N., R.M. Suryan, D.D. Roby, and G.R. Balogh. 2009. Post-breeding season distribution of black-footed and Laysan albatrosses satellite-tagged in Alaska: Inter-specific differences in spatial overlap with North Pacific fisheries. Biological Conservation 142:751–760.

Fisheries and Oceans Canada. 2019. Population status update for the Northern Resident killer whale (Orcinus orca) in 2018. DFO Canadian Science Advisory Secretariat Science Response 2019/025. 13 p.

Ford, J. K. B., G. M. Ellis, P. F. Olesiuk, and K. C. Balcomb. 2010. Linking killer whale survival and prey abundance: food limitation in the oceans' apex predator? Biology letters. Volume 6(1), pages 139–142.

Forney, K., & Wade, P. (2006). Worldwide Distribution and Abundance of Killer Whales. Whales, Whaling, and Ocean Ecosystems. 10.1525/california/9780520248847.003.0012.

Freed, J. C., Young, N. C., Brower, A. A., Delean, B. J., Muto, M. M., Raum-Suryan, K. L., Savage, K. M., Teerlink, S. S., Jemison, L. A., Wilkinson, K. M., Jannot, J. E., and Somers, K. A. 2023. Human-caused mortality and injury of NMFS-managed Alaska Marine Mammal Stocks, 2017-2021. AFSC Processed Rep. 2023-05, 6 p. + Supporting file. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Gende, S. M., and M. F. Sigler. 2006. Persistence of forage fish "hot spots" and its association with foraging Steller sea lions (Eumetopias jubatus) southeast Alaska. Deep-Sea Research Part IiTopical Studies in Oceanography 53(3–4):432–441.

Goethel, D.R., Rodgveller, C.J., Echave, K.B., Shotwell, S.K., Siwicke, K, Hanselman, D., Malecha, P.W., Cheng, M., Williams, M., Omori, K., and Lunsford, C.R. 2022. Assessment of the sablefish stock in Alaska. North Pacific Fishery Management Council, Anchorage, AK. https://apps-afsc.fisheries.noaa.gov/Plan_Team/2022/sablefish.pdf

Goethel, D.R., Cheng, M.L.H., Echave, K.B., Marsh, C., Rodgveller, C.J., Shotwell, K., and Siwicke, K. 2023. Assessment of the sablefish stock in Alaska. North Pacific Fishery Management Council, Anchorage, AK. https://www.npfmc.org/wp-content/PDFdocuments/SAFE/2023/sablefish.pdf

Goldbogen, J. A., J. Calambokidis, D. A. Croll, J. T. Harvey, K. M. Newton, E. M. Oleson, G. Schorr, and R. E. Shadwick. 2008. Foraging behavior of humpback whales: kinematic and respiratory patterns suggest a high cost for a lunge. Journal of Experimental Biology. Volume 211(23), pages 3712–3719.

Hanselman, D.H., B.J. Pyper, and M.J. Peterson. 2018. Sperm whale depredation on longline surveys and implications for the assessment of Alaska sablefish. Fish. Res. 200: 75-83. Doi: 10.1016/j.fishres.2017.12.017

Harrington, G.A., J.L. Pirtle, M. Zaleski, C. Felkley, S. Rheinsmith, and J. Thorson. In prep. Essential Fish Habitat 2023 5-year Review Summary Report. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-f/AKR-31, 135 p.

Hastings, K. K., M. J Rehberg, G. M. O'Corry-Crowe, G. W. Pendleton, L. A. Jemison, and T. S. Gelatt. 2019. Demographic consequences and characteristics of recent population mixing and colonization in Steller sea lions, Eumetopias jubatus. J. Mammal. DOI: dx.doi.org/10.1093/jmammal/gyz192

Hastings, K. K., T. S. Gelatt, J. M. Maniscalco, L. A. Jemison, R. Towell, G. W. Pendleton, and D. S. Johnson. 2023. Reduced survival of Steller sea lions in the Gulf of Alaska following marine heatwave. Front. Mar. Sci. 10:1127013. DOI: dx.doi.org/10.3389/fmars.2023.1127013

Jackson, T, and Daly, B. 2023. Pribilof Islands Golden King Crab Stock Assesssment 2023. https://meetings.npfmc.org/CommentReview/DownloadFile?p=b3e2e3e0-98d4-42d2-87b0-317655ee2a22.pdf&fileName=PIGKC_SAFE_2023.pdf

Jemison, L. A., G. W. Pendleton, L. W. Fritz, K. K. Hastings, J. M. Maniscalco, A. W. Trites, and T. S. Gelatt. 2013. Interpopulation movements of Steller sea lions in Alaska, with implications for population separation. PLoS ONE 8(8):e70167.

Jemison, L. A., G. W. Pendleton, K. K. Hastings, J. M. Maniscalco, and L. W. Fritz. 2018. Spatial distribution, movements, and geographic range of Steller sea lions (Eumetopias jubatus) in Alaska. PLoS ONE 13(12):e0208093. DOI: dx.doi.org/10.1371/journal.pone.0208093.

Johannes, R. E., & Neis, B. (2007). The Value of Anecdote. In N. Haggan, B. Neis, & I. G. Baird (Eds.), Fishers Knowledge in Fisheries Science and Management (pp. 41-58). Paris: UNESCO.

Joy, P., and R. Ehresmann. 2022. Northern Southeast Inside Subdistrict sablefish management plan and stock assessment for 2022. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 1J22-19, Douglas. https://www.adfg.alaska.gov/FedAidPDFs/RIR.1J.2022.19.pdf

Kaimmer, S. M. and R. J. Trumble. 1998. Injury, condition, and mortality of Pacific halibut bycatch following careful release by Pacific cod and sablefish longline fisheries. Fish. Res. 38:131-144.

Knuckey, I. 2021. Estimate of discard weight and mortality associated with potential sablefish release allowance for the IFQ Fixed-Gear Fishery Draft Report for IFQ Council. https://meetings.npfmc.org/CommentReview/DownloadFile?p=479dd061-00a3-4d7f-9763-9afac48c00c4.pdf&fileName=Small%20sablefish%20discard%20-%20Draft%20Report%20V1.pdf

Koopman, M., and Knuckey, I. 2022. Yield per recruit simulations of various size at retention and discard mortalities of fixed gears in the Alaskan Sablefish fisheries. https://meetings.npfmc.org/CommentReview/DownloadFile?p=ebba6923-8bbc-426b-a8dc-5b6fac2bccc2.pdf&fileName=Release%20of%20small%20Sablefish%20for%20IFQ%20Committee.pdf

Lander, M. E., B. S. Fadely, T. S. Gelatt, J. T. Sterling, D. S. Johnson, and N. A. Pelland. 2020. Mixing it up in Alaska: Habitat use of adult female Steller sea lions reveals a variety of foraging strategies. Ecosphere 11(2):e03021.

Mason, J. C. R. J. Beamish, and G. A. McFarlane. 1983. Sexual maturity, fecundity, spawning, and early life history of sablefish (Anoplopoma fimbria) off the Pacific coast of Canada. Can. J. Fish. Aquat. Sci. 40: 2126-2134.

Muto, M. M., V. T. Helker, B. J. Delean, R. P. Angliss, P. L. Boveng, J. M. Breiwick, B. M. Brost, M. F. Cameron, P. J. Clapham, S. P. Dahle, M. E. Dahlheim, B. S. Fadely, M. C. Ferguson, L. W. Fritz, R. C. Hobbs, Y. V. Ivashchenko, A. S. Kennedy, J. M. Lon, and A. N. Zerbini. 2019. Alaska marine mammal stock assessments. US. Dep.Commer., NOAA Tech. Memo. page NMFS-AFSC-404, 395 p.

(NMFS) National Marine Fisheries Service. 1992. Final Supplemental Environmental Impact Statement/ Environmental Impact Statement for the Individual Fishing Quota Management Alternative for Fixed Gear Sablefish and Halibut Fisheries: Gulf of Alaska and Bering Sea/Aleutian Islands. https://repository.library.noaa.gov/view/noaa/18134

NMFS. 2004. Programmatic Supplemental Environmental Impact Statement for the Alaska Groundfish Fisheries Implemented Under the Authority of the Fishery Management Plans for the Groundfish Fishery of the Gulf of Alaska and the Groundfish of the Bering Sea and Aleutian Islands Area. NMFS Alaska Region, P.O. Box 21668, Juneau, AK 99802-1668. June 2004. Available at: https://alaskafisheries.noaa.gov/fisheries/groundfish-seis

NMFS. 2006. Memorandum from Kaja Brix, NMFS Alaska Region Assistant Regional Administrator for Protected Resources to Susan Salveson, NMFS Alaska Region Assistant Regional Administrator for Sustainable Fisheries re: Reinitiation of ESA Section 7 Consultation Memo, June 21, 2006

NMFS. 2010. Endangered Species Act - Section 7 Consultation Biological Opinion: Authorization of groundfish fisheries under the Fishery Management Plan for groundfish of the Bering Sea and Aleutian Islands management area; Authorization of groundfish fisheries under the Fishery Management Plan for Groundfish of the Gulf of Alaska; State of Alaska parallel groundfish fisheries. NOAA/NMFS, Juneau Alaska.

NMFS. 2013. 2013 Annual Deployment Plan for Observers in the Groundfish and Halibut Fisheries off Alaska. National Oceanic and Atmospheric Administration, 709 West 9th Street. Juneau, Alaska 99802. Available at: https://media.fisheries.noaa.gov/dam-migration/final2013adp.pdf

NMFS. 2014. Endangered Species Act section 7 consultation biological opinion. Authorization of the Alaska groundfish fisheries under the proposed revised Steller sea lion protection measures, NMFS, Alaska Region.

NMFS. 2015. Alaska Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement Supplemental Information Report. https://www.npfmc.org/wp-content/PDFdocuments/fmp/Final_SIR_2015.pdf

NMFS. 2023. 2024 Annual Deployment Plan for Observers and Electronic Monitoring in the Groundfish and Halibut Fisheries off Alaska. National Oceanic and Atmospheric Administration, 709 West 9th Street. Juneau, Alaska 99802. https://www.fisheries.noaa.gov/resource/document/2024-annual-deployment-plan-observers-and-electronic-monitoring-groundfish-and

NMFS. 2023a. Economic Status of the Groundfish Fisheries of Alaska. March 2023. 2022 Economic Status of the Groundfish Fisheries Off Alaska | NOAA Fisheries

NMFS. 2024. Alaska Groundfish Harvest Specifications Supplemental Information Report. https://www.fisheries.noaa.gov/s3//2024-04/SIR-clean-copy-508.pdf

NMFS 2024b. 2024 Seabird Report to the North Pacific Fishery Management Council. April 2024. Available at: https://meetings.npfmc.org/CommentReview/DownloadFile?p=cf9e8c9d-8fa2-4599-8684-9d51e224f5cf.pdf&fileName=B2%20NMFS%20Seabird%20Report.pdf

NPFMC. 2018. Discussion Paper: Sablefish Discard Allowance. https://meetings.npfmc.org/CommentReview/DownloadFile?p=b6b509dd-a14c-442b-867b-3f88fa9f8d98.pdf&fileName=D2%20Sablefish%20Discard%20Allowance.pdf

NPFMC. 2019a. Discussion Paper: Sablefish Discard Allowance. https://meetings.npfmc.org/CommentReview/DownloadFile?p=547e97ee-897a-4d4d-8811-71fba0d56de3.pdf&fileName=D8%20Sablefish%20Discard%20Allowance%20DiscPaper.pdf

NPFMC. 2019b. Discussion Paper: Sablefish Discard Allowance. https://meetings.npfmc.org/CommentReview/DownloadFile?p=af8355e5-8e81-4165-b20e-2ce11cade94d.pdf&fileName=D2%20Small%20Sablefish%20Discarding%20Discussion%20Paper.pdf

NPFMC. 2021. Initial Review Draft Environmental Assessment/Regulatory Impact Review for Proposed Amendments to the Fishery Management Plans for BSAI and GOA Groundfish: IFQ Sablefish Release Allowance. Retrieved from https://meetings.npfmc.org/CommentReview/DownloadFile?p=0a70f8a0-25c2-4d5e-9044-f289c7f4e40d.pdf&fileName=C3%20IFQ%20Sablefish%20Release%20Allowance%20Analysis.pdf

NPFMC. 2021b. Review of Gulf of Alaska Groundfish Fishery Management Plan Amendment 101 to Allow Pot Longline Gear in the Sablefish IFQ Fishery. Retrieved from https://meetings.npfmc.org/CommentReview/DownloadFile?p=4133df68-586e-4a6a-806c-a55d71998a9c.pdf&fileName=GOA%20Sablefish%20Pots%20Report.pdf

NPFMC. 2023. Small Sablefish Release Update. https://meetings.npfmc.org/CommentReview/DownloadFile?p=1bf689e8-19a4-49cf-bbd9-f1b66c1e95de.pdf&fileName=D1%20Staff%20Update%20Paper.pdf

NPFMC. 2023b. Environmental Assessment for 2023 Essential Fish Habitat Omnibus Amendments. North Pacific Fishery Management Council, Anchorage, AK 99501.

NPFMC. 2023c. Revised Appendix E for Groundfish FMP of the BSAI. North Pacific Fishery Management Council, Anchorage, AK 99501. https://meetings.npfmc.org/CommentReview/DownloadFile?p=1c048be3-6015-48ec-8feec194b74eba32.pdf&fileName=C5%20Appendix%20A%20-%20BSAI%20Groundfish.pdf

NPFMC. 2023d. Revised Appendix B for Groundfish FMP of the GOA. North Pacific Fishery Management Council, Anchorage, AK 99501. https://meetings.npfmc.org/CommentReview/DownloadFile?p=514568dd-2cc6-456a-bc87-5fa0479543ae.pdf&fileName=C5%20Appendix%20B%20-%20GOA%20Groundfish.pdf

NPFMC. 2023e. Environmental Assessment/Regulatory Impact Review for Proposed Regulatory Amendment to Allow Longline Pot Gear in the Bering Sea Greenland Turbot Fishery. Draft for Final Action. https://meetings.npfmc.org/CommentReview/DownloadFile?p=01a455dc-8ecf-44af-b8ba-3e2f323bee37.pdf&fileName=C5%20Greenland%20Turbot%20LLPots%20Analysis.pdf

NPFMC. 2023f. Environmental Assessment/Regulatory Impact Review for Amendment 124 to the BSAI FMP for Groundfish and Amendment 112 to the GOA FMP for Groundfish to revise IFQ Program Regulations IFQ Omnibus Amendments.https://media.fisheries.noaa.gov/2022-11/ea-rir-amds-112-124-gf.pdf

NPFMC. 2024. Small Sablefish Release: DMR & Analytical Approach. https://meetings.npfmc.org/CommentReview/DownloadFile?p=d4ae38e7-b5ee-4521-bd56-b257235c9020.pdf&fileName=D6%20Small%20Sablefish%20Release%20Discussion%20Paper.pdf

NPFMC and NMFS. 2016. 2016 Review of Essential Fish Habitat (EFH) in the North Pacific Fishery Management Council's Fishery Management Plans: Summary Report, Final. October 2016. Available at: https://npfmc.legistar.com/View.ashx?M=F&ID=4695297&GUID=70949C7D-81C4-40B2-9115-B32A6C78CE37

NPFMC and NMFS. 2016b. Twenty-Year Review of the Pacific Halibut and Sablefish Individual Fishing Quota Management Program. December 2016. Available at: https://www.npfmc.org/wp-content/PDFdocuments/halibut/IFQProgramReview_417.pdf

Ortiz, I. and Zador, S. 2023. Ecosystem Status Report 2023: Aleutian Islands, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management Council, 1007 West Third, Suite 400, Anchorage, Alaska 99501.

Parsons, K. M., J. W. Durban, A. M. Burdin, V. N. Burkanov, R. L. Pitman, J. Barlow, L. G. Barrett-Lennard, R. G. LeDuc, K. M. Robertson, C. O. Matkin, and P. R. Wade. 2013. Geographic patterns of genetic differentiation among killer whales in the northern North Pacific. J. Hered. 104(6):737-754. DOI: dx.doi.org/10.1093/jhered/est037

Peterson, Megan J. & Carothers, Courtney, 2013. "Whale interactions with Alaskan sablefish and Pacific halibut fisheries: Surveying fishermen perception, changing fishing practices and mitigation," Marine Policy, Elsevier, vol. 42(C), pages 315-324.

Peterson, M. J., F. Mueter, K. Criddle, and A. C. Haynie. 2014. Killer whale depredation and associated costs to Alaskan sablefish, Pacific halibut and Greenland turbot longliners. PLoS One. Volume 9(2), page e88906.

Rice, D. W. 1989. Sperm whale (Physeter macrocephalus). In Handbook of marine mammalspages 177-233. Ed. by S. Ridgway, and R. Harrison. A.

Roche, C., Guinet, C., & Gasco, N., and Duhamel, G. (2007). Marine mammals and demersal longline fishery interactions in Crozet and Kerguelen Exclusive Economic Zones: An assessment of depredation levels. CCAMLR science journal of the Scientific Committee and the Commission for the Conservation of Antarctic Marine Living Resources. 14. 0-0.

Rodgveller, C. J., J. W. Stark, K. B. Echave, and P.-J. Hulson. 2016. Age at maturity, skipped spawning, and fecundity of female sablefish (Anoplopoma fimbria) during the spawning season. Fish. Bull. 114:89-102.

Rodgveller, C.J., and Siwicke, K. 2020. Assessment of the Grenadier Stock Complex in the Gulf of Alaska, Eastern Bering Sea, and Aleutian Islands. North Pacific Fishery Management Council, Anchorage, AK. https://apps-afsc.fisheries.noaa.gov/refm/docs/2020/Grenadiers.pdf

Rone, B. K., A. N. Zerbini, A. B. Douglas, D. W. Weller, and P. J. Clapham. 2017. Abundance and distribution of cetaceans in the Gulf of Alaska. Mar. Biol. 164:23. DOI: dx.doi.org/10.1007/s00227-016-3052-2

Shotwell, S.K., Fissel, B., and Hanselman, D.H. 2019. Appendix 3C Ecosystem and Socioeconomic Profile of the Sablefish stock in Alaska. In Stock assessment and fishery evaluation report for the groundfish resources of the GOA and BS/AI. https://apps-afsc.fisheries.noaa.gov/refm/docs/2019/sablefish.pdf

Siddeek, M.S.M., Daly, B., Jackson, T. 2023. Aleutian Islands golden king crab stock assessment. North Pacific Fishery Management Council, Anchorage, Alaska.

Siddon, E. 2023. Ecosystem Status Report 2023: Eastern Bering Sea, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management Council, 1007 West 3rd Ave., Suite 400, Anchorage, Alaska 99501.

Sogard, S.M, and B.L. Olla. 1998. Contrasting behavioral responses to cold temperatures by two marine fish species during their pelagic juvenile interval. Env.Biol.Fish. 53:405-412.

Somers, K.A., Jannot, J., Richerson, K., Tuttle, V., Riley, N., and McVeigh, J.T. 2020. Estimated discard and catch of groundfish species in the 2018 U.S. West Coast fisheries. NOAA Fisheries, NWFSC Observer Program, 2725 Montlake Blvd E., Seattle, WA 98112.

Stachura, M., Lunsford, C., Rodgveller, C., & Heifetz, J. 2012. Estimation of discard mortality of sablefish (Anoplopoma fimbria) in Alaska longline fisheries. Fishery Bulletin- National Oceanic and Atmospheric Administration. 110. 271-279.

Stewart, I., and Hicks, A. 2024. Assessment of the Pacific halibut (Hippoglossus stenolepis) stock at the end of 2023. IPHC-2024-SA-01. Available from https://www.iphc.int/uploads/2024/01/IPHC-2024-SA-01.pdf

Suryan, R.M., K.S. Dietrich, E.F. Melvin, G.R. Balogh, F. Sato, and K. Ozaki. 2007. Migratory routes of short-tailed albatrosses: Use of exclusive economic zones of North Pacific Rim countries and spatial overlap with commercial fisheries in Alaska. Biological Conservation 137:450-460.

Sweeney, K., K. Luxa, B. Birkemeier, and T. Gelatt. 2023. Results of Steller sea lion surveys in Alaska, June-July 2021. Memorandum to the Record, April 2023. Available from Marine Mammal Laboratory, AFSC, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115

Tide, C. and Eich, A.M. 2022. Seabird Bycatch Estimates for Alaska Groundfish Fisheries: 2021. U.S. Department of Commerce, NOAA Technical Memorandum NMFSF/AKR-25, 46 p. 10.25923/01e2-3s52.

U.S. Fish and Wildlife Service (USFWS). 2013b. Southwest Alaska Distinct Population Segment of the Northern Sea Otter (Enhydra lutris kenyoni) - Recovery Plan. U.S. Fish and Wildlife Service, Region 7, AK, USA.

U.S. Global Change Research Program (USGCRP). 2023: Fifth National Climate Assessment. Crimmins, A.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. U.S. Global Change Research Program, Washington, DC, USA. https://doi.org/10.7930/NCA5.2023

Wade, P. R., T. J. Q. II, J. Barlow, C. S. Baker, A. M. Burdin, J. Calambokidis, P. J. Clapham, E. Falcone, J. K. B. Ford, C. M. Gabriele, R. Leduc, D. K. Mattila, L. Rojas-Bracho, J. Straley, B. L. R. Taylor, J. Urbán, D. Weller, B. H. Witteveen, and M. Yamaguchi. 2016. Estimates of abundance and migratory destination for North Pacific humpback whales in both summer feeding areas and winter mating and calving areas. page Paper SC/66b/IA21 submitted to the Scientific Comm.

Wade, P. R. 2021. Estimates of abundance and migratory destination for North Pacific humpback whales in both summer feeding areas and winter mating and calving areas. International Whaling Commission Report SC/68c/IA/03.

Wild, L. A., F. Mueter, B. Witteveen, and J. M. Straley. 2020. Exploring variability in the diet of depredating sperm whales in the Gulf of Alaska through stable isotope analysis. Royal Society open science. Volume 7(3), page 191110

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

Witteveen, B. H., R. J. Foy, K. M. Wynne, and Y. Tremblay. 2008. Investigation of foraging habits and prey selection by humpback whales (Megaptera novaeangliae) using acoustic tags and concurrent fish surveys. Marine Mammal Science. Volume 24(3), pages 516–534.

Womble, J. N., and M. F. Sigler. 2006. Seasonal availability of abundant, energy-rich prey influences the abundance and diet of a marine predator, the Steller sea lion Eumetopias jubatus. Marine Ecology Progress Series 325:281–293.

Womble, J. N., M. F. Sigler, and M. F. Willson. 2009. Linking seasonal distribution patterns with prey availability in a central-place forager, the Steller sea lion. Journal of Biogeography 36(3):439–451.

Yano, K., and Dahlheim, M. E. 1995. Killer whale, Orcinus orca, depredation on longline catches of bottomfish in the southeastern Bering Sea and adjacent waters. Fishery Bulletin, 93: 355–372.

Yano, K., and Dalheim, M. 1995. Behaviour of killer whales Orcinus orca during longline fishery interactions in the southeastern Bering Sea and adjacent waters. Fisheries Science, 61: 584–589

Yati E, Minobe S, Mantua N, Ito S, and Di Lorenzo E. 2020. Marine Ecosystem Variations Over the North Pacific and Their Linkage to Large-Scale Climate Variability and Change. Front. Mar. Sci. 7:578165. doi: 10.3389/fmars.2020.578165

Young, N. C., Brower, A. A., Muto, M. M., Freed, J. C., Angliss, R. P., Friday, N. A., Birkemeier, B.D., Boveng, P. L., Brost, B. M., Cameron, M. F., Crance, J. L., Dahle, S. P., Fadely, B. S., Ferguson, M. C., Goetz, K. T., London, J. M., Oleson, E. M., Ream, R. R., Richmond, E. L., Shelden, K. E. W., Sweeney, K. L., Towell, R. G., Wade, P. R., Waite, J. M., and Zerbini, A. N. 2023. Alaska Marine Mammal Stock Assessments, 2023. DRAFT. https://www.govinfo.gov/content/pkg/FR-2024-01-29/pdf/2024-01653.pdf

Young, N. C., Brower, A. A., Muto, M. M., Freed, J. C., Angliss, R. P., Friday, N. A., Boveng, P. L., Brost, B. M., Cameron, M. F., Crance, J. L., Dahle, S. P., Fadely, B. S., Ferguson, M. C., Goetz, K. T., London, J. M., Oleson, E. M., Ream, R. R., Richmond, E. L., Shelden, K. E. W., Sweeney, K. L., Towell, R. G., Wade, P. R., Waite, J. M., and Zerbini, A. N. 2023b. Alaska marine mammal stock assessments, 2022. U.S. Department of Commerce, NOAA Technical Memorandum NMFS- AFSC-474, 316 p. https://repository.library.noaa.gov/view/noaa/52074/noaa_52074_DS1.pdf?download-document-submit=Download

Appendix 1 Sablefish size/age conversions

For background the following metrics are provided to understand size and weight of sablefish at age.

Sex	Age	Proportion Females Mature	Total length (in)	Round weight (lb)	Dressed weight (lb)	Grade
Male	1	--	18.3	1.5	1.0	Grade 1/2
Male	2	--	20.3	2.4	1.5	Grade 1/2
Male	3	--	21.9	3.2	2.0	Grade 2/3
Male	4	--	23.1	3.9	2.5	Grade 2/3
Male	5	--	24.1	4.6	2.9	Grade 2/3
Male	6	--	24.9	5.1	3.2	Grade 3/4
Male	7	--	25.5	5.5	3.5	Grade 3/4
Male	8	--	26.0	5.9	3.7	Grade 3/4
Male	9	--	26.4	6.2	3.9	Grade 3/4
Male	10	--	26.7	6.4	4.0	Grade 4/5
Male	11	--	27.0	6.5	4.1	Grade 4/5
Male	12	--	27.2	6.7	4.2	Grade 4/5
Male	13	--	27.3	6.8	4.3	Grade 4/5
Male	14	--	27.5	6.8	4.3	Grade 4/5
Male	15	--	27.6	6.9	4.4	Grade 4/5
Female	1	0.01	18.1	1.5	1.0	Grade 1/2
Female	2	0.02	20.4	2.4	1.5	Grade 1/2
Female	3	0.05	22.4	3.3	2.1	Grade 2/3
Female	4	0.10	24.0	4.3	2.7	Grade 2/3
Female	5	0.18	25.4	5.3	3.3	Grade 3/4
Female	6	0.32	26.6	6.2	3.9	Grade 3/4
Female	7	0.49	27.6	7.0	4.4	Grade 4/5
Female	8	0.67	28.5	7.8	4.9	Grade 4/5
Female	9	0.81	29.2	8.5	5.3	Grade 5/7
Female	10	0.90	29.8	9.1	5.7	Grade 5/7
Female	11	0.95	30.3	9.6	6.1	Grade 5/7
Female	12	0.97	30.7	10.1	6.4	Grade 5/7
Female	13	0.99	31.1	10.5	6.6	Grade 5/7
Female	14	0.99	31.4	10.9	6.9	Grade 5/7
Female	15	1.00	31.6	11.2	7.0	Grade 7+

Below are the formulas used to convert ages to lengths or weights, lengths to weights, round weight to dressed weight (Eastern cut), and fork length to total length. Values are sources from the 2022 stock assessment, except for the fork length to total length formula, which was estimated using data collected during the 2021 Longline Survey (personal communication, K. Echave, AFSC, May 2023).

Conversion	**Formula**
Female age to fork length (cm)	$Length_{age} = 81.2(1 - \exp(-0.17(age + 3.28)))$
Male age to fork length (cm)	$Length_{age} = 67.9(1 - \exp(-0.23(age + 3.3)))$
Female age to round weight (kg)	$\ln(Weight_{age}) = \ln(5.87) + 3.02 \ln(1 - \exp(-0.17(age + 2.98)))$
Male age to round weight (kg)	$\ln(Weight_{age}) = \ln(3.22) + 3.02 \ln(1 - \exp(-0.27(age + 2.41)))$
Fork length (cm) to round weight (cm) (sexes combined)	$Weight = 0.00001125 Length^{2.99}$
Round weight to dressed weight (Eastern cut) (sexes combined)	$DressedWeight = 0.63 * RoundWeight$
Fork length (cm) to total length (cm) (sexes combined)	$TotalLength = 5.24 + 0.97 * ForkLength$

Appendix 2 Responses to SSC Comments

The SSC noted a number of concerns and requested further discussion on a number of topics during their review of the NPFMC (2024) document outlining the proposed projection approach, which were outlined in NPFMC (2024b). SSC comments (*italics*) and responses to those comments are provided here.

The SSC recommends that the analysts consider the assumption of constant relative fishing mortality between trawl and fixed gear fisheries and whether it is consistent with recent observed fishery behavior during a period of higher recruitment and greater abundance of small fish.

The ratio of fishing mortality among fleets for all projection years is based on the terminal year estimate (i.e., 25.5% to the trawl sector) from the 2023 stock assessment (i.e., following the assumption used in official ABC projections for sablefish). Thus, it is expected that this value adequately reflects the current fleet dynamics during a period of high recruitment. Since 1980, the fraction of harvest coming from the trawl fleet has only been higher in two years (maximum value of 39%). However, the average value of the last 40 years has been around 10% -- 20%. The sensitivity run scenario was implemented to demonstrate the potential impact under the assumption that the proportion of harvest from the trawl sector goes back towards the long-term average, which was deemed more likely in the future if recruitment returned to long-term mean levels and sablefish markets normalized and the fixed gear fishery caught a higher proportion of their quota. Aside from increasing the proportion of catch from the fixed gear fleet (and increasing the associated revenue from that fleet), the overall impacts on SSB and landings were minimal. Conversely, if the proportion of harvest from the trawl fleet were to increase, then any positive benefits under discarding scenarios would likely be further decreased, given the higher age-2 selectivity in the trawl fleet. However, the reduced selectivity of older ages in the trawl fleet would concomitantly allow a minimally increased survival of older age classes. Overall, it is not expected that a change in the proportion of catch from the trawl sector would have any strong influence on the interpretation of the results of this analysis.

The SSC recommends a detailed discussion of how discard mortality would be managed and how these potential management options align with assumptions embedded in the simulation model.

As noted, the projection model assumes a total landings-based quota accounting system, such that all landings and dead discards count against the ABC. Thus, for monitoring and management purposes, both landings and dead discards would need to be monitored by and accounted for by NMFS to ensure the ABC is not exceeded. See Sections 2.2.2, 2.2.3 and Section 6 for more details on monitoring and catch accounting implications of the proposed motion.

The SSC recommends explicitly stating the fishery behavior assumptions that are used in the simulation, and providing a thorough discussion of how actual behavior might change in the presence of differing incentives and tools available to harvesters to alter times, locations and gear used to target sablefish. The SSC expressed concern related to the lack of justification for the human behavior assumptions implicitly embedded in the simulation model, noting the potential for a change in behavior to change discards.

There are no explicit assumptions regarding behavior in the biological projection, aside from the assumption of knife-edge retention. As noted in the 'Projection Caveats' section, addressing changes in behavior or fleet dynamics would require a different type of bioeconomic or agent-based modeling framework. The current model is not sufficient to adequately address these types of complexities. Moreover, more information on behavior and sablefish economics would be required to parametrize such a model, which are not likely available. We expect that discarding could change the behavior of the fleet, but could not envision a way to adequately implement such dynamics in the current simulation-projection framework. Please see Section 5.4.1 for a separate analysis on how changes in fleet behavior are likely to lead impact the sablefish resource under the proposed action.

The SSC recommends that it may be informative to explore alternative price structures (compared to simply using recent observed price by size category).

Although we did implement two alternate price scenarios (i.e., using average price and a variable price linked to the magnitude of landings), both retained extremely simplified price structure assumptions and utilized no specific economic rationale. Thus, it is unlikely that either scenario could be deemed more realistic than the assumption in the main scenarios that prices were time-invariant and based on 2023 prices. However, these alternate price scenarios do provide a demonstration of the potential implications of different prices.

The SSC also discussed the need to describe where price information is from, and what the support/number of observations that are used to calculate prices in each category is.

See Section 3.1.1.4 for a description of price data.

The SSC recommends a detailed discussion of how discard mortality would be managed and how these potential management options align with assumptions embedded in the simulation model.

See Sections 2.2.2 and 2.2.3. The simulation model assumes all dead fish count towards the ABC.

The SSC recommends a detailed discussion of where potential data gaps may arise, and how these might be addressed via changes in at-sea monitoring and catch accounting methods.

See Sections 2.2.2 and 2.2.3.

The SSC recommends that the June 2024 initial review include a discussion of potential social and economic impacts that extend beyond gross landed value to aspects of the fishery such as effects on crew retention, use of different types of pots and the size of vessels that may be able to make such changes, different impacts among affiliated fishing communities and areas, etc.

See Section 5.4 for social and economic impacts including differential impacts across fishing communities and harvesters, which includes crew. Use of different types of pots is not included in this analysis, as this action does not propose changes to authorized gear. Discussion of this topic has been included in past Council analyses (NPFMC 2021b and NPFMC 2023f).

Responses to Comments from 2021 SSC Report:

Given that smaller sablefish are more prevalent in the Western GOA, Aleutian Islands (AI), and Bering Sea, the proposed amendment is likely to affect communities differently, although those northern communities are in general less dependent upon sablefish. The SSC requests that reporting of simulation results identify differential impacts across communities or regions, and especially any communities that are of particular concern for positive or adverse impacts.

Differential impacts are described in Section 5, but not in relation to simulation results.

Please use metric as the units throughout this document. If reporting catch weight in pounds is informative, please include this as a parenthetical to the value in metric units.

The analysts have done this where possible and where it makes sense to given that the IFQ fishery is often described in pounds due to quota.

Responses to other 2021 SSC comments on uncertainty, age structure, and productivity of the sablefish stock not included as the plan for addressing those was discussed during February 2024 SSC meeting and incorporated into the analysis.

Appendix 3 Discussion of Escape Rings and Selectivity

In June 2023, the Council discussed whether or not to include escape rings as an element in the alternatives of the motion. The Council directed staff that the analysis should include a discussion of selectivity in sablefish pots and whether requiring escape mechanisms meets the objectives of this action. **If the Council adds this element to the suite of alternatives, staff will complete a more thorough level of analysis in the EA/RIR prior to final action.**

Use of Escape Rings in Pot Gear in North Pacific Sablefish Fisheries

As of 2023, almost 80% of IFQ/CDQ sablefish in Alaska was caught using pot gear (Figure A3 1; Table A3 1). Pot gear fishing for sablefish was only legal in the BSAI prior to its legalization in 2017 in the GOA to primarily avoid whale depredation of catch. Since 2017, there has been rapid adoption of pot gear due to the development of collapsible 'slinky' pots, which are easily utilized on smaller boats compared to traditional pots (Goethel et al. 2022).

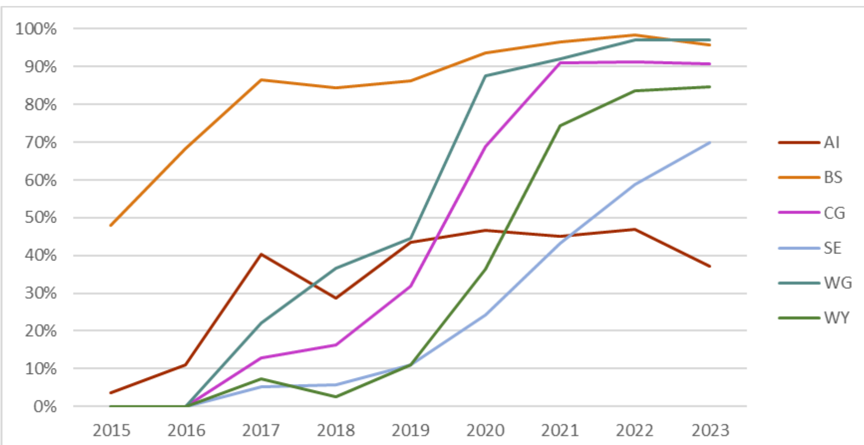

Figure A3 1 Percentage of IFQ/CDQ sablefish catch by pot gear by FMP and management area. Source: ADFG Fish Tickets, data compiled by AKFIN.

Table A3 1 Percentage of IFQ/CDQ sablefish catch by gear by FMP and management area.

	AI		*BS*		*CG*		*SE*		*WG*		*WY*		*% Pot average by year (all areas)*
	H&L	Pot	H&L	Pot	H&L	Pot	H&L	Pot	H&L	Pot	H&L	Pot	
2015	96%	4%	52%	48%	100%	0%	100%	0%	100%	0%	100%	0%	9%
2016	89%	11%	32%	68%	100%	0%	100%	0%	100%	0%	100%	0%	13%
2017	60%	40%	14%	86%	87%	13%	95%	5%	78%	22%	93%	7%	29%
2018	71%	29%	15%	85%	84%	16%	94%	6%	63%	37%	97%	3%	29%
2019	57%	43%	14%	86%	68%	32%	89%	11%	55%	45%	89%	11%	38%
2020	53%	47%	6%	94%	31%	69%	76%	24%	12%	88%	64%	36%	60%
2021	55%	45%	4%	96%	9%	91%	57%	43%	8%	92%	26%	74%	74%
2022	53%	47%	1%	99%	9%	91%	41%	59%	3%	97%	16%	84%	79%
2023	63%	37%	4%	96%	9%	91%	30%	70%	3%	97%	15%	85%	79%

Source: ADFG Fish Tickets, data compiled by AKFIN.

Escape rings, or metal rings secured to a pot's external mesh, offer an effective strategy to avoid small fish when pot fishing (Haist and Hilborn 2000; Haist et al. 2004). Escape rings are broadly used in pot/trap fisheries due to their efficacy in reducing bycatch and incidental catch of unmarketable size classes. Escape rings can mitigate some of the impacts of large amounts of small sablefish caught being in pot gear.

Federal regulations do not currently require or prohibit the use of escape rings in pot gear for sablefish, although many participants in the Federal sablefish IFQ fishery choose to use pot gear with escape rings. In 2024, the North Pacific Observer Program began collecting information on escape ring presence and size in pot gear and opening status of escape rings if they have been closed off (e.g., zip tied shut or crushed closed) or remain open (AFSC 2024). Pot gear used in the sablefish IFQ fishery varies from rigid (e.g., square, conical, and pyramid) to collapsible (e.g., slinky) pots and preferences on use of escape rings may vary to fit the need of individual vessels and the type of pot gear they use.

In British Columbia, Canadian regulations adopted in 1998 require two 3.5-inch escape rings on pot gear as well as a minimum size limit for retention of 55 cm (approx. 21.7 in.) to allow the majority of sablefish to reach sexual maturity and reproductive age before capture for all gear types (Haist and Hilborn 2000; Haist et. al 2004).

In the State Southern Southeast Inside fisheries (Chatham and Clarence Strait), a requirement for two 4-inch circular escape rings on opposite sides of a on the vertical or sloping walls of pot gear was adopted in 2018. The 4-inch size was based on sablefish length at 50% maturity of 61 cm for both management areas and corresponds to sablefish weighing 4-5 lbs with the objective of minimizing capture of small immature sablefish so they have an opportunity to reproduce and contribute to the population prior to being harvested (Ehresmann and Olson 2021). This was later reduced to 3.75" by the Board of Fisheries (BOF) in 2022 and required for commercial, subsistence, and personal use sablefish pot fisheries in Southeast Alaska based on a 2019 ADF&G study in Chatham Strait, Alaska, that compared different treatments of escape ring sizes including a control with no escape rings, 3.5, 3.75, and 4 inch escape rings in conventional pot gear (in contrast to slinky pots). Figure A3 2 shows the results of this study, which found catch rates of small fish (< 3 dressed lb.) were reduced while catch rates of large fish (>= 3 dressed lb.) were maintained with 3.5-inch escape rings (Sullivan et al. in prep). Small fish capture rates were reduced with 3.75 and 4-inch rings as well, but at the cost of a detectable reduction in larger sablefish catch rates. A similar study has not been conducted using slinky pots; however, preliminary results from slinky pot and hook-and-line comparison studies suggest that escape rings are similarly effective on slinky pot gear (Sullivan et al. 2022). The objective of this regulatory change at the 2022 BOF meeting was to maintain catch of larger and more mature sablefish while reducing the catch and discard mortality of small immature sablefish. Additionally, the escape ring requirement was expanded to include the subsistence and personal use sablefish fisheries due to the increased participation in these fisheries and for consistent sablefish pot gear regulations across the fisheries in Southeast, Alaska.

According to a pilot study conducted in 2021 by the AFSC comparing collapsible slinky pots and H&L gear (Sullivan et al. 2022), pots tend to catch smaller sablefish than H&L gear, however, the use of escape rings shifts size selectivity of pot gear more towards sizes that are comparable to H&L gear.

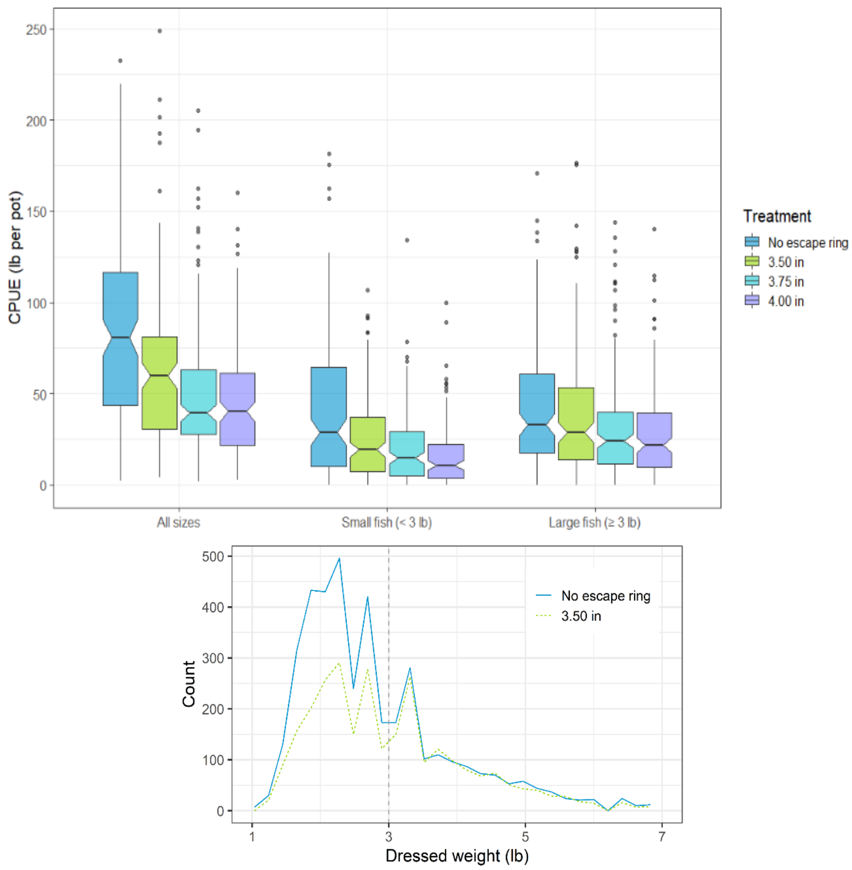

Figure A3 2 Catch per unit effort (total dressed lb. per pot) of all sizes of sablefish combined, small sablefish (< 3 dressed lb.), and large sablefish (>= 3 dressed lb.) by escape ring treatment in May 2019, Chatham Strait, Alaska. The data are presented as notched boxplots; if the notches are not overlapping, the medians (50th percentile) between groups are significantly different. The Eastern cut dressed weight product recovery rate was assumed to be 0.63. Data courtesy of the Alaska Department of Fish and Game. Source: *Sullivan et al. in prep*

Requirements for Other Fisheries

Gear modifications have been adopted by fishermen and fisheries managers as across many fisheries to achieve a desired outcome to reduce discard mortality and improve size-selectivity of larger mature fish that are more economically valuable, as well as to reduce bycatch of non-target species (Armstrong et al. 1990; Valdermarsen and Suuronen 2001; Graham et al. 2007; Suuronen and Gilman 2020). Pot or trap gear designs and escape mechanisms are species-specific and can vary by fishery. Effectiveness of these modifications is influenced by a number of factors including soak time, escape mechanism shape, size, placement, and overall quantity installed (Nulk 1978; Tallack 2007; Shepard et al. 2002; Barnes et al. 2022). For Alaska king and Tanner crab fisheries, a king and Tanner crab pot is required to have stretched mesh webbing or circular escape rings of a minimum size that vary by fishery and must be located on the vertical or sloping sidewall surface to accommodate for the different types of pots utilized in this fishery (i.e. square, conical, or pyramid) to allow escapement of females and sub-legal males (5 AAC 34.001 and 5 AAC 35.001). Similarly, experiments conducted for pot fisheries for the Atlantic cod (*Gadus morhua*) in the Baltic Sea, Atlantic black sea bass (*Centropristis striata*), and American lobster (*Homarus americanus*) using escape vents (ring or square) or windows found that selectivity was improved by reduction in catch of undersized or less valuable fish, while maintaining or increasing the catch rate of larger fish (Nulk 1978; Smolowitz et al.1978; Shepard et al. 2002; Ovegard et al. 2011). This improved harvesting efficiency and helped inform policy on escape vent requirements for pot gear (50 CFR 648.144(b) and 679.21(c)).

Required versus Voluntary Escape Rings

There are benefits and disadvantages to regulating/requiring escape rings, some of which are described below.

Regulations requiring escape rings that specify minimum size, quantity, and placement on a pot to improve size-selectivity of sablefish would reduce data collection and uncertainty associated with voluntary discarding measures as described under Alternative 2 Options 1 and 2. Requiring the use of escape rings in the IFQ fishery could also reduce bycatch of other species across the sector (Haist et al., 2000). Pot gear varies in the IFQ fishery between rigid and collapsible pots and regulations specifying an escape ring size, quantity, and placement may vary among pot gear types in order to be effective.

Age and length compositions between the H&L and pot gear demonstrate strong overlap, with pot gear generally selecting for slightly younger and smaller individuals (Sullivan et al. 2022; Goethel et al. 2023). Reducing the number of small sablefish caught sector-wide could have a positive impact on the sale value by including less low-value fish in the market and may have biological benefits by allowing small sablefish to reach size at maturity and reproduce before being harvested, without any injury or mortality that could result from handling and release. The ADF&G sablefish escape ring study demonstrated that pots with escape rings substantially decreased the capture of small sablefish across multiple escape ring sizes (3.5 in, 3.75 in, and 4.0 in) compared to when not using escape rings (Sullivan et al. in prep; Figure A3 2).

Marine mammals (killer and sperm whales) are known to partially or completely removing catch from fishing gear, particularly H&L gear. Interactions with pot gear are not well understood, but based on anecdotal information, appear to be increasing in Alaska. Sablefish IFQ fishermen rapidly transitioned to pot gear to minimize interaction and impacts from whale depredation in recent seasons. Alternative 2 Options 1 and 2 allow for voluntary release of sablefish and in February 2021, the Council reviewed an analysis paper that discussed concerns about whales congregating around fishing vessels when sablefish are released back into the water. Requiring escape rings in pot gear could help mitigate interactions with whales, however, information from fishermen have reported that whales have learned to pull sablefish out who become stuck in an escape ring with part of their body protruding out of the pot causing damage to the pot and loss of captured fish (personal communication, K. Milani, May 2024).

The analysts understand that over the past few years, innovation in the industry regarding pot gear designs has attempted to address whale depredation issues and specific needs of vessels such as lightweight pots. One recent example of a new prototype is a reinforced slinky pot with strong webbing or mesh. Regulations that do not provide sufficient flexibility for gear modifications could stifle innovation or stem potential developments of gear. Regulations that are too prescriptive could require further amendments in future years as harvesters adapt gear to changing fishery conditions. Those with a general knowledge of the fishery have indicated that while many IFQ fishermen who use pots have escape rings on their gear, the ability to close off escape rings can be beneficial to aid in topping off any remaining quota, for example at the end of the fishing season or a vessels' last fishing IFQ trip of the year. Additional testimony from those involved in the fishery could inform further discussion on this topic.

Regulating this solution would require enforcement and monitoring to solve an issue that is focused on flexibility and increasing the value of sablefish catch, rather than effects on the health of the sablefish stock. An incentive already exists for fishermen to use this solution, so requiring the use of escape rings through regulatory measures could be unnecessary. Currently, monitoring is collecting data on escape ring size and quantity on pot gear as part of the observer sampling protocol.

Requiring escape rings in pot gear would provide increased consistency with the Council's purpose and need statement to reduce catch of small immature sablefish and meet the objectives of Alternative 2 Options 1 and 2. Escape rings can provide a gear modification that would be simple to implement and comply with that would increase capture of larger more valuable sablefish while reducing capture and discard mortality of small immature sablefish. **NMFS recommends the Council consider the addition of requiring escape rings as an Alternative action which would allow analysts to review fishery gear modification research and management strategies that improve size-selectivity, reduce discard mortality, and integrate size at maturity to allow for a species to reproduce prior to being captured.** Furthermore, analysts would be able to utilize ongoing observer program data collection on quantity and size of escape rings across different pot gear types used in the sablefish IFQ fishery.

References

(AFSC) Alaska Fisheries Science Center. 2024 Observer Sampling Manual. Fisheries Monitoring and Analysis Division, North Pacific Groundfish Observer Program. AFSC, 7600 Sand Point Way N.E., Seattle, Washington, 98115. Available at https://www.fisheries.noaa.gov/resource/document/north-pacific-observer-sampling-manual

Armstrong, D.W., Ferro, R.S.T., MacLennan, D.N., Reeves, S.A., 1990. Gear selectivity and the conservation of fish. J. Fish Biol. 37, 261–262.

Barnes, Thomas C., Matt K. Broadhurst, and Daniel D. Johnson. "Disparity among recommended and adopted escape-gap designs and their utility for improving selection in an Australian portunid trap fishery." *Fisheries Research* 248 (2022): 106219.

Ehresmann, R. K., & Olson, A.P. (2021). 2021 Southern Southeast Inside Subdistrict Sablefish Fishery Management Plan. *Alaska Department of Fish and Game*.

Goethel, D.R., Cheng, M.L.H., Echave, K.B., Marsh, C., Rodgveller, C.J., Shotwell, K., and Siwicke, K. 2023. Assessment of the sablefish stock in Alaska. North Pacific Fishery Management Council, Anchorage, AK.

Goethel, Daniel R., D. H. Hanselman, C. J. Rodgveller, K. H. Fenske, S. K. Shotwell, K. B. Echave, Patrick W. Malecha, K. A. Siwicke, and C. R. Lunsford. "Assessment of the sablefish stock in Alaska." *Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska and the Bering Sea/Aleutian Islands as Projected for* (2021).

Graham, N., R. S. Ferro, W. A. Karp, and P. MacMullen. 2007. Fishing practice, gear design, and the ecosystem approach—three case studies demonstrating the effect of management strategy on gear selectivity and discards. ICES Journal of Marine Science 64(4):744-750.

Haist, V., Hilborn, R., & Wyeth, M. (2000). Sablefish Stock Assessment for 2001 and Advice to Managers for 2002. *Department of Fisheries and Oceans.*

Haist, V., Kronlund, A. and Wyeth, M. 2004. Sablefish (Anoplopoma fimbria) in British Columbia,

Canada: Stock assessment for 2003 and advice to managers for 2004. Fisheries and Oceans

Canada, Research Document, 2004/055, 1–74.

Nulk, V. E. 1978. The effects of different escape vents on the selectivity of lobster traps. Marine Fisheries Review 40(5-6):50-58.

Ovegård, M., S. Königson, A. Persson, and S. Lunneryd. 2011. Size selective capture of Atlantic cod (Gadus morhua) in floating pots. Fisheries Research 107(1-3):239-244.

Shepherd, G. R., C. W. Moore, and R. J. Seagraves. 2002. The effect of escape vents on the capture of black sea bass, Centropristis striata, in fish traps. Fisheries Research 54(2):195-207.

Smolowitz, Ronald Joel, LCDR NOAA Corps, and Northwest Fisheries Center. "Lobster, Homarus americanus, trap design and ghost fishing." *Marine Fisheries Review* 40, no. 5-6 (1978): 2-8.

Sullivan, J.Y, Olson, A.P., Baldwin, A.P., and B.C. Williams. Unpublished. Size-selectivity and capture efficiency of sablefish (*Anoplopoma fimbria*) in Southeast Alaska using pot gear with escape rings. Alaska Department of Fish and Game.

Sullivan, J., J. A. Dimond, and P. Malecha. 2022. Slinky pot and hook-and-line comparison project during the experimental leg of the 2021 AFSC sablefish longline survey. AFSC Processed Rep. 2022-02, 18 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., Auke Bay Laboratories,17109 Pt. Lena Loop Road, Juneau, AK, 99801.
This document is available online at: https://repository.library.noaa.gov/

Suuronen, P., and E. Gilman. 2020. Monitoring and managing fisheries discards: new technologies and approaches. Marine policy 116:103554.

Tallack, S. M. L. 2007. Escape ring selectivity, bycatch, and discard survivability in the New England fishery for deep-water red crab, Chaceon quinquedens. ICES Journal of Marine Science 64(8):1579-1586.

Valdemarsen, J.W., Suuronen, P., 2001. Modifying fishing gear to achieve ecosystem objectives. Reykjavik Conference on Responsible Fisheries in the Marine Ecosystem. Reykjavik Fisheries Technical Paper, 19, 20

Appendix 4 Requirements applicable to sablefish discarding in other regions/ fisheries

Region	Management program	Gear type	Regulations related to discarding (e.g., size limits, escape rings, DMRs, application to quota)	At-sea monitoring	Port sampling
Alaska (federal waters)	Individual Fishing Quota	Hook-and-line	Mandatory full retention, no size limit, no discarding allowed	Mix of zero coverage (<40 foot vessels), human observers and electronic monitoring. See most recent annual deployment plan for target selection rates.	None
Alaska (federal waters)	Individual Fishing Quota	Pot	Mandatory full retention, no size limit, no discarding allowed	Mix of zero coverage (<40 foot vessels), human observers and electronic monitoring. See most recent annual deployment plan for target selection rates.	None
Alaska (state waters, Chatham Strait and Clarence Strait)	Equal Quota Share	Hook-and-line and Pot	Voluntary release program, no size limit, two circular 3.75" escape rings on opposing vertical or sloping walls required on all pots, flea bitten or dead fish must be retained. https://www.akleg.gov/basis/aac.asp#5.28.170 --- see (f) and (g) "A permit holder must retain all visibly injured or dead sablefish. Sablefish that are not visibly injured or dead may be released unharmed, but the permit holder must record the live releases in a logbook by gear settings". NSEI/Chatham Strait fishery assumes a DMR of 16% into the assessment model, while SSEI/Clarence Strait has no DMRs. See p.7 of NSEI assessment: https://www.adfg.alaska.gov/FedAidPDFs/RIR.1J.2022.19.pdf NSEI assessment has "management decrements" deducted from the ABC before setting TAC. This includes DMRs from sablefish caught as bycatch in the sablefish fishery (25%), sport fishery (11.7% informed from	None	Yes -- during Mark-Recap years, as many landings as possible are sampled. For all other years, samples are taken only Mon-Fri work hours.

Region	Management program	Gear type	Regulations related to discarding (e.g., size limits, escape rings, DMRs, application to quota)	At-sea monitoring	Port sampling
			Stachura et al. 2012 study), personal use/subsistence fishery (16%), and deadloss mortality based on 3-year rolling avg from the ADF&G longline survey. See p. 2-3 in NSEI assessment.		
British Columbia	Individual Transferable Quota	Pot	All traps (pots) require two 3.5-inch escape rings. Minimum size limit for retention of 55 cm (approx. 21.65 in.). Sablefish <55 cm fork length are released by regulation in all fisheries. There are no quota deductions applied to releases of sub-legal fish (0% DMR). For legal sized sablefish that are released, there is a 100% DMR (100% of discards apply towards quota).	Electronic monitoring. 10% of hauls are video reviewed and tested against logbooks. It is up to fishery manager discretion to determine if 100% video review is required.	100% dockside monitoring provided by third party service provider
British Columbia	Individual Transferable Quota	Hook & Line	Minimum size limit for retention of 55 cm (approx. 21.65 in.). Sablefish <55 cm fork length are released by regulation in all fisheries. There are no quota deductions applied to releases of sub-legal fish (0% DMR). 100% DMR for legal sized sablefish (100% of discards apply towards quota). Exception is troll gear for which there is a DMR of 15% for legal sized sablefish.	Electronic monitoring. 10% of hauls are video reviewed and tested against logbooks. It is up to fishery manager discretion to determine if 100% video review is required.	100% dockside monitoring provided by third party service provider
British Columbia	Individual Transferable Quota	Trawl	Minimum size limit for retention of 55 cm. Sablefish <55 cm fork length are released by regulation in all fisheries. There are no quota deductions applied to releases of sub-legal fish (0% DMR). DMR for legal-sized fish is a function of towing time (25% discard mortality rate for the first hour fished or portion thereof and, 25% for each additional hour)	Electronic monitoring. There are several categories of audit of trip data. Baseline video to logbook review is 10% of fishing events for wetboats and 25% of fishing events	100% dockside monitoring provided by third party service provider

Region	Management program	Gear type	Regulations related to discarding (e.g., size limits, escape rings, DMRs, application to quota)	At-sea monitoring	Port sampling
				for receiving tank vessels (RTVs). Additional review is required for larger discrepancies between EM and at-sea log data.	
West Coast	Limited Entry/Individual Fishing Quota	Trawl	Discarding allowed for all IFQ vessels EXCEPT "shoreside whiting" vessels (land >50% hake/whiting) engaged in maximized retention. Maximized retention allows for the discard of minor operational amounts of catch at sea if the observer has accounted for the discard. All IFQ discards count towards quota with 100% mortality applied to fish < 28 cm (age-0 fish) and 50% mortality rate applied to fish >= 28 cm	100% observed with a human observer or EM. ~20% of EM trips also carry an observer. Vessels 125 ft or longer engaged in at-sea processing (e.g., at-sea whiting catcher-processors and motherships) must carry two observers; all others must carry one.	100% dockside catch monitoring provided by third party service provider to verify landings, as well as generally less than 100% port sampling of biological data by the respective state departments of fish and wildlife.
West Coast	Limited Entry/Individual Fishing Quota	Hook-and-line and Pot	Discarding allowed, discards count towards quota with 100% mortality applied to fish < 28 cm (age-0 fish) and 20% mortality rate applied to fish >= 28 cm Minimum 2 x 2-inch opening on pot gear.	About 30% coverage on average with human observer but varies depending on WCGOP capacity. Vessels 125 ft or longer engaged in	Generally less than 100% port sampling of biological data by the respective state departments of fish and wildlife.

Region	Management program	Gear type	Regulations related to discarding (e.g., size limits, escape rings, DMRs, application to quota)	At-sea monitoring	Port sampling
				at-sea processing must carry two observers; all others must carry one. VMS required when fishing in federal waters.	
West Coast	Open Access	Hook-and-line	Discarding allowed, 100% mortality applied to observed discarded fish < 28 cm (age-0 fish) and 20% mortality rate applied to fish >= 28 cm	About 5% coverage on average with human observer but varies depending on WCGOP capacity. VMS required when fishing in federal waters.	Generally less than 100% port sampling of biological data by the respective state departments of fish and wildlife

Appendix 5 Simulation framework for sablefish discards in the sablefish IFQ fishery

Appendix 5: Small Sablefish Release: Simulation Analysis and Results

May 17, 2024[1]

1 Analytic Approach

Executive Summary

To explore the potential implications of the proposed small sablefish release action (Alternative 2, Option 2), the simulation framework for projecting Acceptable Biological Catch (ABC) for Alaskan sablefish was adapted to include fishery discarding. Specifically, an age-based retention function and discard mortality rate (DMR) were integrated into the sex- and age-based projection module and associated $F_{40\%}$ calculations. Various scenarios were developed assuming either full retention or discarding with a 22 inch total length minimum size limit, which was assumed equivalent to discarding only age-2 fish (i.e., by using a knife-edge retention function where no fish of age-2 are retained and all fish age-3 and older are retained). DMRs of 12%, 20%, and 35% were implemented based on recommendations provided by the SSC at their February 2024 meeting. Projections were carried out for 50 years and important performance metrics [e.g., spawning stock biomass (SSB), landed catch, gross revenue, and dead discards] were calculated and compared across scenarios. Sensitivity analyses were also conducted, considering alternate recruitment, retention, and future price scenarios to address SSC concerns.

Results indicated that Alternative 2, Option 2 would have negligible impacts on the stock (e.g., dead discards were minimal and SSB was reduced slightly compared to full retention), while resulting in a slight improvement in gross revenue for the fixed gear fishery. These results held for all recruitment scenarios explored. None of the scenarios demonstrated a strong risk of the stock entering an overfished state, and the probability of becoming overfished was independent of discard scenario (i.e., allowing discarding did not increase the probability of becoming overfished compared to full retention). A larger minimum size limit (i.e., increasing the age of required retention) would have more significant impacts, including a minimal decline in SSB with greater improvement in gross revenue. Overall, the limited influence of discarding was due to natural mortality (i.e., resulting in 10% mortality of age-2 fish) being the primary driver of age-2 dynamics. Age-2 total mortality declined by less than 1% (i.e., 12% to 11%) when moving from full retention to age-3 retention with a 12% DMR (i.e., the highest discarding survival scenario).

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A web-based interactive application was developed to better aid comparisons across model scenarios and to help managers and stakeholders better digest the implications of the results. The tool is available at https://shinyfin.psmfc.org/small_sablefish/.

Introduction

During their February 2024 meeting, the SSC supported (NPFMC, 2024b) the proposed simulation methodology presented by the AFSC for projecting the impacts of the proposed sablefish release action (NPFMC, 2024a). This section outlines the final methods for the analysis as amended to address SSC concerns, summarizes the primary results, and discusses the implications in terms of potential impacts on the sablefish resource (i.e., spawning stock biomass and dead discards) and fishery (i.e., landings and gross revenue). The main concerns provided by the SSC regarding the proposed analysis are also addressed.

For the proposed sablefish release action, it is important to understand that when discarding is allowed the discard mortality rate (*DMR*) and retention selectivity (i.e., proportion of the catch at a given size or age that is retained) effectively act as scalars on total mortality. For instance, the age-based total mortality (*Z*), which is the sum of fishing mortality (*F*) and natural mortality (*M*), declines with reduced retention selectivity, and the magnitude of the decline is determined by the DMR:

$$Z_a = F * Selectivity_a * Retention_a + F * Selectivity_a * (1 - Retention_a) * DMR + M_a \quad \textbf{(eqn. 1)}$$

Under a full retention fishery, the retention selectivity is 1.0 and all selected fish die. Conversely, when no mortality occurs due to discarding (i.e., DMR = 0), then the second term in eqn. 1 goes to zero. Thus, total mortality at a given age is lower with discarding when there is no discard mortality compared to when a full retention fishery operates. For non-zero values of the DMR, the total mortality increases (i.e., relative to the situation where DMR = 0) and is scaled in proportion with the DMR (eqn. 1). Therefore, for a given combination of fishery selectivity and retention functions, a change in DMR effectively scales total mortality analogous to a change in natural mortality (eqn. 1).

Moving from the impacts of discarding on a given age or length of fish to the population level is complicated by biological (i.e., growth and maturity schedules) and fishery (i.e., selectivity, retention, and DMR) processes due to the transference of fishing effort across different age or size classes in the population (Bohaboy et al., 2022). For instance, implementing a minimum size limit (MSL) effectively legalizes high-grading, thereby, allowing a smaller fish to be caught and released, then replaced by larger, more valuable, and likely more fecund fish. This may increase the survival of smaller fish but also increase the mortality of larger fish. The balance between growth, maturity, natural mortality, fishery selectivity, fishery retention, and discard mortality rate at each size or age will determine whether discarding provides a net benefit to the resource or fishery.

Discarding is likely to have a strong biological benefit only if the resource is being caught in large numbers at sizes where fish are still growing rapidly, have yet to mature, have a relatively low natural mortality (compared to fishing mortality), and a limited discard mortality. In such cases, small fish are likely to survive release, are not likely to die due to natural mortality, and will have a high probability of contributing to the spawning stock biomass (SSB) in future years by ensuring at least one opportunity to spawn (i.e., a chance to replace itself in the population). Taking these factors into account for sablefish, Funk and Bracken (1984) concluded that:

> "Neither sablefish yield nor landed value per recruit are improved by the addition of size limits or market conditions which favor the retention of only large fish. By the time sablefish recruit to the fishery, their period of rapid growth is over, hence there are few advantages to be gained by delayed harvest. Although the natural mortality rate is low, apparently it is approximately equal to the rate of production due to growth by the

> population until sablefish reach 45 to 50 cm. At this size mortality begins to exceed growth so further delaying harvest only reduces yield and landed value....There does not appear to be any advantage to either setting a minimum size limit or delaying the harvest."

Therefore, full retention fisheries, in cases where delayed age of recruitment to the fishing gear already occurs, typically provide improved biological performance over those that allow discarding, because fishery waste (i.e., dead discards) is reduced and mortality is spread across age classes (i.e., MSLs can concentrate effort on larger, more productive fish; Cox et al., 2019; Bohaboy et al., 2022). For instance, in an earlier analysis of the proposed discarding action for Alaskan sablefish using the 2018 SAFE model, results demonstrated that both SSB and ABC declined compared to the full retention scenario as the age of retention or DMR increased (i.e., under the assumption that only landings, and not dead discards, counted against the ABC; NPFMC, 2019b). Thus, full retention led to the most optimistic long-term population trajectories and associated catch. Similarly, a management strategy evaluation for British Columbia sablefish demonstrated that conservation metrics were improved under full retention compared to discarding scenarios (Cox et al., 2019).

Implementing a MSL for Alaskan sablefish has been considered as a management option for at least the last 40 years (Funk and Bracken, 1984; Terry, 1987; Lowe, 1991; NPFMC, 2019a,b, 2021, 2023, 2024a). For example, Terry (1987) explored the impacts of a proposed NPFMC action to allow sablefish discarding at a time when similar dynamics were occurring in the population and fishery as are currently being observed (i.e., relatively large year classes entering the fishery and extreme variability in size-based prices with smaller fish having little market value). Results indicated that when a MSL was implemented for the directed fixed gear fleet, a MSL would not increase yield, but revenue could be increased by 9%. Continuing the work of Terry (1987), Lowe et al. (1991) concluded that when the DMR was accounted for in the model, yield and net value declined with discarding, while biomass increases were negligible. Thus, it was concluded that a MSL would be ineffective for Alaskan sablefish.

However, an equilibrium YPR model is not necessarily adequate to understand the short-term dynamics for a species like sablefish, which demonstrate high interannual variability in recruitment. Mainly, because YPR (or associated SPR) does not account for variability in recruitment, these types of equilibrium modeling approaches cannot effectively address density-dependence or the differential impact of age-based mortality as specific cohorts move through the fishery (e.g., the potential negative consequences for SSB when harvest is transferred from younger to older ages with a MSL). To better inform the scientific implications of the current sablefish release motion, previous work (i.e., NPFMC, 2019b) using dynamic catch projections (as opposed to equilibrium YPR models) was updated and refined to better reflect current conditions in the Alaskan sablefish resource and fishery. The results provide quantitative metrics to understand the biological impacts of implementing a 22 inch minimum size limit for Alaskan sablefish.

Methods and Study Design

The simulation model used to project Acceptable Biological Catch (ABC) for Alaskan sablefish, which utilizes the outputs of the most recent sablefish assessment (Goethel et al., 2023), formed the basis of the current analysis. The model was modified to incorporate discarding dynamics, as well as alternate performance metrics (e.g., gross revenue). The general analysis follows the approach implemented by the sablefish stock assessment authors in 2019 to address the impacts of the sablefish release motion, as proposed at that time (NPFMC, 2019b). The current analysis provides similar comparisons of ABC and SSB, but with important parametrization updates to reflect current resource and fishery conditions, improvements to better model the discarding process, increased scenarios to better reflect uncertainty, and a wider array of performance metrics. A per-recruit analysis is also provided to enable ease of comparison with earlier modeling initiatives, but with updated inputs reflecting current sablefish dynamics. We begin with a brief description of the per-recruit model, fully document the dynamic projection model (the model equations and inputs are provided in Tables 1 – 3), summarize the various projection scenarios (Table 4) and sensitivity runs (Table 5), and describe the various performance metrics used to compare scenario results.

Per-Recruit Model

A traditional age-based yield-per-recruit (YPR) model was implemented to enable comparison with previous analyses, including those presented in the February 2021 analysis (NPFMC, 2021), which utilized assumptions and inputs consistent with the current projection model. The underlying modeling framework used essentially the same population dynamics (Table 1) and inputs (Table 2) as the projection model, but made calculations for a single cohort assuming a constant recruitment value. For a given value of fishing mortality, the total yield from the cohort was summed across all ages and divided by the number of assumed recruits to calculate the yield-per-recruit. Gross revenue-per-recruit (RPR) was calculated by multiplying the yield (kg) at each age by the price per kilogram (in whole weight) at each age (Table 3; see the 'Projection Model' section for further details on converting size grade pricing data to age-based prices), then summing across cohort ages and dividing by the assumed number of recruits. For RPR, gross revenue was summed across both the trawl and fixed gear fleets (i.e., total gross revenue was used) assuming the same price structure for each fleet, which differed from the gross revenue calculations in the projection model that used only fixed gear fleet gross revenue. Finally, spawning biomass-per-recruit (SSBR) was then determined based on the total spawning biomass summed across ages from the cohort and also divided by the assumed number of recruits. For discard scenarios, a knife-edge retention selectivity at age-3 (i.e., only fish age-3 and older were retained) was assumed and a discard mortality rate was applied (see the 'Projection Model' section for further population dynamics modeling details). For a more complete description of per-recruit models with discarding see Lowe et al. (1991; methods were essentially the same except age-based instead of length-based dynamics were assumed here with updated model inputs to reflect current dynamics). YPR, RPR, and SSBR were calculated over a range of fishing mortalities (i.e., 0 — 0.5 in 0.0025 increments) to illustrate the resulting curves and to identify when the maximum values of YPR (i.e., occurring at F_{MAX}) and RPR were achieved.

$F_{40\%}$ Biological Reference Point

The NPFMC utilizes a sloped $F_{40\%}$ harvest control rule (HCR) based on the SSBR model to identify the fishing mortality ($F_{40\%}$) that reduces spawning stock biomass to 40% ($B_{40\%}$) of the unfished level ($B_{100\%}$) in equilibrium. The corresponding biomass-based reference points are then calculated by multiplying the corresponding SSBR value by the average recruitment (i.e., the average of the 2023 SAFE estimated recruitment values from 1979 – 2021, equal to 25.3 million fish). Thus, $B_{100\%}$ is equal to $SSBR_{100\%}$ * $\bar{R}_{1979-2021}$ and $B_{40\%}$ is equal to $SSBR_{40\%}$ * $\bar{R}_{1979-2021}$. The F_{ABC} is then set equal to $F_{40\%}$ and the F_{OFL} is equal to $F_{35\%}$, when SSB is above $B_{40\%}$. When SSB is less than or equal to $B_{40\%}$, the fishing mortality reference points are then decreased linearly corresponding to the ratio of current SSB to $B_{40\%}$ (see the HCR description in Table 1). For the projection model implemented in this analysis, the ABC was determined based on $F_{40\%}$ and the associated sloped NPFMC HCR as adjusted for discarding (i.e., the $F_{40\%}$ calculation integrated discard dynamics) and described in Table 1.

Projection Model

As noted, the catch projection model used for the current analysis is based on the NPFMC accepted approach for setting ABCs, with slight modifications to account for discarding and address SSC requests (NPFMC, 2024b). In particular, a 50 year projection (i.e., 2024 – 2073) was implemented to encapsulate both short-term and long-term impacts. Similarly, future recruitment was sampled (with replacement) from a set of estimated recruitments from the 2023 SAFE (Goethel et al., 2023), instead of being sampled from an assumed probability distribution as is the case with the typical NPFMC ABC projections.

Depending on the projection scenario, the recruitment set included either the full time series (1979 – 2021) or the recent time series (2016 – 2021) and the set could remain consistent across the projected time series or shift at the mid-point (i.e., 2049; see the 'Main Scenarios' section for more details on the projected recruitment options). By sampling from the realized distribution of sablefish recruitment, the current analysis aims to better reflect the extreme, spasmodic recruitment events observed for sablefish, which can be difficult to emulate with a probability distribution. The sampling with replacement approach was requested by the SSC.

The projection was age- and sex-specific and utilized the outputs of the most recent (2023) Alaska sablefish SAFE (Goethel et al., 2023) to parametrize the simulation, including biological inputs (i.e., size-at-age, weight-at-age, maturity-at-age, and a constant natural mortality across ages; Table 2), fishery selectivity (i.e., for the fixed gear and trawl fleets; Figure 1), recent fishing mortality ratio among fleets (i.e., 25.5% of the catch was taken by the trawl fleet), 2023 abundance-at-age (i.e., from the terminal year of the assessment), and the time series of recruitment estimates. A forward projection approach was implemented where the abundance-at-age was calculated forward in time from the previous age based on the simulated recruitment value or the input initial abundance-at-age (Table 3). Fishing and natural mortality in each year determined the removals and were used to tabulate landings and discards based on Baranov's catch equation. Spawning stock biomass (SSB) was also determined based on the weight of mature female fish.

The NPFMC sloping $F_{40\%}$ harvest control rule (HCR) was implemented to project catch each year based on stock status (i.e., depletion level; Table 3). To ensure more realistic catch projections, and to match the assumptions used to calculate future sablefish ABCs, the specified catch approach was implemented wherein only a proportion of the ABC was utilized based on the recent three year average utilization. Thus, only 66% of the ABC was assumed to be caught each year, but sensitivity runs with full ABC utilization were also implemented (see the 'Sensitivity Run Scenarios' section).

The total fishing mortality was partitioned among sectors based on the terminal year ratio of fishing mortality from the stock assessment, which resulted in a fixed gear to trawl fleet ratio of 74.5 : 25.5. Each fleet had a unique set of sex-specific selectivity functions, where the trawl fleet tended to select a higher proportion of smaller, younger fish and a smaller proportion of older, larger fish (i.e., selectivity was dome-shaped for the trawl fleet; Figure 1).

For discarding scenarios, the fishing mortality and catch were differentiated by the amount retained (i.e., the retained yield or landings) and the amount discarded (i.e., for the fixed gear fleet, since full retention was always assumed for the trawl fleet). Discards were further differentiated by the amount assumed to survive (i.e., live discards) and those assumed to die due to the DMR (i.e., dead discards). All dead fish (i.e., the sum of retained catch and dead discards) were assumed to count against the ABC for a given fleet. In other words, the HCR utilized a total removals-based quota accounting (see Bohaboy et al., 2022).

Discarding was modeled using a knife-edge (i.e., a logistic function with infinite slope) retention selectivity function and an input discard mortality rate (DMR). Thus, discards-at-age were the product of the fishing mortality rate, the selectivity-at-age by the fishing gear, and the retention-at-age (see eqn. 1). Dead discards were then the fraction of the discards-at-age that died based on the applied DMR (eqn. 1). Given the design of the proposed sablefish release action (i.e., optional retention of fish less than 22 inches total length) and the limited details available to inform the discarding process, a knife-edge retention selectivity was chosen to illustrate the maximum discarding under this motion (i.e., all fish that could be discarded were discarded). The main discarding scenarios assumed a knife-edge retention selectivity at age-3, because a 22 in total length minimum size limit roughly corresponded to the average length at age-3 (i.e., for both males and females) based on the total length to fork length conversions in NPFMC (2023; see Table 2). Moreover, the knife-edge retention function was chosen, because a) for the purpose of enforcement of a MSL, it is not feasible to have an 'optional' release (which would result in a non-knife-edge retention function), b) under the assumption of full compliance there should only be discards of fish at or below the MSL (i.e., resulting in 100% retention above the MSL), and c) given the lack of data on discarding (since the proposed action has yet to be implemented), the eventual assessment (at least initially) will not be able to directly estimate retention and will need to rely on a similar knife-edge assumption. Thus, there is no data from which to realistically determine the parameterization of alternate retention selectivity functions.

To understand potential fishery performance, gross revenue was also calculated each year based on price grade information available since 2015 (Table 3). Because this data primarily reflects information from the fixed gear fleet, total gross revenue was tallied only for the fixed gear fleet based on the fixed gear fleet retained catch-at-age. To calculate gross revenue, the size grade price information ($ per pound dressed weight; Table 3) was converted to $ per kilogram, then converted from dressed weight to whole weight based on the conversions in NPFMC (2023; Table 1). Each age by sex was assigned to a price grade, again based on the conversion in NPFMC (2023), thereby, assigning a $ per kilogram whole weight at each age by sex (Table 2). Gross revenue-at-age was then the product of retained catch-at-age for the fixed gear fleet, weight-at-age, and price-at-age, with total gross revenue equal to the gross revenue-at-age summed across ages and sexes. For the main scenarios, prices were assumed to be constant at the 2023 values (Table 3). Although gross revenue for the fixed gear fleet is a very crude metric of fishery performance (i.e., it ignores critical economic valuations of cost, present value, or altered fishing behavior when moving from a full retention fishery to one that allows discarding), it provides a basic indication of the relative impacts on fishery value across scenarios. Moreover, by accounting for the steep price gradient across size or age classes, gross revenue calculations enable an improved resolution for understanding likely fishery performance impacts compared to simple landings metrics. However, it is important to emphasize that the simple biological projection model does not incorporate any further economic or behavioral elements that would help better elucidate the potential impacts of moving from a full retention to minimum size limit fishery.

To encapsulate variability in the recruitment time series, a total of 500 iterations of each simulation scenario were implemented. Given that recruitment was the only stochastic process in the projection model, 500 iterations was deemed sufficient to portray random variation. For recruitment, the same random number seeds were used across scenarios for a given iteration to ensure consistency, but differed across each iteration. For resultant performance metrics, various simulation intervals (e.g., 50% and 85%) were illustrated to portray variability.

Performance Metrics

The primary metrics used to compare the impacts of the various discarding scenarios included: SSB, total landings, dead discards, and gross revenue. These were deemed to be the most informative metrics, because the time series of these values provide indications of resource status and biomass of mature fish (i.e., SSB), fishery variability (i.e., landings), fishery waste (i.e., dead discards), and fishery performance (i.e., gross revenue). Comparisons were primarily undertaken through visual analysis of the time series of these metrics, with emphasis on the initial ten years. Mean values (i.e., of the median or mean across all 500 iterations) across the first ten years and across all years were also reported to highlight the central tendency of the performance metrics as another way to compare across scenarios.

Main Scenarios

A variety of simulation scenarios were developed to address key modeling uncertainties (i.e., future recruitment and discard mortality rate). The main scenarios were meant to explicitly emulate the proposed sablefish release action, while addressing the primary SSC requests. These scenarios differ only in the simulated future recruitment, whether or not discarding was allowed (i.e., full retention vs. knife-edge age-3 retention), and the assumed discard mortality rate. A full factorial design was implemented for each of the three factors. The list of main scenarios and associated model settings are provided in Table 4.

For simulated recruitment, four different scenarios were implemented based on SSC requests. The first scenario, 'historical' recruitment, simulated future recruitment by choosing with replacement from the full time series (1979—2021) of recruitment estimates (i.e., with a mean of 25.3 million fish) from the 2023 SAFE assessment. This scenario was meant to encapsulate the full wide-ranging (i.e., both extremely low and extremely high recruitment) and spasmodic dynamics of sablefish year class variability. The 'recent' recruitment scenario chose with replacement from the 2016—2021 time series of recruitment estimates (i.e., the time period over which recruitment has been extremely high starting with the 2014 year class; mean of 61.5 million fish) and was meant to emulate a potential regime shift to a high recruitment regime. Both the 'low-high' and 'high-low' recruitment scenarios were requested by the SSC and implemented a change in the recruitment dynamics at the mid-way point (i.e., year 2049) of the projection period. The 'low-high' scenario first choose with replacement from the full time series of recruitment estimates, then choose with replacement from just the recent time series of recruitment for the second half of the projection time series. For the 'high-low' scenario, the opposite approach was taken (i.e., sampling was done from the recent then the full time series of recruitment estimates). To ensure consistency, when feasible, across scenarios with a common recruitment assumption and for a given iteration, recruitment values were identical (i.e., all 'historical' scenarios had the same recruitment time series within a given iteration). Similarly, the first 25 recruitment values from the historical and low-high recruitment scenarios were identical for a matching iteration, while the second 25 recruitment values for the low-high and recent recruitment scenarios similarly matched. Comparison across the array of recruitment scenarios provided indications of whether the assumptions guiding future recruitment influenced interpretation of the impact of the proposed discarding action.

Two retention scenarios were explored. The 'full retention' scenario emulated the current management regime and matched the ABC projections currently used for sablefish (i.e., results matched those provided in the 2023 SAFE report). As noted previously, when discarding was assumed, a knife-edge age-3 retention selectivity function was implemented. Thus, the retention assumption represented the main axis of comparison for understanding the impacts of discarding.

Three DMR rates were simulated, which were meant to envelope a plausible range of DMRs, including a lower bound, an upper bound, and middle value. These values were chosen by the SSC (see NPFMC, 2024b, for the full rationale for choosing these values). Using a plausible range of DMRs enabled adequate representation of the impacts of discarding without the need for an overwhelming number of simulation scenarios based on incremental DMRs. The upper bound on DMR was meant to encapsulate uncertainty in the DMR due to the potential for increased predation by whales or other unforeseen causes of handling mortality. The lower bound on DMR likely reflected the situation where the DMR was solely due to handling mortality, but was set greater than zero as some degree of handling mortality is expected to occur under normal fishery operations where discarding is occurring.

Sensitivity Run Scenarios

Four sensitivity run axes were explored, including alternate assumptions related to retention, ABC utilization, the proportion of catch from the trawl sector, and the assumed price structure (see Table 5 for a full list of sensitivity runs and associated assumptions). All of the sensitivity runs were based on the 'historical' recruitment scenario and matched the assumptions of the main scenarios except where explicit differences were noted. When discarding was assumed, a 20% DMR was implemented.

Three alternate retention scenarios were explored. The first two scenarios continued to assume knife-edge retention selectivity, but allowed the age of retention to increase to age-4 or age-5. The remaining scenario assumed a logistic retention selectivity function. These sensitivity runs demonstrate how the impacts of discarding might change if the MSL was increased (e.g., age-4 or age-5 knife-edge retention selectivity) or if there was difficulty enforcing the MSL and fish above the MSL were discarded at moderate rates until age-5 (i.e., the logistic selectivity scenario; see Figure 1 for demonstration of the alternate retention selectivity functions).

Next, uncertainty in the catch projections were explored by assuming that the full ABC was utilized. This scenario was demonstrated with the full retention assumption, because the proportion of the ABC utilized was simply a scalar on fishing mortality (see Table 1). Thus, the relative impacts proportionally scale in the same direction and magnitude across discarding assumptions (i.e., the relative differences between a 'full retention' and discarding scenario will be the same within the full ABC or partial ABC utilization scenario sets).

The next scenario then explored the percentage of the catch taken by the trawl fleet. Since 2017, the trawl fleet has harvested between 20% and 40% of the sablefish catch, with the recent mean around 25%. However, the mean percentage of catch from the trawl sector over the last 40 years has been between 10% and 20%. Exploration of the impacts of the assumption regarding catch by sector was requested by the SSC, and this scenario provides an alternate view of the discarding motion if trawl catch were to decline to 10% (e.g., as might be expected if sablefish recruitment and population abundance return to the levels observed over the last 30 years). Because the main scenarios assumed a high level of trawl catch (i.e., 25.5%), increasing the trawl removal percentage was not deemed realistic.

Finally, two alternate price scenarios were explored to better encapsulate fishery performance if prices were to return to higher levels. In the first scenario, the recent average prices from 2015—2023 were assumed, but still utilizing constant prices for the entire projection period. For the final scenario, a variable price scheme was implemented wherein the price in a given year was linked to the fixed gear landings. The primary assumption in this scenario was that price was inversely proportional to landings, such that higher prices were associated with lower fixed gear landings (i.e., based on the assumption that lower landings would reduce market saturation and result in higher prices). The minimum price was based on the 2023 prices and were associated with landings > 27kt (i.e., 2023 landings). The maximum price was based on the 2017 prices and were associated with landings < 12kt (i.e., approximate 2017 landings). The price at each age was then scaled linearly between the maximum and minimum price for landings between 12 and 27 kt. The variable price scenario was meant to naively represent a dynamic pricing example to better reflect the expectation that prices would likely return to more 'normal' levels as sablefish market saturation declined. However, no economic or fishery behavioral considerations were integrated into this scenario, so results should be interpreted with care.

Web-based Interactive Application

A companion web-based application to this analysis is available at: https://shinyfin.psmfc.org/small_sablefish/. The goal of developing a hands-on interactive app was to help ease comparisons among the array of scenarios and to hopefully enable a deeper understanding of the underlying model dynamics and implications of the proposed release motion. Moreover, it provides an alternate way of learning and understanding about the analysis for those that may not have the time or interest in reading large scientific documents. By utilizing an online app, it also allows a wider number of scenarios to be presented that could not be completely described in a written document. Therefore, although not intended for review, the online app provides alternate scenarios that may prove of interest for those hoping to gain a deeper understanding of the sablefish HCR and release motion. In addition to the scenarios listed here, the online app includes a near full factorial combination of sensitivity runs as well as alternate scenarios that provide further insight (e.g., a hindcast approach to demonstrate how discarding might have impacted the population dynamics if the release motion had been implemented at the time when recruitment had just started to increase in 2017, given the known recruitments between 2017 and 2023). We encourage stakeholders, managers, and scientists to explore the app and welcome any feedback as to whether this interactive approach was useful for presenting the results of the analysis or as an aid to better understanding the implications of the motion.

Results

Allowing discarding has minimal implications for the equilibrium per-recruit models (Figure 2). Results generally align with previous analyses for sablefish discarding motions using per-recruit approaches (e.g., Terry, 1987; Lowe et al., 1991; NPFMC, 2021). YPR is maximized at relatively high fishing mortalities (i.e., F_{MAX} ~ 0.45), RPR is maximized at intermediate values (~0.15), and $F_{40\%}$ occurs at slightly lower levels (~0.086), with exact values depending on the scenario (Figure 2). Among the main discarding scenarios, full retention results in the lowest gross revenue and highest yield, while SSBR is nearly indistinguishable among scenarios. Thus, the per-recruit models indicate that allowing discarding may provide some slight benefits to the fishery, but will have negligible impacts on the resource.

Despite the relatively simple equilibrium assumptions, the per-recruit model results are almost directly reflected in the dynamic simulation-projection model outcomes (Table 6). The assumed recruitment scenario (Figure 3) had the largest impact on output metrics, while differences across discarding scenarios within a given recruitment scenario were minimal (Figures 4 – 7). Dead discards represented a small fraction of total landings across all scenarios, leading to minimal impacts on the resource or the fishery. Generally, there was no change in the impacts of discarding across recruitment scenarios, as metrics scaled nearly proportionally with recruitment, despite drastically different time series trends (Figures 4 – 7). Given that $B_{40\%}$ is equal to 120 kt, there was a small probability of entering and remaining (for a short period) in an overfished state for recruitment scenarios that drew from the full recruitment time series (e.g., the 'historic' recruitment scenario), due to the chance of encountering a sequence of multiple below average recruitment events. However, the median and 50% simulation intervals for SSB were above $B_{40\%}$ for all years, recruitment scenarios, and discarding scenarios. Thus, the likelihood of sablefish being in an overfished state during the projection period was low and independent of whether or not discarding was allowed.

For the 'historical' recruitment scenarios, the average dead discards (i.e., for the 35% DMR scenario where dead discards were the highest) represented less than 1% of total landings (Figure 4, Table 6). Thus, SSB and landings were minimally impacted with no difference in mean values across the time series (Table 6). Minor increases in mean gross revenue were projected when discarding of age-2 fish was allowed, where the largest increases occurred with the smallest DMR (i.e., 12%). The population trajectories across the time series reflected both the delayed onset of maturity for recent year classes and associated lags for those young fish to begin entering the highly valuable price categories (i.e., SSB and gross revenue peak around 2030). Because recruitment returns to more average (i.e., lower than recent) conditions, landings decline almost immediately, given that total removals are driven by exploitable abundance which peaks in 2025. By about the mid-way point of the time series (~2050), all metrics have generally returned to more average and less dynamic conditions, with values much lower than at the outset of the projections (Figure 4). Although the lower 85% simulation intervals of SSB declined below $B_{40\%}$ for the second half of the time series, the probability of entering and remaining in an overfished state was low (i.e., ~40% of iterations entered an overfished state at least one time, but < 7% of all years across all iterations, within a given discarding scenario, were overfished). Given the design of the $F_{40\%}$ HCR, which reduces fishing mortality when SSB < $SSB_{40\%}$, the assumption of only 66% ABC utilization, and the use of a total removals-based ABC accounting, the low probability of entering and remaining in an overfished state was expected.

For the 'recent' recruitment scenarios, all metrics increase until the mid-way point of the time series when the new average conditions reflecting the higher mean recruitment are reached (Figure 5). Thus, SSB increases considerably as continued high recruitment leads to a steadily increasing supply of fish reaching maturity, landings increase as exploitable abundance remains high, and gross revenue similarly increases due to a mixture of a higher volume fishery and also an increased number of high value, larger fish (i.e., later in the time series). None of the 'recent' recruitment scenarios or iterations entered an overfished state in any year of the projection.

The 'high-low' and low-high' recruitment scenarios demonstrate a mixture of the two trends from the 'historical' and 'recent' recruitment scenarios, but, as noted, the relative impacts of discarding within these scenarios generally match those from the previously described recruitment scenarios. For the 'high-low' scenario, the trajectories for the first 25 years reflect the 'recent' recruitment scenario exactly, then metrics decline rapidly as recruitment reverts to the lower average values associated with the 'historical' recruitment scenario (Figure 6). The opposite holds for the 'low-high' scenario, where conditions over the first 25 years match the 'historic' recruitment scenario trends, then metrics begin to rapidly increase as recruitment reverts to the higher average value associated with the 'recent' recruitment scenario (Figure 7). Less than < 1% of all years across all iterations within a given discarding scenario for the high-low scenario and ~2% for the low-high scenario entered an overfished state, resulting in a slightly lower probability of being in an overfished state than under the 'historical' recruitment scenario.

Sensitivity Runs

Allowing for an increased minimum size limit (i.e., age of required retention) had moderate impacts on output metrics, with stronger effects as the age of required retention increased (Figure 8 and Table 6). For the sensitivity run with logistic retention selectivity, the results were intermediate between the main scenarios (i.e., age-3 retention) and the more extreme (i.e., age-5 retention) sensitivity scenarios, because the assumed retention function allowed for relatively low levels of discarding at age-3 and age-4 (Figure 1). Delaying the age of retention acted to slightly reduce SSB (by allowing increased harvest on older fish early in the time series), slightly increase landings, moderately improve gross revenue, and increase dead discards (though total dead discards remained relatively low given abundance levels). Despite reductions in SSB, the probability of being in an overfished state only increased to ~7% of years across all iterations for the age-5 retention scenario.

The assumption with the largest overall impact on the resource and fishery (aside from projected recruitment assumption) was the proportion of the ABC utilized. As expected, assuming full ABC utilization each year led to much lower SSB with concomitant increases in landings and gross revenue (Figure 9 and Table 6). Moreover, the probability of being in an overfished state increased significantly, with ~33% of all years across all iterations being in overfished state under full ABC utilization. The relative increase in gross revenue in the full ABC utilization scenario compared to the main scenarios is driven predominantly by the increase in landings volume, given that there is a decline in older, high value fish (as demonstrated by the lower SSB levels).

Decreasing the proportion of the harvest from the trawl sector from 25.5% to 10% had little impact on most metrics, with a slight decline in long-term SSB and associated increases in landings (Figure 9 and Table 6). Under this scenario, the overall mortality remains consistent with a slight shift across ages, given the differences in selectivity among fleets (Figure 1). However, given that selectivity across fleets is similar for younger ages, the general impact of adjusting the harvest proportion among fleets is mostly negligible with the slight decline in SSB due to the fixed gear fleet having higher selectivity of older fish. The major impact of this scenario is an increase in gross revenue for the fixed gear fleet, which is nearly proportional to the increase in the amount of harvest being reassigned to that fleet (Figure 9).

The final two price scenarios differed from the main scenarios only in the price structure, which affected the resulting gross revenue trajectories (Figure 9). As expected, the average price scenario leads to much higher gross revenue due to higher prices. The only noticeable change in trajectory occurs at the start of the time series, where the initial gross revenue increase is less pronounced for the average price scenario and reaches its maximum more quickly. The initial dynamic is driven by the fact that average prices do not have as steep a gradient between smaller and larger (i.e., younger and older) fish. Thus, gross revenue peaks faster because a high number of mid-value, intermediate size fish are as valuable as a smaller number of high-value large fish. Conversely, with current prices (as assumed in the main scenarios), fish must enter the 5/7 size grade (i.e., equivalent to age-9 for females, while males never enter this category) before their value increases substantially. The variable price scenario also performs as expected, with gross revenue increasing inversely proportional to the decreases in landings (Figure 9). Given the price structure assumptions, the median gross revenue near the end of the time series is higher under the variable price scenario compared to the average price scenario, despite a much lower initial gross revenue.

Discussion

Under the conditions specified in the proposed sablefish release action (i.e., voluntary release of fish less than 22 inches total length), the results of the projections indicate that there is likely to be a negligible impact on the population of allowing discarding of small sablefish. However, there may be slight benefits to the fishery in terms of gross revenue. The results of the dynamic projections align with those from the per-recruit models. Moreover, these results agree with previous analyses using both dynamic projections (NPFMC, 2019b) and equilibrium per-recruit models (Funk and Bracken, 1984; Terry, 1987; Lowe et al., 1991; NPFMC, 2021). All analyses have found that implementing a minimum size limit for Alaskan sablefish would be unlikely to greatly improve harvest or revenue, but would not detrimentally impact the SSB. The basic principles of population dynamics dictate that “by the time sablefish recruit to the fishery, their period of rapid growth is over, hence there are few advantages to be gained by delayed harvest.” (Funk and Bracken, 1984).

The limited impact of allowing discarding is primarily due to the proposed action limiting discarding to fish less than 22 inches total length, corresponding to essentially only age-2 fish. Given that fixed gear selectivity at age-2 is < 25% for both sexes (Figure 1), allowing discards of this age class of fish does not have a large impact on the population. Moreover, natural mortality is a much larger driver of age-2 dynamics than fishing mortality. For instance, natural mortality alone results in a 10% mortality of age-2 fish, with fishing mortality adding only an additional 1 – 2% mortality. Thus, age-2 mortality only declines 1% (i.e., from 12% to 11%) when moving from full retention to allowing discarding under the most optimistic (i.e., highest survival) discarding scenario with a 12% DMR. As an example of the impacts of discarding, in the first year of the projection approximately 36,000 fewer fish die from fishing in the age-3 retention scenario with a DMR of 12% compared to the full retention scenario. This translates into a 0.4% increase in age-2 abundance in the first year. Over the lifespan of the cohort, that equates to an ~0.5 kt increase in SSB, equivalent to about a 0.3% increase in SSB.

Therefore, released fish do not add significantly to the reproductive potential of the resource (i.e., do not increase SSB) due to the low rate of fishing mortality and high rate of natural mortality at the age of release (i.e., age-2). Similarly, there is little opportunity to legally high-grade, because the weight of age-2 fish that are released is small, especially when considering the tradeoff in weight between different ages or sizes of fish (i.e., three age-2 fish would need to be discarded to enable the retention of 1 grade 3/4 fish; Table 2). Hence, the improvements in gross revenue are not as high as might be expected.

However, the sensitivity scenarios illustrate that the impacts of discarding increase with an increasing age or size of retention. By delaying harvest further (e.g., to age-5), an increasing number of fish would be discarded, because selectivity of the fixed gear fleet increases rapidly, especially for females (Figure 1). As expected, there is a tradeoff between increased discards and subsequent landings and SSB, where landings increase and SSB declines, because discarding a moderate number of smaller fish in early years enables high-grading to larger, older fish. The tradeoff in SSB is minimal (i.e., surviving young fish are generally able to replace the larger fish being harvested in the long-term), while revenue is improved. These results corroborate those from previous analyses of this motion (NPFMC, 2019b, 2021), which demonstrated that the impacts of discarding increased rapidly as larger sizes or ages were able to released.

Moreover, the increased high-grading associated with a higher age of retention would necessitate a higher fishing effort. For instance, the F_{ABC} for the age-5 retention scenario increased by 12% over the status quo full retention scenario. Thus, there would be real-world costs (e.g., fuel) and potential ecosystem interactions associated with increased effort under increased retention sizes or ages.

The impacts of discarding were generally consistent across recruitment scenarios, indicating that the effects of the proposed motion would be unlikely to differ with uncertain future recruitment trends. However, the issue of recruitment regime shifts was not addressed, which likely led to overly optimistic outcomes for many of the scenarios. Mainly, because $B_{40\%}$ was not recalculated using the new mean recruitment values, there was likely a mismatch in biological reference points in future years for scenarios where mean recruitment increased or shifted. However, approaches for dealing with regime shifts are not well defined within the NPFMC $F_{40\%}$ HCR and were not considered within the scope of this analysis.

Issues of management robustness when using a $F_{40\%}$ reference point for a long-lived and highly dynamic species such as sablefish was further highlighted by the increase in the potential of being in an overfished state when the ABC was fully utilized. As has been noted in recent sablefish SAFE documents (Goethel et al., 2023), the highly spasmodic and cyclical nature of sablefish recruitment may lead to long-term declines in the resource when using a maximum catch strategy based on an equilibrium reference point like $B_{40\%}$. For instance, if an extended period of below average recruitment occurs, as is common for sablefish, then fishing at $F_{40\%}$ can actually decrease the SSB below $B_{40\%}$, because the stock is not able to adequately replace itself (i.e., due to recruitment being less than the average value assumed to calculate the biomass reference point). The sloped HCR will help reduce the potential decline of the resource, but may not be adequate for maintaining or rebuilding to the target $B_{40\%}$, at least not until another set of above average recruitment events 'rescues' the population. However, the robustness of the HCR is not specific to the proposed discarding action, given that no tested discarding scenario increased the probability of entering an overfished state. Yet, it is an important consideration for long-term sustainable management of sablefish that merits further investigation, ideally through a more robust management strategy evaluation (MSE) approach (see https://ovec8hkin.github.io/SablefishMSE/ for a description of an ongoing sablefish MSE project that aims to explore these topics).

Projection Caveats

The assumptions of the projection model were made to emulate future biological and fishery dynamics to the best of our current knowledge, given that there is high uncertainty in aspects such as future recruitment. The projections provide a quantitative basis to make relative comparisons among full retention and discarding scenarios, but any results, especially those beyond a few years into the future, should be analyzed with caution. Moreover, the array of alternate scenarios explored provide deeper insight into potential uncertainty for critical modeling assumptions (e.g., future recruitment and retention), but were far from exhaustive. Many of the uncertainties will lead to straightforward impacts, such as incorrectly specifying DMR, which will act as a scalar on mortality. However, without any existing data on sablefish discarding, limited knowledge on sablefish fishery behavior, or understanding of sablefish recruitment drivers, it is very difficult to develop a set of scenarios that fully encapsulate potential future dynamics. Other primary drivers of projection results and associated implications for understanding the proposed discarding action include assumptions regarding:

- Fishery selectivity—if the selectivity is over- or under-estimated at age-2, it would scale age-2 mortality and the resulting impacts of discarding proportionally (i.e., if more fish are selected, then more fish would be released, thus, projection results would be more similar to the age-4 or age-5 retention scenarios). Given that some discarding is likely already occurring in the fishery, age-2 selectivity is probably being underestimated in the assessment.
- Natural mortality—it is probable that natural mortality is being underrepresented at younger ages, because an age-invariant value is estimated in the assessment. If natural mortality is larger than was

simulated, then it would further negate any ‘positive’ impacts of discarding on SSB, because more released fish would die from natural causes. For instance, if whale predation increased with discarding, then it might be expected that the negative impacts on SSB would be more extreme (e.g., akin to an increased DMR).

- Growth—Research has shown that sablefish may demonstrate density-dependent growth, where growth rates have declined in association with recent large year classes (M. Cheng, UAF, personal communication). If growth has declined, then it would lead to increased discarding because more, older fish would be under the < 22 inch total length size limit. Thus, the expected implications of allowing for discarding would likely be more in line with the higher retention scenarios (e.g., age-4 or age-5 retention sensitivity runs).
- Economics—The naïve economic assumptions used to determine gross revenue were greatly simplified and assumed that all fish caught could be sold and that prices were constant (aside from the variable price sensitivity run). Including a full bioeconomic module onto the projections would be beneficial, but would require improved data collection on sablefish economics and markets.
- Fishery Behavior—Given that the projection framework is a biological model with coarse resolution, it was not feasible to include any specific fishery behavior elements. The model assumed that there would be no changes in fishing practices if discarding were allowed (aside from implementing a knife-edge retention function). Adding a fleet dynamics and behavior sub-model would allow better emulation of plausible changes in behavior under discarding scenarios, but would require a completely different framework (e.g., an agent-based model) to adequately encapsulate fishery behavior.

As noted previously, further work to explore uncertainty in the projections would best be achieved with a an MSE tool, which represents the ideal analytical approach to adequately identify the tradeoffs among performance metrics, quantify risk, thoroughly address the potential for increased uncertainty or bias in the assessment model due to the proposed action, or determine HCRs that are more robust to sablefish dynamics (e.g., to address spasmodic recruitment).

Assessment Uncertainty Considerations

Adopting and implementing the proposed sablefish release action will undoubtedly have several scientific implications, many of which cannot be fully addressed or accounted for in a simple projection model. One major consideration is the increased uncertainty in the stock assessment model, catch projections, and resulting ABC estimates. These considerations have been well-documented in previous reviews of this action, particularly in section 2.2.3 and Table 2-9 of the NPFMC (2021) report, which discusses the impacts on assessment and catch advice under discarding scenarios.

The exact impacts on scientific advice depend on the types, quantity, and quality of data available from vessels discarding sablefish. Ideally, data would be available to inform the magnitude and size/age composition of discarded sablefish with reasonable precision, similar to data collected for landings. However, regardless of data availability, uncertainty in the assessment will increase simply due to the unknown value of the DMR. Additionally, reductions in observer sampling of age-2 fish (i.e., if most are discarded and not sampled) would further increase the uncertainty in estimates of age-2 recruitment, which are already highly uncertain in the assessment model.

If sablefish discard data is imprecise or not collected (e.g., there is no size composition data from discards), the assessment will become more uncertain and potentially biased due to incorrect assumptions. Ideally, the parameters defining the discarding process would be directly estimated through maximum likelihood estimation by fitting the discard data, similar to how fishing mortality and selectivity parameters are estimated. As discard data quality declines or becomes unavailable, discard parameters would need to be fixed at prespecified values increasing the likelihood of bias in the stock assessment.

The degree of bias and its impact on catch advice is difficult to quantify due to unknowns about data availability and precision.

Initially, there will be almost no discard data, and what data is available is likely to be highly uncertain. Therefore, the assessment might fix discard parameters without fitting the discard data as done for Gulf of Mexico Vermillion Snapper (SEDAR, 2020). Conversely, the assessment model could begin with recruitment at age-3, bypassing the need to model the uncertain and poorly informed discarding process. Either approach would result in increased assessment uncertainty and likely reduced estimation stability.

Any assessment uncertainty would affect catch projections, as the projection module would use similar assumptions (as described in Table 1). Given this increased uncertainty, assessment authors might recommend a larger catch buffer as part of the risk table process. It is also important to note that ABC calculations would follow the process outlined here, assuming a total removals-based quota accounting (i.e., including all dead discards and landed fish). As such, the ABC provided by the assessment authors would include both landings and dead discards. Therefore, both landed catch and dead discards in the sablefish fishery would need to be monitored to avoid any potential ABC overages.

Responses to SSC Comments

The SSC noted a few concerns and requested further discussion on a number of topics during their review of the NPFMC (2024a) document outlining the proposed projection approach, which were summarized in NPFMC (2024b). Responses to the concerns related specifically to this analysis are provided here.

- *The SSC recommends that the analysts consider the assumption of constant relative fishing mortality between trawl and fixed gear fisheries and whether it is consistent with recent observed fishery behavior during a period of higher recruitment and greater abundance of small fish.*
    - The ratio of fishing mortality among fleets for all projection years is based on the terminal year estimate (i.e., 25.5% to the trawl sector) from the 2023 stock assessment (i.e., following the assumption used in official ABC projections for sablefish). Thus, it is expected that this value adequately reflects the current fleet dynamics during a period of high recruitment. Since 1980, the fraction of harvest coming from the trawl fleet has only been higher in two years (maximum value of 39%). However, the average value of the last 40 years has been around 10% -- 20%. A sensitivity run scenario (i.e., 10% of harvest from the trawl sector) was implemented to demonstrate the potential impact under the assumption that the proportion of harvest from the trawl sector goes back towards the long-term average, which was deemed more likely in the future if recruitment returned to long-term mean levels, sablefish markets normalized, and the fixed gear fishery caught a higher proportion of their quota. Aside from increasing the proportion of catch from the fixed gear fleet (and increasing the associated revenue from that fleet), the overall impacts on SSB and landings were minimal. Conversely, if the proportion of harvest from the trawl fleet were to increase, then any positive benefits under discarding scenarios would likely be further decreased, given the higher age-2 selectivity in the trawl fleet. However, the reduced selectivity of older ages in the trawl fleet would concomitantly allow a minimally increased survival of older age classes. Overall, it is not expected that a change in the proportion of catch from the trawl sector would have any strong influence on the interpretation of the results of this analysis.

- *The SSC recommends a detailed discussion of how discard mortality would be managed and how these potential management options align with assumptions embedded in the simulation model.*

- As noted, the projection model assumes a total removals-based quota accounting system, such that all landings and dead discards count against the ABC. Thus, for monitoring and management purposes, both landings and dead discards would need to be monitored by the Catch Accounting & Data Quality Branch at the NMFS AKRO through catch and observer reporting to ensure the ABC is not exceeded. These considerations are discussed in the catch accounting implications section of this document.

- *The SSC recommends explicitly stating the fishery behavior assumptions that are used in the simulation, and providing a thorough discussion of how actual behavior might change in the presence of differing incentives and tools available to harvesters to alter times, locations and gear used to target sablefish. The SSC expressed concern related to the lack of justification for the human behavior assumptions implicitly embedded in the simulation model, noting the potential for a change in behavior to change discards.*
  - Given that this is a simple biological projection, there are no explicit assumptions regarding behavior, aside from the assumption of knife-edge retention. As noted in the 'Projection Caveats' section, addressing changes in behavior or fleet dynamics would require a different type of bioeconomic or agent-based modeling framework. The current model is not sufficient to adequately address these types of complexities. Moreover, information on behavior and sablefish economics would be required to parametrize such a model, which are not likely available. We expect that discarding could change the behavior of the fleet, but could not envision a way to adequately implement such dynamics in the current simulation-projection framework. Please see 5.4.1 for a separate analysis on how changes in fleet behavior are likely to impact the sablefish resource and fleet economics under the proposed action.

- *The SSC recommends that it may be informative to explore alternative price structures (compared to simply using recent observed price by size category).*
  - Although we did implement two alternate price sensitivity scenarios (i.e., using average price and a variable price linked to the magnitude of landings), both maintained extremely simplified price structure assumptions and utilized no specific economic rationale. Thus, it is unlikely that either scenario could be deemed more realistic than the assumption in the main scenarios where prices were time-invariant and based on 2023 prices. However, these alternate price scenarios do provide a demonstration of the potential implications of different price structures.

Conclusions

Across the array of catch projection scenarios explored, allowing small sablefish to be released (i.e., at age-2 or younger, which corresponds to the proposed 22 inch minimum size in the release action) had a minimal impact on the sablefish resource. For instance, regardless of the assumed discard mortality rate (i.e., within the 12% -- 35% range explored) or recruitment scenario, allowing discarding only slightly altered SSB and landings trajectories, but gross revenue did increase compared to full retention scenarios. Moreover, under no scenario was the probability of entering an overfished state high, but it did increase under the full ABC utilization sensitivity run. However, the potential for entering an overfished state was generally independent of the discarding scenario, indicating that the NPFMC $F_{40\%}$ harvest control rule and assumed future recruitment trajectory were the primary drivers, and it was not related to whether or not discarding was allowed.

The potential impacts of allowing discarding were generally minimal because fishery selectivity is relatively low at age-2 and assumed natural mortality is high compared to fishing mortality. Thus, age-2 mortality only declines 1% (i.e., from 12% to 11% mortality) when moving from full retention to allowing discarding under the highest survival rate (i.e., a 12% DMR) discarding scenario. Under higher age or sizes of required retention, the potential impacts of discarding are increased (i.e., larger declines in SSB and greater improvements in revenue occur). The results of this analysis generally align with previous analyses using both dynamic projections and equilibrium per-recruit models, with some slight discrepancies primarily due to the updated model inputs that were taken from the 2023 Alaska sablefish stock assessment.

As with any modeling framework, a number of caveats and limitations exist for interpretation of the results, but it is expected that the relative comparisons among full retention and discarding scenarios will be robust to many uncertainties. However, the projection framework is a simple biological model with a naïve price structure that was used to calculate gross revenue. Without a more detailed and informed bioeconomic model, it was not possible to analyze the potential economic impacts or integrate dynamic behavior or decision-making. From a scientific perspective, the proposed motion would also lead to increased uncertainty in the stock assessment as well as resulting catch advice, due to the limited data that will likely be available to inform the discarding process in the models (e.g., limited quantity and precision of data on discard magnitude and associated size or age composition of discarded catch).

A web-based interactive application was also developed as part of this work to better aid comparisons across model scenarios and to help managers and stakeholders better digest the implications of the results. The tool is available at https://shinyfin.psmfc.org/small_sablefish/.

2 References

Bohaboy, E.C., Goethel, D.R., Cass-Calay, S.L., and Patterson, W.F., III. 2022. A simulation framework to assess management trade-offs associated with recreational harvest slots, discard mortality reduction, and bycatch accountability in a multi-sector fishery. Fisheries Research. 250: 106258. doi: 10.1016/j.fishres.2022.106268.

Cox, S., Holt, K., Johnson, S. 2019. Evaluating the robustness of management procedures for the Sablefish (*Anoplopoma fimbria*) fishery in British Columbia, Canada for 2017-18. DFO Can. Sci. Advis. Sec. Res. Doc. 2019/032. vi + 79 p. Accessed from [January, 2024]: https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/40853330.pdf

Funk, F., and Bracken, B.E. 1984. Status of the Gulf of Alaska Sablefish (*Anoplopoma fimbria*) Resource in 1983. Alaska Department of Fish and Game, Informational Leaflet No. 235. Division of Commercial Fisheries. Juneau, AK. 55p. Accessed from [January 17, 2024]: https://www.researchgate.net/publication/338175923_Status_of_the_Gulf_of_Alaska_sablefish_Anoplopoma_fimbria_resource_in_1983_Alaska_Department_of_Fish_and_Game_Informational_Leaflet_235

Goethel, D.R., Cheng, M.L.H., Echave, K.B., Marsh, C., Rodgveller, C.J., Shotwell, K., and Siwicke, K. 2023. Assessment of the sablefish stock in Alaska. North Pacific Fishery Management Council, Anchorage, AK. Accessed from [January 2023]: https://www.npfmc.org/wp-content/PDFdocuments/SAFE/2023/sablefish.pdf.

Lowe, S.A., Fujioka, J.T., and Terry, J.M. 1991. Bioeconomic analysis of a minimum size limit for Gulf of Alaska sablefish using a yield per recruit model. Fisheries Research. 11: 307-320. doi: https://doi.org/10.1016/0165-7836(91)90007-3

NPFMC. 2019a. Discussion Paper: Sablefish Discard Allowance. https://meetings.npfmc.org/CommentReview/DownloadFile?p=547e97ee-897a-4d4d-8811-71fba0d56de3.pdf&fileName=D8%20Sablefish%20Discard%20Allowance%20DiscPaper.pdf

NPFMC. 2019b. Discussion Paper: Sablefish Discard Allowance. https://meetings.npfmc.org/CommentReview/DownloadFile?p=af8355e5-8e81-4165-b20e-2ce11cade94d.pdf&fileName=D2%20Small%20Sablefish%20Discarding%20Discussion%20Paper.pdf

NPFMC. 2021. Initial Review Draft Environmental Assessment/Regulatory Impact Review for Proposed Amendments to the Fishery Management Plans for BSAI and GOA Groundfish: IFQ Sablefish Release Allowance. https://meetings.npfmc.org/CommentReview/DownloadFile?p=0a70f8a0-25c2-4d5e-9044-f289c7f4e40d.pdf&fileName=C3%20IFQ%20Sablefish%20Release%20Allowance%20Analysis.pdf

NPFMC. 2023. Small Sablefish Release Update. https://meetings.npfmc.org/CommentReview/DownloadFile?p=1bf689e8-19a4-49cf-bbd9-f1b66c1e95de.pdf&fileName=D1%20Staff%20Update%20Paper.pdf

NPFMC. 2024a. Small Sablefish Release: DMR & Analytical Approach. https://meetings.npfmc.org/CommentReview/DownloadFile?p=d4ae38e7-b5ee-4521-bd56-b257235c9020.pdf&fileName=D6%20Small%20Sablefish%20Release%20Discussion%20Paper.pdf

NPFMC. 2024b. Scientific and Statistical Committee Final Report to the North Pacific Fishery Management Council February 5th – 7th, 2024b. Available from: https://meetings.npfmc.org/CommentReview/DownloadFile?p=e9d1e183-d943-4c9d-8512-de958128e636.pdf&fileName=SSC%20Report%20Feb%202024_FINAL.pdf

SEDAR (Southeast Data, Assessment, and Review). 2020. SEDAR 67 Stock Assessment Report: Gulf of Mexico Vermilion Snapper. North Charleston, SC. https://sedarweb.org/documents/sedar-67-gulf-of-mexico-vermilion-snapper-final-stock-assessment-report/

Terry, J. 1987. Amendment Proposal 6: Minimum size limit for sablefish (GOA and BSAI).

3 Tables

Table 1. The primary equations describing the projection module.

Derived quantity	Equation	Description
Recruitment (R)	$R_{Sex,Year} = 0.5 * (x \in_R \overline{Recruit}(Time\_Period))$	The set *Recruit* contains the 2023 SAFE recruitment estimates for the associated time period defined by the recruitment scenario (see Table 4); recruitment occurs at age-2.
Weight-at-Age (Wt)	Input	See Table 2.
Weight Conversion	$Round\_Weight = \frac{Dressed\_Weight}{0.63}$	For converting size grade data in dressed weight to whole weight for use in the projections of revenue; conversion from NPFMC (2023).
Maturity-at-Age (Mat)	Input	See Table 2.
Selectivity (S)	Input	See Table 2 and Figure 1.
Retention (Ret)	Input	Equal to 100% for the trawl fleet; for the fixed gear fleet it can be 100% for all ages ('Full Retention' Scenario) or 0% at age-2 and 100% at all other ages (i.e., knife-edge retention starting at age-3), with alternate values for sensitivity run retention scenarios (see Table 5 and Figure 1).
Discard Mortality Rate (DMR)	Input	Equal to 0%, 12%, 20%, or 35%, depending on the scenario (See Table 4).
Price-at-Age (P)	Input	Price ($) per kg in round weight, which was converted from $ per lbs. dressed weight (see Table 3).
Natural Mortality (M)	$M_{Sex,Age} = 0.113$	From the 2023 SAFE.
Fishing Mortality (F) to Achieve Acceptable Biological Catch (ABC)	$F_{ABC} = \begin{cases} F_{40\%}, & if\ SSB_{Year} > SSB_{40\%} \\ F_{40\%} * \frac{\frac{SSB_{Year}}{SSB_{40\%}} - 0.05}{0.95}, & if\ SSB_{Year} \leq SSB_{40\%} \\ 0, & if\ SSB_{Year} < 0.05 * SSB_{40\%} \end{cases}$	The sloping NPFMC $F_{40\%}$ harvest control rule, where $F_{40\%} = 0.086$ under full retention, but differs slightly for each discarding scenario.
Yearly Fishing Mortality Multiplier	$F_{Mult,Year} = ABC_{Prop} * F_{ABC}$	$ABC_{Prop} = 66\%$, except under the sensitivity run where the full ABC is utilized.
Landed Fishing Mortality-at-Age	$F^{Fleet}_{Landed,Sex,Age,Year} = F_{Mult,Year} * Prop_{Fleet} * S^{Fleet}_{Sex,Age} * Ret^{Fleet}_{Sex,Age}$	Fleets include the fixed gear fleet and the trawl gear fleet; $Prop_{Fixed\_Gear} = 0.745$.
Discarded Fishing Mortality-at-Age	$F^{Fleet}_{Disc,Sex,Age,Year} = F_{Mult,Year} * Prop_{Fleet} * S^{Fleet}_{Sex,Age} * (1 - Ret^{Fleet}_{Sex,Age}) * DMR$	Fishing mortality due to discarding.
Total Fishing Mortality by Fleet and Age	$F^{Fleet}_{Tot,Sex,Age,Year} = F^{Fleet}_{Landed,Sex,Age,Year} + F^{Fleet}_{Disc,Sex,Age,Year}$	Total fishing mortality by fleet.

Derived quantity	Equation	Description
Total Fishing Mortality-at-Age	$F_{Tot,Sex,Age,Year} = \sum_{Fleet} F^{Fleet}_{Tot,Sex,Age,Year}$	Total population fishing mortality summed across all fleets.
Total Mortality (*Z*)-at-Age	$Z_{Sex,Age,Year} = F_{Tot,Sex,Age,Year} + M_{Sex,Age}$	Total mortality-at-age.
Abundance-at-Age (*N*)	$N_{Sex,Age+1,Year+1} = N_{Sex,Age,Year} e^{-Z_{Sex,Age,Year}}$	Projected abundance, where abundance at age-2 (i.e., new recruitment) is equal to $R_{Sex,Year}$.
Spawning Stock Biomass (*SSB*)	$SSB_{Year} = \sum_{Age} (Mat_{Age} * N_{Fem,Age,Year} e^{-Spawn\_Fract * Z_{Fem,Age,Year}})$	Note that spawning occurs in January, so SSB is not reduced for mortality during the year.
Retained Catch-at-Age (*CAA*) by Fleet	$CAA^{Fleet}_{Sex,Age,Year} = N_{Sex,Age,Year} * (1 - e^{-Z_{Sex,Age,Year}}) \frac{F^{Fleet}_{Landed,Sex,Age,Year}}{Z_{Sex,Age,Year}}$	Retained (landed) catch-at-age by fleet in numbers.
Retained Yield (*Y*) by Fleet	$Y^{Fleet}_{Sex,Year} = \sum_{Age} Wt_{Sex,Age} * CAA^{Fleet}_{Sex,Age,Year}$	Retained landings in weight by fleet.
Dead Discards-at-Age (*DAA*) by Fleet	$DAA^{Fleet}_{Sex,Age,Year} = N_{Sex,Age,Year} * (1 - e^{-Z_{Sex,Age,Year}}) \frac{F^{Fleet}_{Disc,Sex,Age,Year}}{Z_{Sex,Age,Year}}$	Dead discards-at-age by fleet in numbers.
Dead Discards (*D*) by Fleet	$D^{Fleet}_{Sex,Year} = \sum_{Age} Wt_{Sex,Age} * DAA^{Fleet}_{Sex,Age,Year}$	Dead discards in weight by fleet.
Gross Revenue (*R*)	$R^{Fixed\_Gear}_{Sex,Year} = \sum_{Age} Wt_{Sex,Age} * CAA^{Fixed\_Gear}_{Sex,Age,Year} * Price_{Sex,Age,Year}$	Total gross revenue by sex and year for the fixed gear fleet *only*; price was converted from size grade to age (see Tables 2 and 3) and was assumed time-invariant based on 2023 prices for the main scenarios.
Depletion	$\%SSB_{100\%_{Year}} = \frac{SSB_{Year}}{SSB_{100\%}}$	$SSB_{100\%}$ = 300 kt and $SSB_{40\%}$ = 0.4 * $SSB_{100\%}$ = 120 kt.

Table 2. Sablefish price grade, fork length (cm), weight (kg), proportion mature, and selectivity by age and sex. Inputs are taken from the 2023 sablefish SAFE report (Goethel et al., 2023) and the June 2023 small sablefish release update document (NPFMC, 2023).

	Price Grade		Fork Length (cm)		Round Weight (kg)		Maturity	Selectivity (Fixed Gear)		Selectivity (Trawl Gear)	
Age	Male	Female	Male	Female	Male	Female	Female	Male	Female	Male	Female
2	1/2	1/2	47.9	48.0	1.1	1.1	0.02	0.21	0.11	0.24	0.49
3	2/3	2/3	52.0	53.2	1.4	1.6	0.05	0.35	0.54	0.46	0.73
4	2/3	2/3	55.3	57.6	1.8	2.0	0.09	0.52	0.92	0.65	0.87
5	2/3	3/4	57.9	61.3	2.1	2.5	0.18	0.68	0.99	0.79	0.95
6	3/4	3/4	60.0	64.4	2.3	2.9	0.31	0.81	1.00	0.88	0.99
7	3/4	4/5	61.6	67.0	2.5	3.3	0.49	0.89	1.00	0.95	1.00
8	3/4	4/5	62.9	69.2	2.7	3.6	0.67	0.94	1.00	0.99	0.99
9	3/4	5/7	64.0	71.1	2.8	3.9	0.81	0.97	1.00	1.00	0.96
10	4/5	5/7	64.8	72.7	2.9	4.2	0.90	0.98	1.00	1.00	0.92
11	4/5	5/7	65.4	74.0	3.0	4.4	0.95	0.99	1.00	0.98	0.88
12	4/5	5/7	66.0	75.1	3.0	4.7	0.98	1.00	1.00	0.95	0.83
13	4/5	5/7	66.4	76.1	3.1	4.8	0.99	1.00	1.00	0.91	0.78
14	4/5	5/7	66.7	76.9	3.1	5.0	0.99	1.00	1.00	0.86	0.73
15	4/5	7+	66.9	77.6	3.1	5.1	1.00	1.00	1.00	0.82	0.68
16	4/5	7+	67.1	78.1	3.2	5.2	1.00	1.00	1.00	0.77	0.63
17	4/5	7+	67.3	78.6	3.2	5.3	1.00	1.00	1.00	0.72	0.58
18	4/5	7+	67.4	79.0	3.2	5.4	1.00	1.00	1.00	0.67	0.53
19	4/5	7+	67.5	79.4	3.2	5.5	1.00	1.00	1.00	0.62	0.49
20	4/5	7+	67.6	79.7	3.2	5.5	1.00	1.00	1.00	0.57	0.45
21	4/5	7+	67.7	79.9	3.2	5.6	1.00	1.00	1.00	0.53	0.41
22	4/5	7+	67.7	80.1	3.2	5.6	1.00	1.00	1.00	0.48	0.37
23	4/5	7+	67.8	80.3	3.2	5.7	1.00	1.00	1.00	0.44	0.34
24	4/5	7+	67.8	80.4	3.2	5.7	1.00	1.00	1.00	0.40	0.31
25	4/5	7+	67.8	80.6	3.2	5.7	1.00	1.00	1.00	0.37	0.28
26	4/5	7+	67.9	80.7	3.2	5.8	1.00	1.00	1.00	0.33	0.25
27	4/5	7+	67.9	80.8	3.2	5.8	1.00	1.00	1.00	0.30	0.23
28	4/5	7+	67.9	80.8	3.2	5.8	1.00	1.00	1.00	0.27	0.21
29	4/5	7+	67.9	80.9	3.2	5.8	1.00	1.00	1.00	0.25	0.19
30	4/5	7+	67.9	80.9	3.2	5.8	1.00	1.00	1.00	0.22	0.17
31+	4/5	7+	67.9	81.0	3.2	5.8	1.00	1.00	1.00	0.20	0.15

Table 3. Sablefish price data (in $ per lbs. dressed weight) used for the analysis. The main scenarios assumed a constant price equal to the 2023 prices. The sensitivity run using average prices used the 2015 – 2023 mean. The variable price sensitivity run assumed a linear, inverse proportionality between price and landings, where minimum price was taken from 2023 and associated with landings > 27kt (i.e., 2023 landings) and the maximum price was from 2017 and associated with landings < 12kt (i.e., approximate 2017 landings). Data from ADF&G fish tickets, provided by AKFIN.

	Price Grade					
Year	**1/2**	**2/3**	**3/4**	**4/5**	**5/7**	**7+**
2015	$4.22	$4.27	$5.19	$6.09	$7.55	$8.94
2016	$4.85	$5.05	$5.78	$6.63	$8.16	$10.04
2017	$5.70	$6.05	$7.16	$8.25	$9.34	$10.70
2018	$1.63	$2.89	$4.13	$5.28	$8.27	$9.14
2019	$1.49	$2.06	$2.71	$3.56	$5.88	$6.69
2020	$0.45	$1.19	$1.74	$2.17	$3.33	$4.97
2021	$0.96	$1.91	$2.46	$2.84	$3.78	$5.60
2022	$0.84	$1.75	$2.40	$3.57	$5.97	$6.94
2023	$0.43	$0.95	$1.34	$1.88	$4.33	$5.35
Mean	$2.29	$2.90	$3.66	$4.47	$6.29	$7.60

Table 4. Main simulation scenarios to project the impact on sablefish dynamics under different assumptions of discarding, recruitment, and discard mortality rate (DMR).

Abbreviation	Recruitment	Retention	DMR	% ABC Harvested	% Catch from Trawl	Price
Full_Retention	Historical	Full	None	66%	25.5%	2023 (Fixed)
Hist_Recr_DMR_12%	Historical	Age-3 (Knife-edge)	12%	66%	25.5%	2023 (Fixed)
Hist_Recr_DMR_20%	Historical	Age-3 (Knife-edge)	20%	66%	25.5%	2023 (Fixed)
Hist_Recr_DMR_35%	Historical	Age-3 (Knife-edge)	35%	66%	25.5%	2023 (Fixed)
Rec_Recr_Full_Ret	Recent	Full	None	66%	25.5%	2023 (Fixed)
Rec_Recr_DMR_12%	Recent	Age-3 (Knife-edge)	12%	66%	25.5%	2023 (Fixed)
Rec_Recr_DMR_20%	Recent	Age-3 (Knife-edge)	20%	66%	25.5%	2023 (Fixed)
Rec_Recr_DMR_35%	Recent	Age-3 (Knife-edge)	35%	66%	25.5%	2023 (Fixed)
Lo_Hi_Recr_Full_Ret	Low-High	Full	None	66%	25.5%	2023 (Fixed)
Lo_Hi_Recr_DMR_12%	Low-High	Age-3 (Knife-edge)	12%	66%	25.5%	2023 (Fixed)
Lo_Hi_Recr_DMR_20%	Low-High	Age-3 (Knife-edge)	20%	66%	25.5%	2023 (Fixed)
Lo_Hi_Recr_DMR_35%	Low-High	Age-3 (Knife-edge)	35%	66%	25.5%	2023 (Fixed)
Hi_Lo_Recr_Full_Ret	High-Low	Full	None	66%	25.5%	2023 (Fixed)
Hi_Lo_Recr_DMR_12%	High-Low	Age-3 (Knife-edge)	12%	66%	25.5%	2023 (Fixed)
Hi_Lo_Recr_DMR_20%	High-Low	Age-3 (Knife-edge)	20%	66%	25.5%	2023 (Fixed)
Hi_Lo_Recr_DMR_35%	High-Low	Age-3 (Knife-edge)	35%	66%	25.5%	2023 (Fixed)

Table 5. Sensitivity run simulation scenarios used to demonstrate the impact of various assumptions regarding ABC utilization, retention, proportion of catch from trawl gear, and price on the projected sablefish dynamics.

Abbreviation	Recruitment	Retention	DMR	% ABC Harvested	% Catch from Trawl	Price
Age-4_Ret_Hist_Recr_DMR_20%	Historical	Age-4 (Knife-edge)	20%	66%	25.5%	2023 (Fixed)
Age-5_Ret_Hist_Recr_DMR_20%	Historical	Age-5 (Knife-edge)	20%	66%	25.5%	2023 (Fixed)
Log_Ret_Hist_Recr_DMR_20%	Historical	Logistic	20%	66%	25.5%	2023 (Fixed)
Full_ABC_Hist_Recr_Full_Ret	Historical	Full	None	100%	25.5%	2023 (Fixed)
Trwl_10%_Hist_Recr_DMR_20%	Historical	Age-3 (Knife-edge)	20%	66%	10%	2023 (Fixed)
Price_Avg_Hist_Recr_DMR_20%	Historical	Age-3 (Knife-edge)	20%	66%	25.5%	Average (2015—2023)
Price_Var_Hist_Recr_DMR_20%	Historical	Age-3 (Knife-edge)	20%	66%	25.5%	Variable (Inversely Proportional to Landings)

Table 6. Summary results of the projections. Values represent the mean across the given time period of the median value for a given year across all 500 iterations of the simulation scenario, except for the recruitment and dead discards which are the mean of the mean value for a given year. Recruitment is in millions of fish and revenue is in millions of dollars (tabulated for the fixed gear fleet only), while SSB, landings, and dead discards are in kilotons.

Grouping	Abbreviation	Recruit (Avg. 2024-2033)	Recruit (Avg. All Years)	SSB (Avg. 2024-2033)	SSB (Avg. All Years)	Landings (Avg. 2024-2033)	Landings (Avg. All Years)	Revenue (Avg. 2024-2033)	Revenue (Avg. All Years)	Dead Discards (Avg. 2024-2033)	Dead Discards (Avg. All Years)
Main Runs	*Full_Retention*	24.5	25.1	219	174	27.9	21.7	79.1	62.9	0.000	0.000
	Hist_Recr_DMR_12%	24.5	25.1	219	174	27.9	21.7	79.5	63.3	0.021	0.021
	Hist_Recr_DMR_20%	24.5	25.1	219	174	27.9	21.7	79.5	63.2	0.035	0.035
	Hist_Recr_DMR_35%	24.5	25.1	219	174	27.9	21.7	79.4	63.2	0.061	0.062
	Rec_Recr_Full_Ret	60.6	61.2	259	350	38.0	45.8	96.1	127	0.000	0.000
	Rec_Recr_DMR_12%	60.6	61.2	259	350	38.0	45.9	96.5	128	0.052	0.052
	Rec_Recr_DMR_20%	60.6	61.2	259	350	38.0	45.9	96.5	128	0.086	0.087
	Rec_Recr_DMR_35%	60.6	61.2	259	350	38.0	45.9	96.3	128	0.150	0.151
	Lo_Hi_Recr_Full_Ret	24.5	43.1	219	236	27.9	31.3	79.1	86.0	0.000	0.000
	Lo_Hi_Recr_DMR_12%	24.5	43.1	219	236	27.9	31.3	79.5	86.5	0.021	0.037
	Lo_Hi_Recr_DMR_20%	24.5	43.1	219	236	27.9	31.3	79.5	86.4	0.035	0.061
	Lo_Hi_Recr_DMR_35%	24.5	43.1	219	236	27.9	31.3	79.4	86.3	0.061	0.106
	Hi_Lo_Recr_Full_Ret	60.6	43.2	259	288	38.0	36.3	96.1	104	0.000	0.000
	Hi_Lo_Recr_DMR_12%	60.6	43.2	259	288	38.0	36.4	96.5	105	0.052	0.037
	Hi_Lo_Recr_DMR_20%	60.6	43.2	259	288	38.0	36.3	96.5	105	0.086	0.061
	Hi_Lo_Recr_DMR_35%	60.6	43.2	259	288	38.0	36.3	96.3	105	0.150	0.107
Sensitivity Runs	*Age-4_Ret_Hist_Recr_DMR_20%*	24.5	25.1	218	173	28.4	22.0	81.3	64.6	0.159	0.161
	Age-5_Ret_Hist_Recr_DMR_20%	24.5	25.1	216	172	29.2	22.5	84.3	66.7	0.424	0.414
	Log_Ret_Hist_Recr_DMR_20%	24.5	25.1	219	174	28.0	21.8	79.8	63.5	0.053	0.053
	Full_ABC_Hist_Recr_Full_Ret	24.5	25.1	195	140	38.2	27.6	107	76.8	0.053	0.052
	Trwl_10%_Hist_Recr_DMR_20%	24.5	25.1	219	173	28.0	21.9	95.1	75.5	0.042	0.042
	Price_Avg_Hist_Recr_DMR_20%	24.5	25.1	219	174	27.9	21.7	145	115	0.035	0.035
	Price_Var_Hist_Recr_DMR_20%	24.5	25.1	219	174	27.9	21.7	90.4	109	0.035	0.035

4 Figures

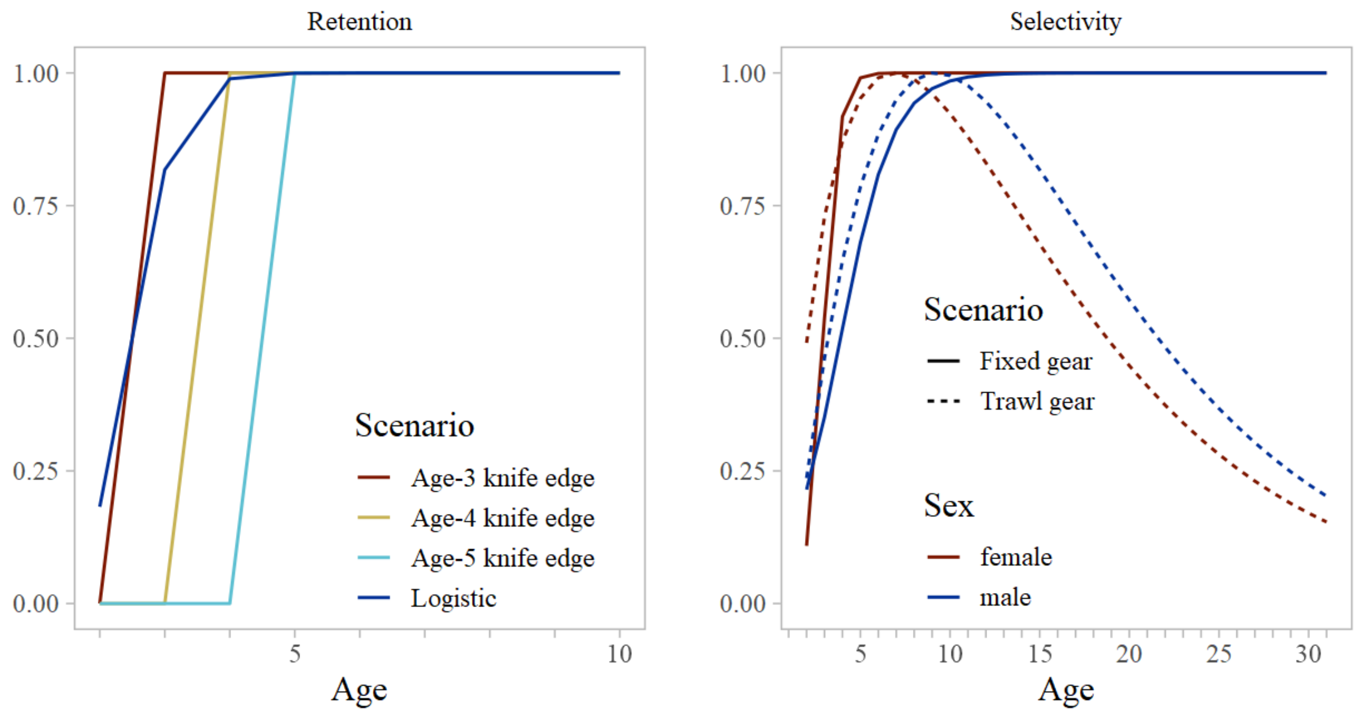

Figure 1. The input retention-at-age for the fixed gear fleet and selectivity-at-age for the fixed gear and trawl fleets by sex. The knife-edge retention curve at age-3 (left panel, red line) was used for the main scenarios (except when full retention was assumed). The other retention curves were used for the various retention sensitivity scenarios.

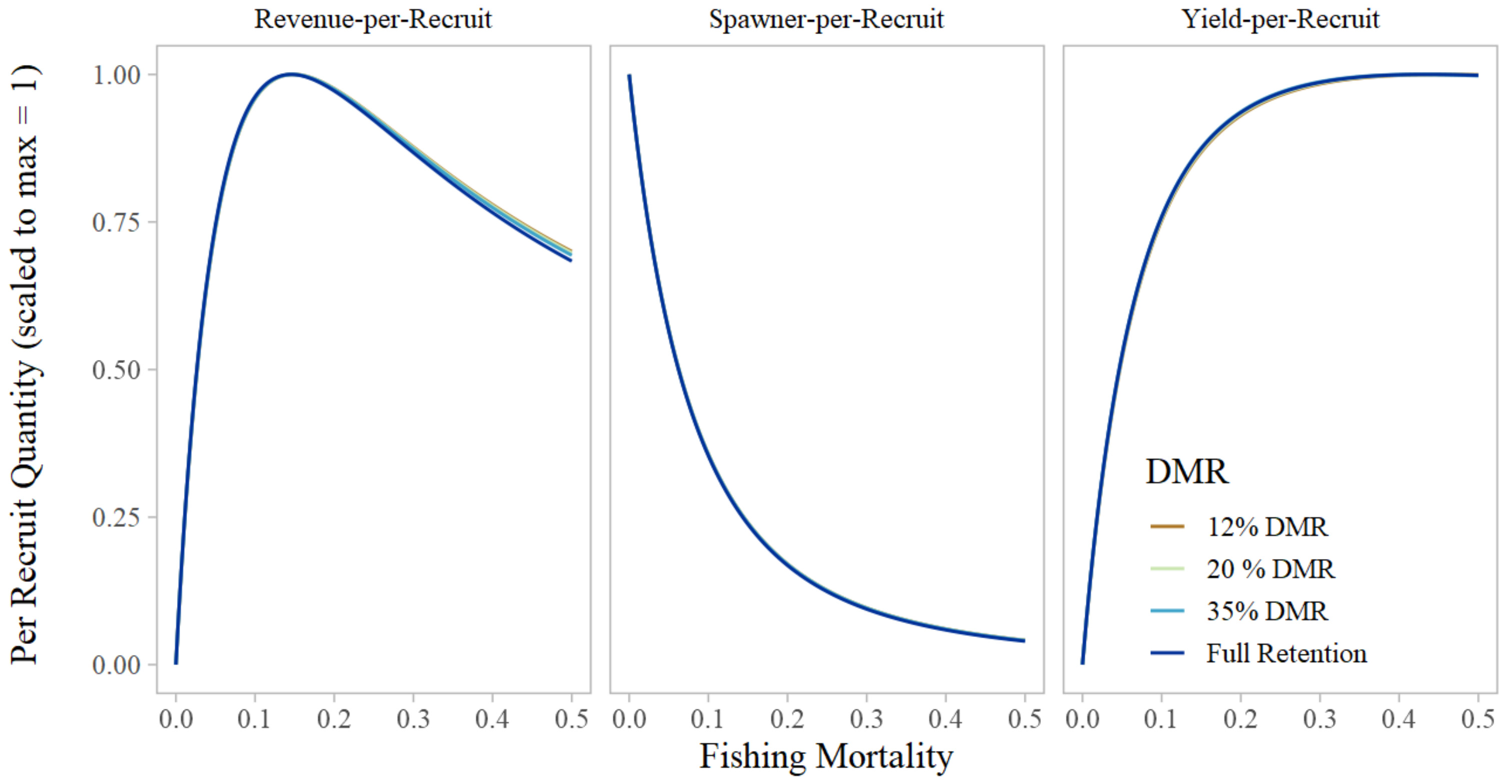

Figure 2. Revenue-per-recruit (RPR), spawning stock biomass-per-recruit (SSBR), and yield-per-recruit (YPR) for each of the base discard mortality rate scenarios, including full retention, assuming knife-edge retention starting at age-3. The location of the fishing mortality that maximized yield-per-recruit (i.e., F_{MAX}) varied by less than 7% (i.e., range of 0.43 to 0.46). Revenue-per-recruit is maximized at a lower fishing mortality (~0.15). $F_{40\%}$ was ~0.086 with slight variability depending on the discard scenario.

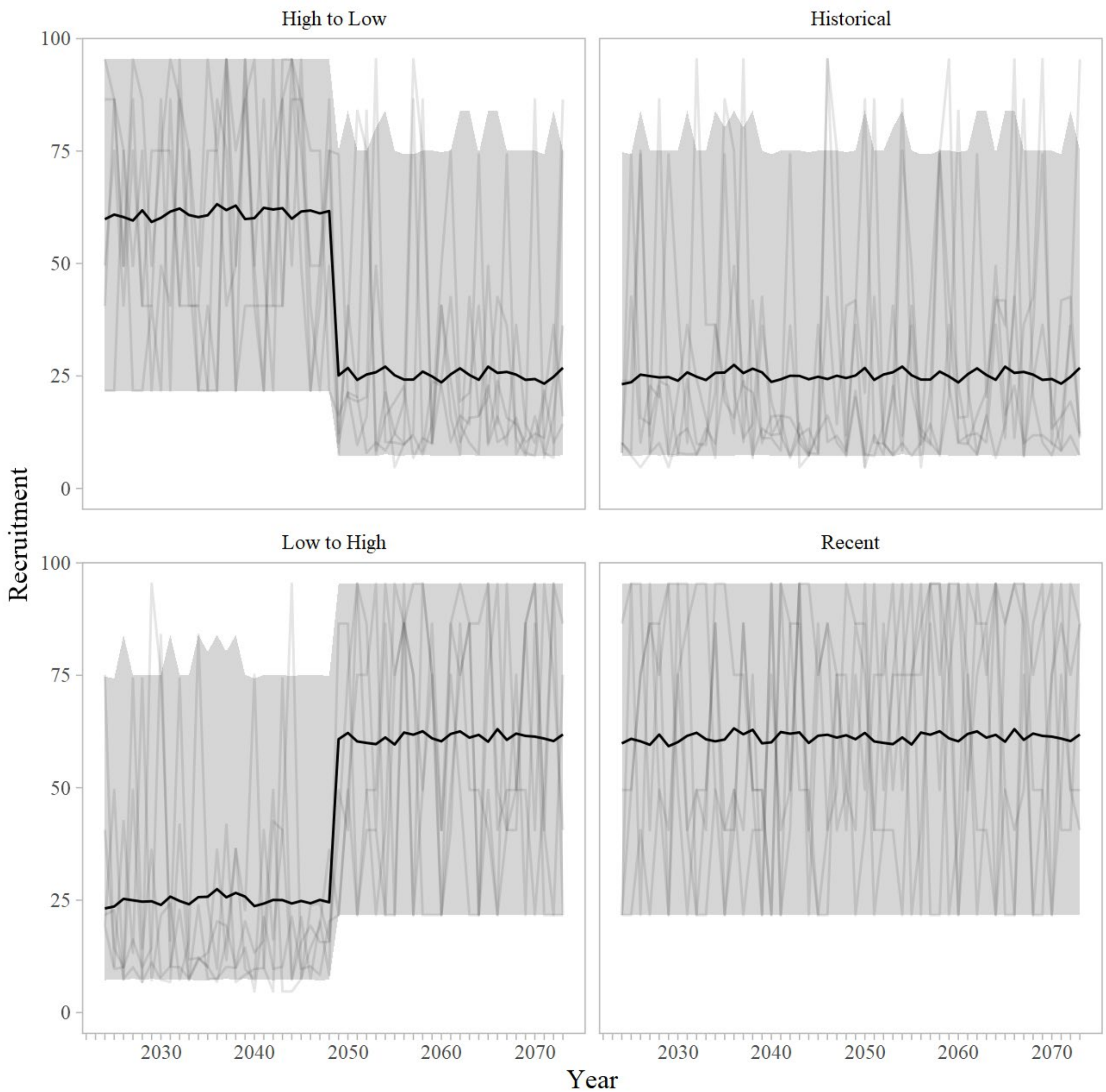

Figure 3. Recruitment (millions of fish; dark black line is mean across the 500 iterations) by year for each of the recruitment scenarios (panels). The 95% simulation intervals are provided by the shading and each thin line represents one realization of the recruitment time series (i.e., there are five iterations shown). Across each recruitment scenario, the same random number seeds were used. Thus, for a given iteration number, the same realized recruitment was achieved for the part of the time series across scenarios assuming the same recruitment dynamics. For instance, the first 25 recruitment values from the 'historical' and 'low-high' recruitment scenarios were identical for a matching iteration, while the second 25 recruitment values for the 'low-high' and 'recent' recruitment scenarios similarly matched (i.e., the change in recruitment occurred in year 2049 for the 'low-high' and 'high-low' recruitment scenarios). Similarly, recruitment values were identical across all scenarios within a given recruitment scenario (i.e., all scenarios assuming 'historical' recruitment had the same recruitment time series within a given iteration).

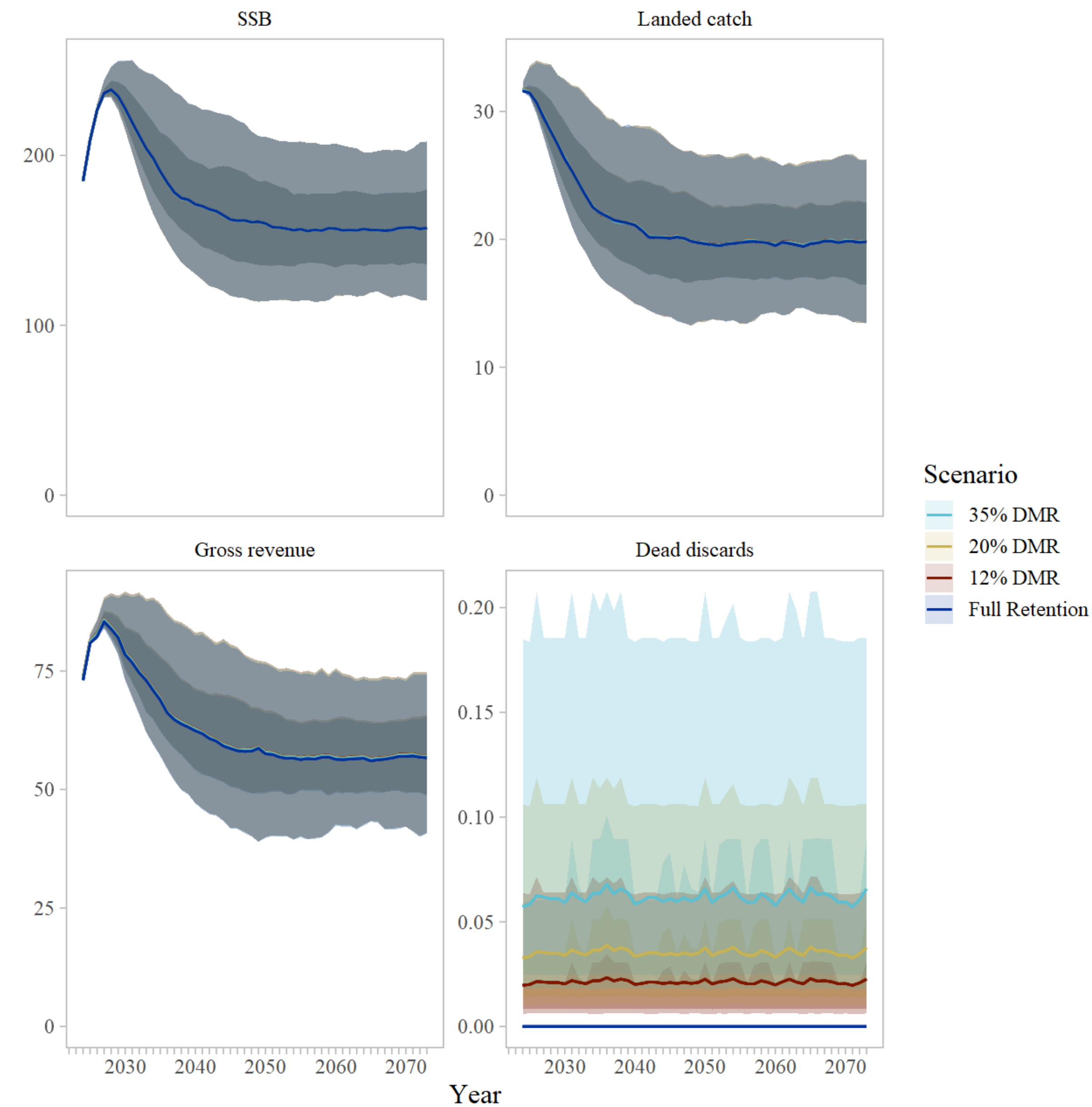

Figure 4. For the 'historic' recruitment scenarios, the resulting spawning stock biomass (SSB in kt; top left panel), landed (retained) catch (kt; top right panel), gross revenue (millions of dollars, for fixed gear fleet only; bottom left panel), and dead discards (kt, bottom right panel) by year under different assumptions of discard mortality rate (line colors). Lines represent the median (or mean for dead discards), while the 50% (darker) and 85% (lighter) simulation intervals across the 500 iterations are provided by the shading. All scenarios assume a specified catch of 66% of the ABC, a trawl fleet catch proportion of 25.5%, and prices fixed at 2023 values. The 'Full Retention' model assumed full retention (i.e., no discarding) and emulates the catch projections currently used to calculated acceptable biological catch (ABC) for Alaskan sablefish. The remaining scenarios assume knife-edge retention at age-3 (i.e., only age-2 fish are discarded). See Table 4 for explanation of scenario names.

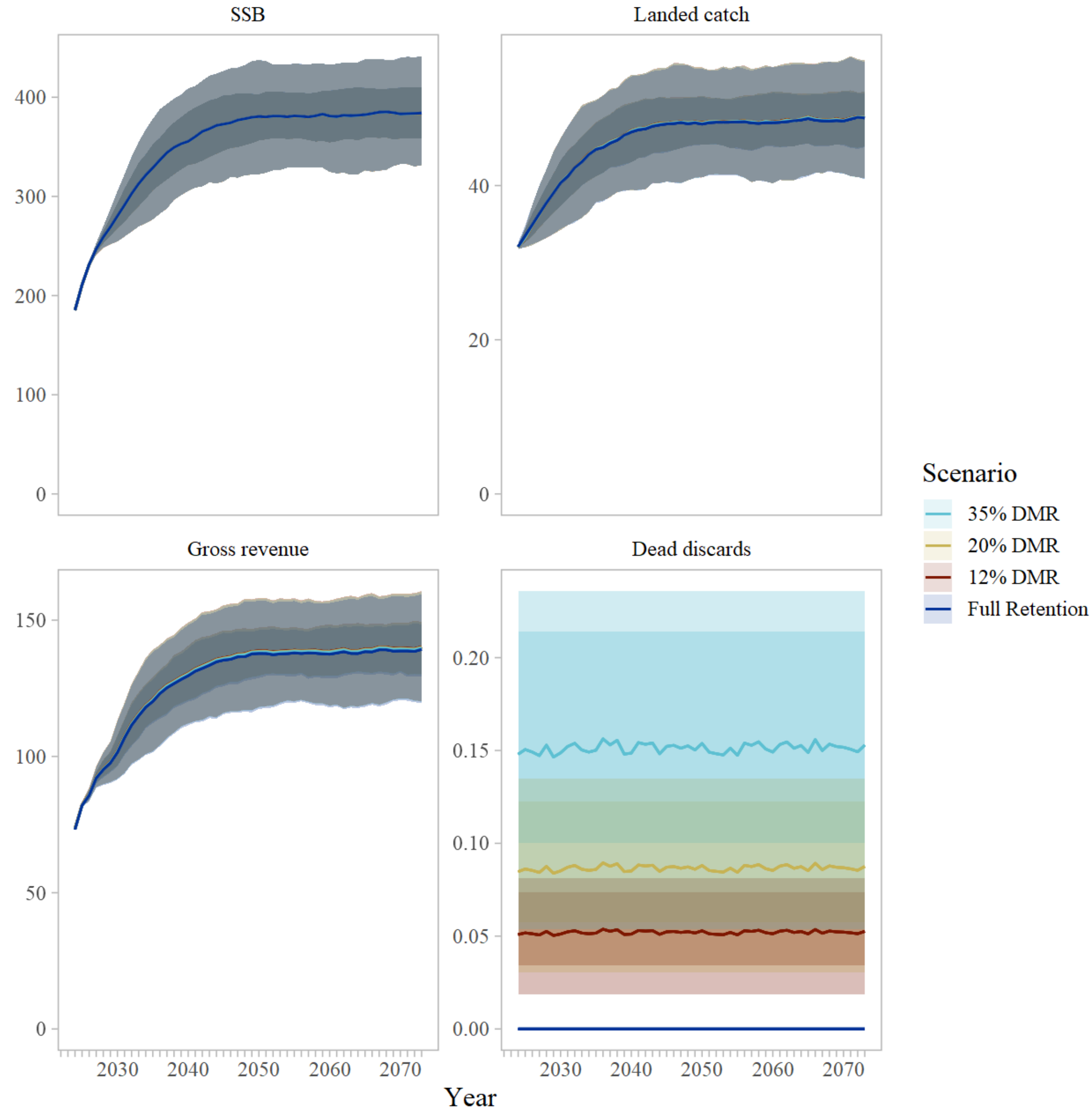

Figure 5. For the 'recent' recruitment scenarios, the resulting spawning stock biomass (SSB in kt; top left panel), landed (retained) catch (kt; top right panel), gross revenue (millions of dollars, for fixed gear fleet only; bottom left panel), and dead discards (kt, bottom right panel) by year under different assumptions of discard mortality rate (line colors). Lines represent the median (or mean for dead discards), while the 50% (darker) and 85% (lighter) simulation intervals across the 500 iterations are provided by the shading. All scenarios assume a specified catch of 66% of the ABC, a trawl fleet catch proportion of 25.5%, and prices fixed at 2023 values. The 'Full Retention' model assumed full retention (i.e., no discarding) and emulates the catch projections currently used to calculated acceptable biological catch (ABC) for Alaskan sablefish. The remaining scenarios assume knife-edge retention at age-3 (i.e., only age-2 fish are discarded). See Table 4 for explanation of scenario names.

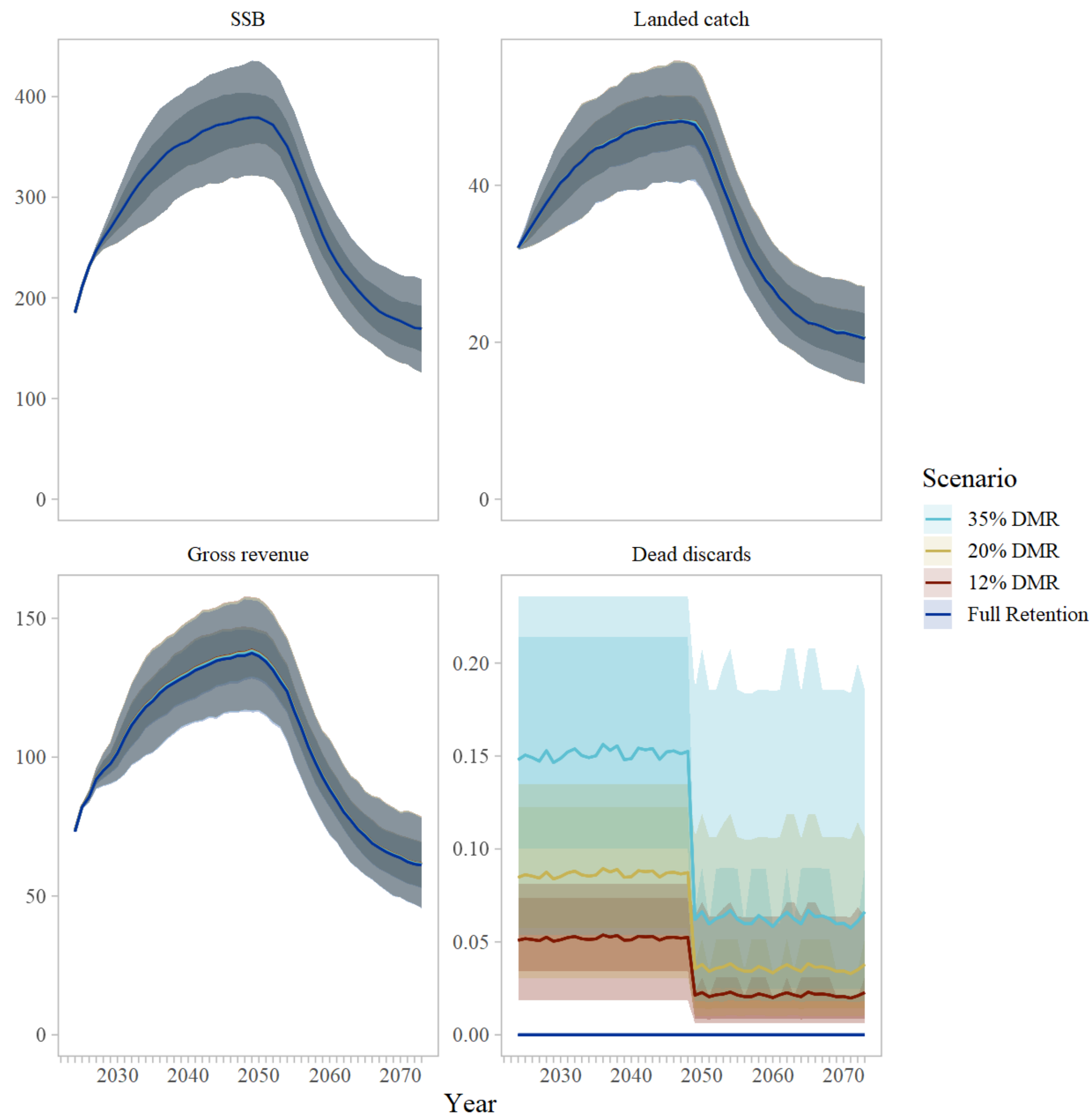

Figure 6. For the 'high-low' recruitment scenarios, the resulting spawning stock biomass (SSB in kt; top left panel), landed (retained) catch (kt; top right panel), gross revenue (millions of dollars, for fixed gear fleet only; bottom left panel), and dead discards (kt, bottom right panel) by year under different assumptions of discard mortality rate (line colors). Lines represent the median (or mean for dead discards), while the 50% (darker) and 85% (lighter) simulation intervals across the 500 iterations are provided by the shading. All scenarios assume a specified catch of 66% of the ABC, a trawl fleet catch proportion of 25.5%, and prices fixed at 2023 values. The 'Full Retention' model assumed full retention (i.e., no discarding) and emulates the catch projections currently used to calculated acceptable biological catch (ABC) for Alaskan sablefish. The remaining scenarios assume knife-edge retention at age-3 (i.e., only age-2 fish are discarded). See Table 4 for explanation of scenario names.

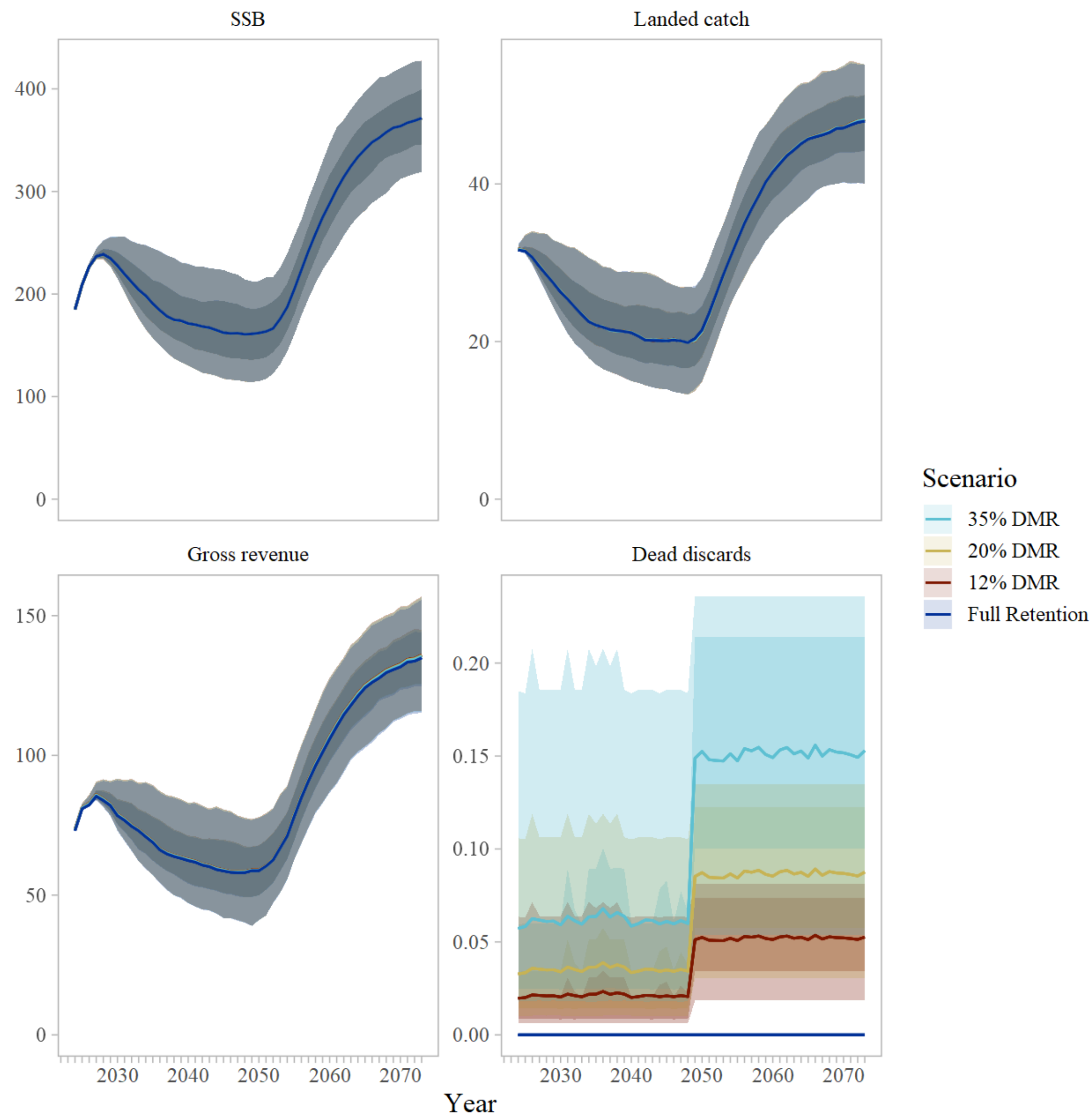

Figure 7. For the 'low-high' recruitment scenarios, the resulting spawning stock biomass (SSB in kt; top left panel), landed (retained) catch (kt; top right panel), gross revenue (millions of dollars, for fixed gear fleet only; bottom left panel), and dead discards (kt, bottom right panel) by year under different assumptions of discard mortality rate (line colors). Lines represent the median (or mean for dead discards), while the 50% (darker) and 85% (lighter) simulation intervals across the 500 iterations are provided by the shading. All scenarios assume a specified catch of 66% of the ABC, a trawl fleet catch proportion of 25.5%, and prices fixed at 2023 values. The 'Full Retention' model assumed full retention (i.e., no discarding) and emulates the catch projections currently used to calculated acceptable biological catch (ABC) for Alaskan sablefish. The remaining scenarios assume knife-edge retention at age-3 (i.e., only age-2 fish are discarded). See Table 4 for explanation of scenario names.

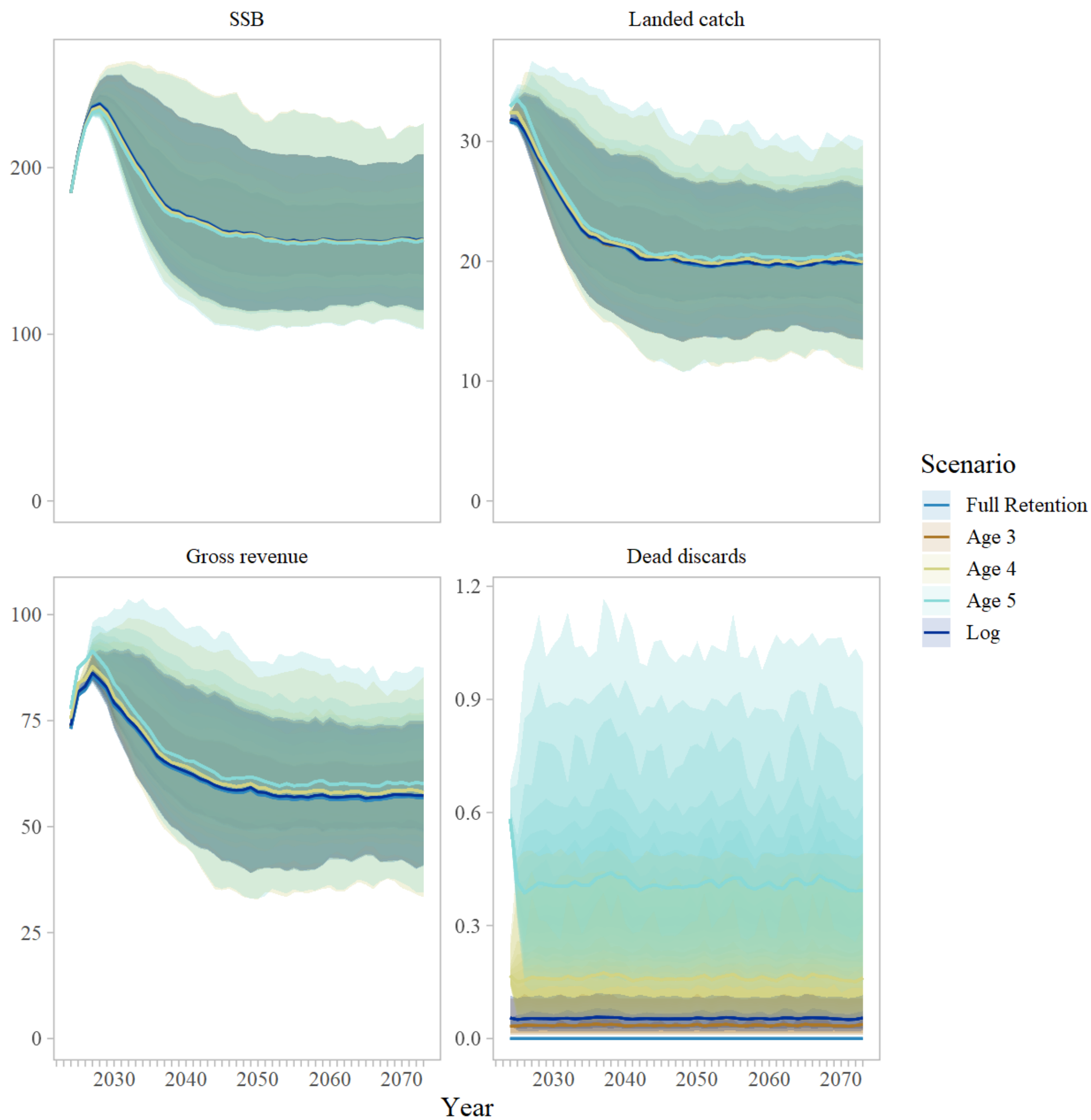

Figure 8. For the various alternate retention sensitivity runs (line colors; age represents the first age of full retention and 'log' represents the scenario using a logistic retention function) assuming 'historical' recruitment, the resulting spawning stock biomass (SSB in kt; top left panel), landed (retained) catch (kt; top right panel), gross revenue (millions of dollars, for fixed gear fleet only; bottom left panel), and dead discards (kt, bottom right panel) by year. Lines represent the median (or mean for dead discards), while the 50% (darker) and 85% (lighter) simulation intervals across the 500 iterations are provided by the shading. All models that include discarding assume a discard mortality rate of 20%. The 'Full Retention' model assumed full retention (i.e., no discarding) and emulates the catch projections currently used to calculated acceptable biological catch (ABC) for Alaskan sablefish. See Table 5 for explanation of scenario names.

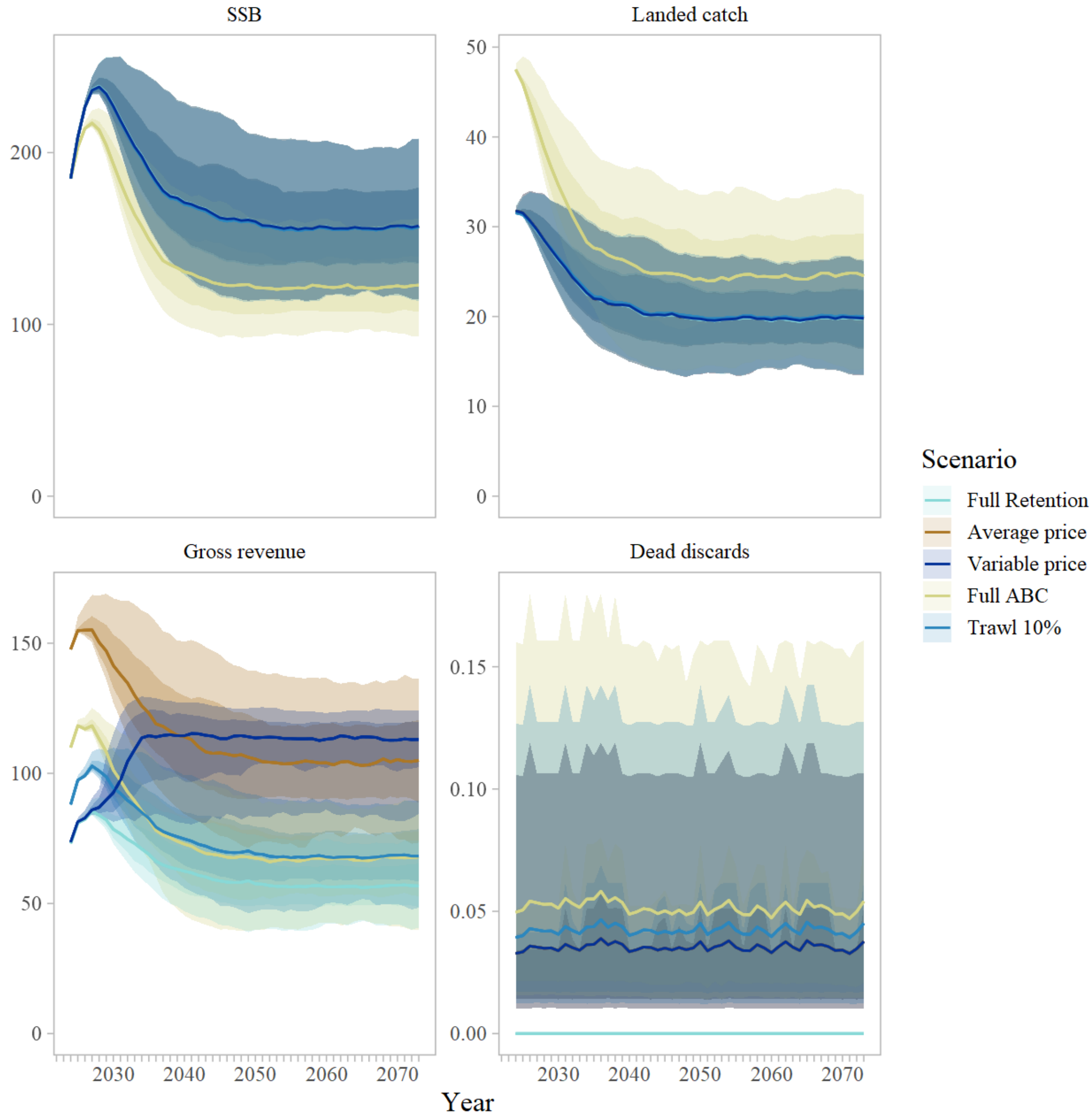

Figure 9. For the remaining sensitivity runs (line colors), including alternate price structures, full ABC utilization, and a decrease in the proportion of fishing mortality from the trawl fleet (i.e., reduced from 25.5% to 10%), assuming 'historical' recruitment, the resulting spawning stock biomass (SSB in kt; top left panel), landed (retained) catch (kt; top right panel), gross revenue (millions of dollars, for fixed gear fleet only; bottom left panel), and dead discards (kt, bottom right panel) by year. Lines represent the median (or mean for dead discards), while the 50% (darker) and 85% (lighter) simulation intervals across the 500 iterations are provided by the shading. Sensitivity runs assume a knife-edge retention function at age-3 and a discard mortality rate of 20%, except the 'Full ABC' utilization run which assumed full retention. The 'Full Retention' model assumed full retention (i.e., no discarding) and emulates the catch projections currently used to calculated acceptable biological catch (ABC) for Alaskan sablefish. See Table 5 for explanation of scenario names.