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

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Abstract: *This Environmental Assessment / Regulatory Impact Review analyzes a potential allowance for participants in the IFQ sablefish fishery to release sablefish they have caught back to the water. This action is intended to provide regulatory flexibility for the fishery when large, unexpected catches of small sablefish are encountered. 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. In order to facilitate the release allowance, a change would have to be made to eliminate the existing regulatory prohibition on discarding sablefish that applies to the IFQ fishery for sablefish caught during directed IFQ fishing or incidentally caught when an IFQ vessel has sablefish IFQ remaining. The allowance would necessitate accounting for IFQ discard mortalities which could be done either through data collection under the existing fishery monitoring program or through preseason estimates generated from analysis of fishery-independent longline survey catches. A discard mortality rate would be applied to the overall quantity of sablefish estimated to have been released by the IFQ fishery and that mortality rate would reflect best scientific information available. An allowance for IFQ discarding would affect the harvest specification process as the sablefish stock assessment incorporates the estimated amount, size and age structure, and associated uncertainties into the calculation of ABC annually. Additionally, a deduction for IFQ discards would be applied to the overall IFQ TAC in order to avoid the need for separate discard accounting for each IFQ account.*

List of Acronyms and Abbreviations

Acronym or Abbreviation	Meaning
AAC	Alaska Administrative Code
ABC	acceptable biological catch
ADF&G	Alaska Department of Fish and Game
AFA	American Fisheries Act
AFSC	Alaska Fisheries Science Center
AKFIN	Alaska Fisheries Information Network
BSAI	Bering Sea and Aleutian Islands
CAS	Catch Accounting System
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
COAR	Commercial Operators Annual Report
Council	North Pacific Fishery Management Council
CP	catcher/processor
CV	catcher vessel
DPS	distinct population segment
E.O.	Executive Order
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	endangered species unit
FMA	Fisheries Monitoring and Analysis
FMP	fishery management plan
FONSI	Finding of No Significant Impact
FR	*Federal Register*
FRFA	Final Regulatory Flexibility Analysis
ft	foot or feet
GOA	Gulf of Alaska
IRFA	Initial Regulatory Flexibility Analysis
IPA	Incentive Plan Agreement
JAM	jeopardy or adverse modification
lb(s)	pound(s)
LEI	long-term effect index
LLP	license limitation program
LOA	length overall
m	meter or meters
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MMPA	Marine Mammal Protection Act
MSST	minimum stock size threshold
t	tonne, or metric ton
NAICS	North American Industry Classification System
NAO	NOAA Administrative Order
NEPA	National Environmental Policy Act
NMFS	National Marine Fishery Service
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
NPPSD	North Pacific Pelagic Seabird Database
Observer Program	North Pacific Groundfish and Halibut Observer Program
OMB	Office of Management and Budget
PBR	potential biological removal
PSC	prohibited species catch
PPA	Preliminary preferred alternative
PRA	Paperwork Reduction Act
PSEIS	Programmatic Supplemental Environmental Impact Statement
RFA	Regulatory Flexibility Act
RFFA	reasonably foreseeable future action
RIR	Regulatory Impact Review
RPA	reasonable and prudent alternative
SAFE	Stock Assessment and Fishery Evaluation
SAR	stock assessment report
SBA	Small Business Act
Secretary	Secretary of Commerce
SPLASH	Structure of Populations, Levels of Abundance, and Status of Humpbacks
SRKW	Southern Resident killer whales
TAC	total allowable catch
U.S.	United States
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
VMS	vessel monitoring system

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Executive Summary

This document analyzes an action under consideration by the Council that would remove the regulatory prohibition on discarding sablefish that applies to participants in the Sablefish IFQ Program. The action is intended to provide flexibility to IFQ participants who began reporting uncertain but potentially overwhelming catches of small, low-value fish as recent year classes of sablefish recruit to the fishery. One approach that explicitly addresses the issue of flexibility is to eliminate the regulatory requirement to retain all sablefish landed in the IFQ fishery.

Purpose and Need

Large year classes of sablefish result in significant catches of small sablefish in the IFQ fixed gear fisheries. Small sablefish have low commercial value and current regulations require IFQ holders to retain all sablefish. Available data suggest that survival rates for carefully released sablefish are high. 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

(Preliminary) Preferred Alternative (to be completed after Council selects a PPA)

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). Additionally, in both the BSAI and GOA Groundfish FMPs, the fourth provision under General Provisions section 3.7.1.7, prohibiting discarding of sablefish, would need to change.

Alternative 2, Allow Voluntary Release of Sablefish in the IFQ Fishery

This alternative would eliminate the regulatory restrictions that prohibit release of sablefish caught by sablefish IFQ vessels as well as the FMP provision prohibiting discarding.

Element 1: DMRs

Apply a DMR to discarded sablefish of:

a. 5%
b. 12%
c. 16%
d. 20%

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

Element 2: Catch Accounting

Option 1: Sablefish discards will be estimated using observer and EM data with a DMR applied annually as part of the specifications process.

Option 2: Sablefish discards will be estimated pre-season based on AFSC longline survey encounter rates of sub-three pound sablefish with the DMR applied annually as part of the specifications process.

Element 3: Discard Mortality Accounting

Sablefish discard 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 and specifications process.

Element 4: Monitoring and Enforcement

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

Environmental Assessment

Alternative 1 is expected to have minimal or beneficial effects on target species, non-target species, marine mammals, and seabirds relative to Alternative 2. No effects are expected on ecosystem component species or habitat under either alternative. Alternative 2 could result in an increase in both the amount of gear deployed by vessels participating in the fishery and in the duration of the fishery, since vessels that choose to discard will need to increase effort to achieve the same amount of their quota. While effort may increase, it would not reach a level that would jeopardize the continued sustainability of the sablefish stock. Allowing the IFQ fishery to discard small sablefish in order to increase their harvest of large sablefish would increase pressure on the spawning biomass.

Regulatory Impact Review

Leaving the regulations in place that prohibit sablefish IFQ participants from releasing sablefish they catch would perpetuate the effects of that prohibition on the fishery, including costs to harvest operations for having to bring unmarketable fish to the dock. The prohibition, however, may also constrain some fishery participants from engaging in highgrading, and was put in place, in part, to prevent this from developing on a wide scale in the IFQ fishery. The short term positive impacts of allowing vessel operations to release small sablefish under Alternative 2 would alleviate those costs. Nevertheless, given the steep price gradient across sablefish market categories creates a background potential for highgrading to develop, and Alternative 2 does not contain any limits on discarding that would offset that potential. Additionally, the increase in total removals by the IFQ fishery that would be necessary to support a discarding allowance creates the potential for reducing the ABC sufficiently to effectively impinge on the TAC that would be allocated as incidental catch to Bering Sea trawl fisheries. The benefits to operations that would affect the potential for discarding varies among management areas, with the greatest benefit occurring in the SE, and with Bering Sea sablefish fisheries being the least likely to benefit from the allowance.

Comparison of Alternatives for Decision-making

	Alternative 1: No Action	Alternative 2: voluntary careful release of sablefish in the IFQ fishery
Differences in Alternatives		
Allowance for discarding	Prohibited - IFQ fishery Allowed - nontarget fisheries	Voluntary discarding allowed for IFQ fishery
Element 1: Sablefish DMRs	100% for any sablefish	- IFQ fishery range (5%, 12%, 16%, 20%) - 100% for all other discards
Element 2: Catch Accounting	Based on observer program data	- Onboard observers, EM - Estimated from longline survey
Element 3: Discard Mortality Accounting	Applied within stock assessment	Applied within stock assessment, increased mortality and uncertainty reduce ABC
Element 4: Monitoring and Enforcement	No change	Enforcement of discard prohibition not necessary Range of monitoring option (section 2.2.4)
Environmental Impacts		
Marine Mammals	No changes	Increase in fishing effort may result in increased take of marine mammals through gear entanglement.
Economic Impacts		
Harvesters	Status quo revenue costs associated with requirement to deliver unmarketable fish	Increased ability to maximize value of catch through selective retention. Increased potential for highgrading Reductions in IFQs related to ABC reductions may outweigh benefits and will vary geographically
Processors	Total product value reduced by deliveries of small market grades	Increased product value per unit, but potentially reduced total value if ABC reductions are large enough
Communities	Status quo conditions	Change in contribution of sablefish value to community depends on changes in landings value and ABC reductions

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 in the Sablefish Individual Fishing Quota (IFQ) Program. The action is intended to provide flexibility to IFQ participants who began reporting uncertain but potentially overwhelming catches of small, low-value fish as recent year classes of sablefish recruit to the fishery. One approach that explicitly addresses the issue of flexibility is to eliminate the regulatory requirement to retain all sablefish landed in the IFQ fishery.

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 Act, the National Environmental Policy Act, 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.

The Council is considering an amendment to the Gulf of Alaska and the Bering Sea and Aleutian Islands Groundfish Fishery Management Plans (FMPs) and a corresponding regulatory amendment that would allow participants in the sablefish IFQ Program to carefully release sablefish. In 2017, unprecedented numbers of newly recruited sablefish began showing up in Gulf of Alaska (GOA) and Bering Sea (BS) fixed gear catches, which initiated the ongoing stakeholder appeal for management action to provide relief from the ban on sablefish discarding that is in place for the IFQ fleet.

Public testimony consistently addresses the need for regulatory changes to provide *flexibility* in contending with uncertain but potentially overwhelming catches of small, low-value fish. One approach that explicitly addresses the issue of flexibility is to eliminate the regulatory prohibition on discarding sablefish, rather than framing it as a regulatory requirement associated with a minimum size limit. This discarding allowance was suggested by the sablefish IFQ fishery in April 2018 as a management response to potential inundation of directed fishing catches of small sablefish from the 2014 year class, the second largest on record (2016), and one that will likely dominate fishery landings for the next several years. Stakeholders and Council members expressed a desire to minimize fishing mortality for the year class, which has considerable potential to expand the spawning stock, and also to minimize the economic burden to the fishery of a massive shift in catches of small, low value sablefish. The sablefish IFQ fishery is managed through the Council and NMFS in accordance with the MSA and corresponding federal regulations. Discarding sablefish has been prohibited under the IFQ Program since its establishment of the Alaska The vast majority of Alaska sablefish landings are from hook-and-line and pot gear operations that participate in the sablefish IFQ Program, which was created to address biological impacts of sablefish fishing that had existed under the previous race-for-fish management regime.

No set-aside was ever established for sablefish discards in the IFQ fishery when the IFQ Program was established (NPFMC 1995). At the time, the Council thought unused trawl Total Allowable Catch (TAC) would be sufficient to absorb the low levels of sablefish discard mortalities by IFQ vessels that had used all their IFQ and by non-IFQ fixed gear vessels. The prohibition on discarding that was implemented in order to discourage high-grading was also anticipated to continue indefinitely. High-grading is a well-documented feature of IFQ fisheries, especially when there is a high differential between high and low valued fish (Anderson 1994).

The Council may amend the sablefish IFQ Program through amendments to the Gulf of Alaska and Bering Sea and Aleutian Islands Groundfish FMPs, as well as connected or independent federal regulations. Such amendments must be approved by the Secretary of Commerce before they can be implemented by NMFS.

1.1 Purpose and Need

Large year classes of sablefish result in significant catches of small sablefish in the IFQ fixed gear fisheries. Small sablefish have low commercial value and current regulations require IFQ holders to retain all sablefish. Available data suggest that survival rates for carefully released sablefish are high. 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

Public testimony at the April 2018 Council meeting indicated that the IFQ sablefish fishery had suddenly begun encountering large numbers of very small and unmarketable sablefish in 2017, and these fish were presenting an economic burden because under regulations they must be retained. 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 paper to explore issues related to this proposal.

In October 2018, the Council reviewed the first discussion paper which included development of a sablefish discard mortality rate (DMR), and changes needed for observer sampling protocols. The paper also provided information on the relationship between value-per-pound and market category, noting that while price varies by year, it is stable across FMP subareas within each year. The Council determined that further information would be needed in a second discussion paper, specifically requesting that a paper evaluate:

- 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 overall TAC or exceeding the ABC.
- Fishing down the existing spawning stock.
- High-grading
- Enforcement options

After the Council reviewed the second discussion paper in April 2019, interest was expressed in a third paper that would address:

- 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.

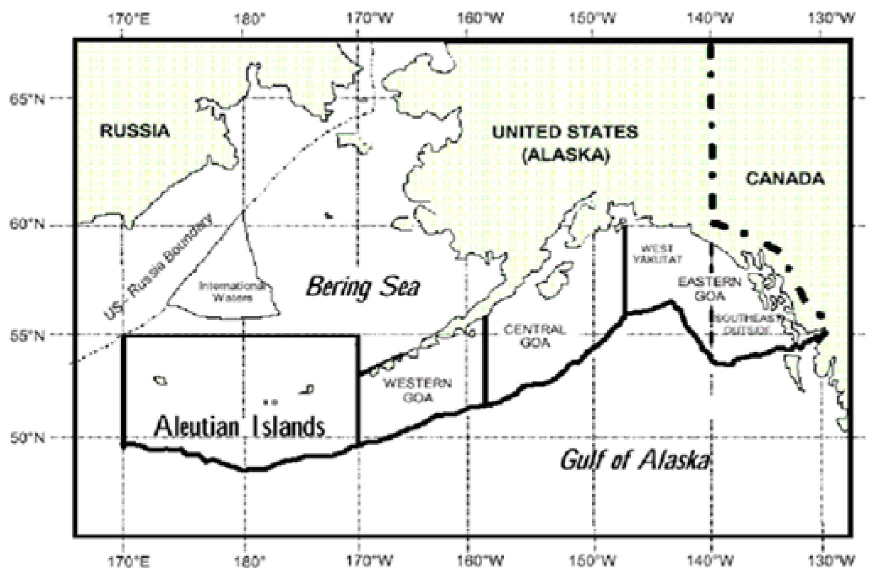
The Council reviewed the third discussion paper in December 2019. That paper addressed the six concerns identified by the Council as well as the potential effects of discarding on stock abundance.

In initiating this analysis, the Council's motion cited the low commercial value and high survival rate for small sablefish and suggested that allowing IFQ fishing operations to return these fish to the water could contribute to stock biomass and the future value of the commercial harvest.

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 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 and Districts in the GOA.



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 alternatives in this chapter were designed to accomplish the stated purpose and need for the action. All of the action alternatives were designed to implement an allowance for release of sablefish captured in the IFQ sablefish fishery.

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.

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 Voluntary Release of Sablefish in the IFQ Fishery

2.2.1 Element 1: DMR

2.2.1.1 Apply a DMR to discarded sablefish of:

a. 5%
b. 12%
c. 16%
d. 20%

As described above, the only federal fisheries in Alaska for which discard mortality data are collected are fisheries that capture halibut. Discard mortality data from these fisheries are collected in the form of injury assessments made by observers. For fisheries that incidentally capture halibut, these data are annually reviewed by an interagency halibut DMR workgroup in order to estimate DMRs. For the directed halibut fishery, these data are used by the IPHC in order to estimate DMRs. A similar process could be developed for estimating DMRs for the directed sablefish fishery and would involve resource dedication approximately equivalent to duplicating the directed halibut DMR estimation process.

Applying a DMR can be achieved at the total catch/removals estimation stage (within NMFS Catch Accounting System, "CAS") or within the stock assessment process. 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, stock assessment authors apply DMRs to the total discard estimates provided by CAS. Authors have the latitude to accept the discard mortalities estimated by CAS or dependently estimate dead discards. Whichever choice the assessment authors make, the incorporation of DMRs into the stock assessment allows total fishing mortality to be partitioned in the assessment model that derives population estimates and recommended quotas.

Previous discussion papers in relation to this action[1,2] outlined the DMR process and discussed steps that the Council could initiate to begin developing DMRs specific for the sablefish IFQ fishery. However, given that this was described as a time consuming process and that there is an apparent desire for this action to move quickly, the Council directed analysts to consider the use of the following proxy DMR options that could be utilized at the initiation of sablefish discarding:

> **-5 % -** Described in the third discussion paper[9] as an average pot DMR value for halibut in the GOA. To our knowledge, this value has no scientific basis in regards to sablefish.
>
> **-12 % -** Stachura et al. (2012) reviewed data on longline-survey-caught sablefish that were recaptured by survey and fishery gear. For the current analysis, we reviewed the methods and assumptions of Stachura et al. (2012) and found they relied on the assumption that fish with 'minor hook injuries' had a 96.5% survival rate, which corresponds to a DMR of 3.5%. This assumption, which was loosely based on a study of Pacific halibut (Trumble et al., 2000), directly scales the estimate of the overall DMR. More information about our review of this study can be found in Section 2.2.3.1. The overall estimated DMR from Stachura et al. (2012) was 11.71%, but the authors consider this to likely be an underestimate given that handling of sablefish is different in survey vs. fishery conditions and also because fishery gear may vary compared to survey gear.
>
> **-16 % -** State of Alaska. For 2019, the Alaska Department of Fish and Game (ADF&G) used a new method to estimate the probability of a sablefish being discarded based on price/lb., weight, sex, and age (Sullivan et al. 2019). This information was incorporated into the assessment model and was reflected in the ABC in the stock assessment. This DMR value was chosen both because it is the DMR used for the Pacific halibut fishery (Gilroy and Stewart 2013) and because it is similar to the estimate for sablefish from Stachura et al. (2012) of 11.7%. The Stachura et al. (2012) estimate was based on the mortality rate of sablefish that were released carefully on a survey platform and so it was assumed that the DMR applied to commercial fishing should be higher than that estimate.

[1] https://meetings.npfmc.org/CommentReview/DownloadFile?p=547e97ee-897a-4d4d-8811-71fba0d56de3.pdf&fileName=D8%20Sablefish%20Discard%20Allowance%20DiscPaper.pdf
[2] https://meetings.npfmc.org/CommentReview/DownloadFile?p=af8355e5-8e81-4165-b20e-2ce11cade94d.pdf&fileName=D2%20Small%20Sablefish%20Discarding%20Discussion%20Paper.pdf

-20 % - Pacific Fisheries Management Council – Somers et al. (2017) used a stratified multistage random sampling method to estimate discard mortalities for all the West Coast groundfish observed sectors. A DMR of 20% was designated for sablefish caught in the “offshore” IFQ longline and pot gear fisheries by the Groundfish Management Team. See Somers et al. (2017) for a more detailed description of DMR estimation procedures.

In the third discussion paper, analysts went through an exercise where they described how various DMRs would result in variable amounts of sablefish “savings” for the sablefish IFQ fishery. In the current analysis, we have repeated that exercise using updated sablefish harvest information. The occurrence of a “savings” or discard-able portion of the fishery catch would allow fishing operations to redirect effort to harvest larger fish under their IFQ. However, as described below in Section 2.2.3.4, implementation of a voluntary discard program under Alternative 2 would result in an overall decrease in ABC, and subsequently, the TAC and individual vessel quotas, regardless of what DMR is used. In this section, we provide relative comparisons of how much discarding could occur as a result of the DMRs specified by the Council and do not attempt to account for lost harvest opportunity resulting from reduced ABCs (see Section 2.2.3.4). To that end, the intent of the exercise in this section is twofold. First, to help understand the level or amount of fishing effort that may be redirected to harvest larger fish. This “redirection” of fishing effort would ultimately translate into an overall increase in fishing effort since vessels choosing to discard some portion of their catch would necessarily be required to fish more (effort) to harvest the same amount of their quota. While the overall harvest of sablefish would still be limited to an individual’s IFQ, an increase in the amount of fishing effort (number of hooks/ pots in the water) may have other environmental impacts not directly related to sablefish. Possible environmental impacts as a result of this action are discussed in Section 3.0 of this document.

The second purpose of this exercise is to allow for a comparison of sablefish “savings” relative to each DMR.

As described above, the effects of any DMR that is applied to discard estimates will be incorporated in both the CAS and the sablefish stock assessment. The reader will find an explanation of how DMRs are applied to the CAS and stock assessment, and their resulting relative effects, in Sections 2.2.2 and 2.2.3, respectively.

To explore how the proxy DMRs provided by the Council would translate into realized sablefish “savings”, we took into account: 1) the weight of landed sablefish by size category, and 2) the size at which a sablefish is considered “small” or under the size limit restriction if a size limit was put into regulation for the purposes of discarding. We then developed hypothetical scenarios that describe how small sablefish discards could impact total landings data from 2014 – 2020 (Table 2-1)

Table 2-1. BSAI and GOA (all subareas) fixed-gear (hook-and-line and pot) sablefish landings and ex-vessel revenue by market category, 2014 - 2020. Source: ADFG Fish Ticket data provided by AKFIN.

	Sold Weight (1,000 lbs.)							% Total				
Market Category	2014	2015	2016	2017	2018	2019	2020 (Partial)	2014-16 Avg.	2017	2018	2019	2020 (Partial)
1 to 2 Lbs	65	57	159	732	506	757	541	1%	6%	3%	5%	4%
2 to 3 Lbs	953	677	753	1,273	1,963	2,286	2,619	6%	10%	13%	16%	18%
3 to 4 Lbs	3,337	2,918	2,442	2,490	3,236	3,350	3,899	23%	20%	22%	24%	27%
4 to 5 Lbs	3,259	2,989	2,390	2,305	2,628	2,673	3,216	23%	18%	18%	19%	22%
5 to 7 Lbs	3,680	3,368	2,888	2,918	3,127	2,587	2,560	26%	23%	21%	19%	18%
7 UP	3,137	2,735	2,488	2,996	3,128	2,202	1,532	22%	24%	21%	16%	11%
Total	**14,432**	**12,744**	**11,120**	**12,715**	**14,587**	**13,856**	**14,368**	**100%**	**100%**	**100%**	**100%**	**100%**

	Ex-Vessel Value ($1,000)							% Total				
Market Category	2014	2015	2016	2017	2018	2019	2020 (Partial)	2014-16 Avg.	2017	2018	2019	2020 (Partial)
1 to 2 Lbs	187	140	434	2,523	577	744	189	0%	3%	1%	2%	1%
2 to 3 Lbs	2,870	1,832	2,416	5,260	3,937	3,700	2,591	4%	7%	6%	9%	11%
3 to 4 Lbs	12,310	10,440	9,604	12,443	9,628	7,048	5,272	18%	17%	15%	18%	22%
4 to 5 Lbs	13,099	12,481	10,735	13,297	9,945	6,972	5,101	20%	18%	16%	18%	21%
5 to 7 Lbs	16,737	17,397	15,885	18,895	18,542	10,706	6,012	28%	25%	29%	27%	25%
7 UP	16,899	16,505	17,445	22,744	21,088	10,588	5,222	29%	30%	33%	27%	21%
Total	**62,101**	**58,796**	**56,521**	**75,161**	**63,717**	**39,758**	**24,388**	**100%**	**100%**	**100%**	**100%**	**100%**

Throughout this section, “small sablefish” refers to fish weighing 1-3 lbs. (0.45-1.36 kg; dressed weight), which is the smallest size class marketed by the fishery and the category with the lowest market value (and least value to commercial fishers). At this weight, sablefish are approximately 58-65 cm (22-25 in) in length. Limiting this analysis to discussions surrounding a 1-3 lbs. threshold may not be entirely accurate in reflecting the current characteristics of discarded sablefish taken from the State of Alaska fishery or observed from EM data and observer debriefings. If 1-3 lbs. sablefish do not accurately portray the size class of fish that are likely to be discarded, the overall impact on sablefish “savings” that any DMR will have will likely increase. Since DMRs and the amount of discarded fish they are applied to directly influence fishing mortality, impacts of this action relative to the CAS and stock assessment, as discussed below, will also increase as the size category and amount of sablefish that are discarded increases. The Council may consider a future iteration of this analysis that includes discards of larger size classes of sablefish.

Table 2-2 categorizes the landings data into two categories, landed sablefish weighing 1-3 lbs. and those weighing greater than 3 lbs. We applied the DMR values to landed sablefish weighing 1-3 lbs. and then added the resulting weights to the > 3 lbs. landings weight to demonstrate the possible savings in sablefish quota that may be realized if small sablefish discarding were to be allowed in the sablefish IFQ fishery. These hypothetical scenarios are based on the following assumptions: 1) the “Sold Weight” data in Table 4 represents the total caught and retained weight of sablefish in the sablefish IFQ fishery, 2) in scenarios where a hypothetical DMR was applied, observers and other catch accounting procedures were hypothetically utilized to ensure that all discarded small sablefish were accurately accounted for, 3) all 1 - 3 lbs. sablefish were discarded and the resulting “Sold Weight” for each DMR scenario corresponds to the weight of sablefish that would be counted against the IFQ TAC/ABC if that DMR was applied to the weight of discarded sablefish, and 4) no reduction in IFQ to account for discard mortalities is addressed, which would decrease available harvest relative to status quo.

Table 2-2 Landings data for the sablefish IFQ fishery under four DMR scenarios.

Sold Weight (1,000 lbs)								
DMR	Size Category	2014	2015	2016	2017	2018	2019	2020
100% (Status Quo)	1-3 lbs.	1,018	733	911	2,005	2,468	3,043	3,161
	> 3 lbs.	13,413	12,010	10,208	10,710	12,119	10,813	11,207
	Total	14,432	12,744	11,120	12,715	14,587	13,856	14,368
5% (Halibut Pot)	1-3 lbs.	50.92	36.67	45.57	100.23	123.42	152.15	158.03
	> 3 lbs.	13413	12010	10208	10710	12119	10813	11207
	Total	13464.18	12046.83	10254.02	10810.13	12242.33	10964.81	11365.23
12% (Stachura et al.)	1-3 lbs.	122.20	88.01	109.37	240.56	296.22	365.15	379.27
	> 3 lbs.	13413	12010	10208	10710	12119	10813	11207
	Total	13535.47	12098.17	10317.81	10950.46	12415.12	11177.81	11586.48
16% (State of Alaska)	1-3 lbs.	162.94	117.35	145.82	320.75	394.95	486.87	505.69
	> 3 lbs.	13413	12010	10208	10710	12119	10813	11207
	Total	13576.20	12127.51	10354.27	11030.64	12513.86	11299.53	11712.90
20% (PFMC)	1-3 lbs.	203.67	146.69	182.28	400.93	493.69	608.59	632.12
	> 3 lbs.	13413	12010	10208	10710	12119	10813	11207
	Total	13616.94	12156.85	10390.72	11110.83	12612.60	11421.25	11839.32

Table 2-3 shows the percent reduction in landed sablefish as a result of the four hypothetical DMRs. From 2014 through 2016 we see only a modest reduction in overall landed weight of sablefish across all scenarios (range of 4.6 – 7.8 %). However, in 2017 and 2018, which corresponds to years when fishermen first began noticing large catches of small sablefish, the reduction in landed weight begins to become more apparent across all scenarios (range of 12.6% – 16.1%) and continues in an increasing trend in 2019 and 2020 (range of 17.6% - 20.9%).

Table 2-3 Percent reduction in landed sablefish as a result of hypothetical DMRs. Landed sablefish data taken from Table 2-2.

Percent reduction in landed sablefish as a result of DMRs							
DMR	2014	2015	2016	2017	2018	2019	2020
5% (Halibut Pot)	6.7%	5.5%	7.8%	15.0%	16.1%	20.9%	20.9%
12% (Stachura et al.)	6.2%	5.1%	7.2%	13.9%	14.9%	19.3%	19.4%
16% (State of Alaska)	5.9%	4.8%	6.9%	13.2%	14.2%	18.4%	18.5%
20% (PFMC)	5.6%	4.6%	6.6%	12.6%	13.5%	17.6%	17.6%

Table 2-4 shows how the percent reduction in landed “small” sablefish (shown in table 5) translates into weight of sablefish “savings” that would not be attributed to the overall TAC/ ABC but could instead be repurposed for high catches of larger, more profitable sablefish.

Table 2-4 Sablefish savings in sold weight under four DMR scenarios.

Sablefish savings in sold weight (1,000 lbs.)							
DMR	2014	2015	2016	2017	2018	2019	2020
5% (Halibut Pot)	967.44	696.76	865.81	1904.43	2345.04	2890.79	3002.56
12% (Stachura et al.)	896.15	645.42	802.02	1764.11	2172.25	2677.79	2781.32
16% (State of Alaska)	855.42	616.08	765.56	1683.92	2073.51	2556.07	2654.89
20% (PFMC)	814.68	586.75	729.11	1603.73	1974.77	2434.35	2528.47

The difference in realized savings between 2014 – 2016 (pre-large recruitment event) and 2017-2020 (post-large recruitment event) is obvious, but it is uncertain if 2017 through 2020 represent a new trend in sablefish catch composition or if these years are simply anomalies that will not persist in the future.

One important aspect for the Council to consider is the relative difference in sablefish “savings” that is achieved between the proxy DMRs analyzed in this document. From Table 2-4, if we compare DMRs of 5% and 20% in 2020 (the year with the larger number of 1-3 lbs fish and the two most extreme DMRs) there is a ~474,000 lbs. difference in sablefish “savings”. When that value is compared to the total harvest of sablefish in 2020 (14,268,000 lbs), that translates into only ~3.3% of the total sablefish harvest in 2020. As such, if the Council decides to move forward with this action, the selection of any of the DMRs presented here would yield comparable sablefish “savings”. This being the case, the Council may wish to choose the initial DMR which it feels has the best scientific justification and basis for its appropriateness for use in the Alaska sablefish IFQ fishery.

In addition, there are recent studies examining post-release predation of fish that had been discarded from vessels. For example, a study on post-released red snapper and triggerfish estimated that large pelagic predators accounted for 83% and 100% of the discard mortality for these species, respectively (Bohaboy et al. 2020). The authors of that study went on to conclude that “Discard mortality due to predation has likely been overlooked in previous mark-recapture, laboratory, and enclosure studies, suggesting cryptic population losses due to predation on discards may be underestimated for red snapper and gray triggerfish”. While many disparities exist between the red snapper and gray triggerfish fisheries in the Gulf of Mexico and the sablefish IFQ fishery in Alaska, given the substantial increase in whale depredation that has occurred in the sablefish IFQ fishery, this issue is certainly one to consider when considering appropriate DMRs. Given the ingenuity and determinedness that whales have shown in pursuing fishing vessels and “stealing” their catch, it is very conceivable to imagine the whales would begin to congregate around the sides of these same fishing vessels if they started to discard large amounts of small sablefish back into the water. This has recently become an issue for vessels that deck sort halibut.

So much so, that halibut DMRs are altered when whales are present around vessels when they are discarding halibut.

Estimating the amount of depredation that could occur on discarded sablefish could be very challenging, especially considering much of it would likely happen below the water's surface. There has already been some discussion among stakeholders that current attempts at estimating the level of whale depredation on sablefish occurring on longline gear is likely producing underestimates of depredation. The same argument might also apply to any estimates of depredation mortality associated with discarding small fish.

While outside of the DMRs currently being considered in this motion, the Council may wish to consider if a DMR that is more conservative than those currently under review is warranted at initiation of this action. For example, a 0.35 release mortality rate (equivalent to a 30% DMR in fisheries off Alaska) is currently applied to the sablefish fishery in British Columbia. Gear-specific DMRs of 15% for trap gear and 80% for trawl gear are also used. Interestingly, the sablefish stock assessment authors for this fishery also speculated that they may be under-estimating the actual mortality of released sablefish (Pers Comm, Branden Connors DFO, Cox et al. In Press). The assessment notes

> "*At-sea release mortality rates used in B.C. integrated fishery management plans may substantially under-estimate the actual mortality of released Sablefish. In particular, the mortality rates in the management plan do not acknowledge that most at-sea releases are small, sub-legal fish that are the most susceptible to release mortality. In addition, fish released at sea are likely to be behaviorally or physiologically impaired and therefore subject to, for example, increased predation by marine mammals or other fish. Release mortality rates for the U.S. West Coast Sablefish fishery, which has a minimum size limit of 55.88 cm (22 inches) fork length, are calculated as a function of sea-surface temperature based on relationships derived in Davis et al. (2001) (Schirripa and Colbert 2005, Schirripa 2007). It therefore appears that Sablefish release mortality rates as specified in DFO management plans are too low to be used in model evaluations of the impacts of at-sea releases. Instead, we set at-sea release mortality rates (per year because they are additive to natural and fishing mortality rates) to 0.16/yr for trap gear, 0.35/yr for longline hook gear, and 1.6/yr for trawl. These equate to total annual mortality rates of 15%, 30%, and 80%, respectively. In comparison, the most recent assessment of Sablefish for the U.S. west coast (Johnson et al. 2015) assumed that release mortality is 100% for age-0 less than 28 cm. For fish above 28 cm the release mortality was assumed to decline rapidly to 20% for the longline hook and trap gears, and to 50% for trawl gear. The effective release mortality rates over all sizes were 60% for longline hook and trap gears, and 75% for trawl gear...*"

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

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

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

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

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

Using methods similar to those described above, we developed a range of hypothetical scenarios to demonstrate the sablefish “savings” that may be achieved over a range of proxy DMR values for sablefish caught in the sablefish IFQ fishery in pot gear. Landings data presented below show gear specific catches of sablefish from both pot and hook-and-line gear (Table 2-5). The use of pots in the GOA sablefish IFQ fishery began in 2017. As such, only four years of data are provided for sablefish landed with both hook-and-line and pot gear (2017 through 2020). We would welcome suggestions on alternative ways to analyze this issue in the future if there is need or desire.

For hook-and-line landings, we developed scenarios using the same DMR values described above. We also separated fish landings into 1-3 lbs. or > 3 lbs. For sablefish landings from pot gear, we used the DMR applied to halibut harvested in pots from the GOA in 2018 (7%), 2019 (4%) and 2020 (0%).

Table 2-5 BSAI and GOA (all sub areas) fixed gear sablefish landings by size category, 2017 thru 2020. Source: ADF&G Fish Ticket data provided by AKFIN.

HAL - Sold Weight (1,000 lbs.)					
DMR	Size Catego	2017	2018	2019	2020
100% (Status Quo)	1-3 lbs.	991	1,445	1,738	1,092
	>3 lbs.	9,846	10,974	8,996	6,426
	Total	10,838	12,419	10,734	7,518
5% (Halibut Pot)	1-3 lbs.	49.56	72.25	86.91	54.60
	>3 lbs.	9846	10974	8996	6426
	Total	9895.94	11046.42	9082.75	6480.35
12% (Stachura et al.)	1-3 lbs.	118.95	173.39	208.58	131.04
	>3 lbs.	9846	10974	8996	6426
	Total	9965.33	11147.57	9204.42	6556.78
16% (State of Alaska)	1-3 lbs.	158.60	231.19	278.10	174.72
	>3 lbs.	9846	10974	8996	6426
	Total	10004.98	11205.36	9273.94	6600.46
20% (PFMC)	1-3 lbs.	198.25	288.99	347.63	218.39
	>3 lbs.	9846	10974	8996	6426
	Total	10044.63	11263.16	9343.47	6644.14

Pot - Sold Weight (1,000 lbs.)					
DMR	Size Catego	2017	2018	2019	2020
100% (Status Quo)	1-3 lbs.	1,013	1,024	1,305	2,069
	>3 lbs.	864	1,145	1,817	4,781
	Total	1,877	2,168	3,122	6,850
0% (2020 GOA Halibut)	1-3 lbs.	0.00	0.00	0.00	0.00
	>3 lbs.	864	1145	1817	4781
	Total	863.52	1144.74	1816.82	4781.46
4% (2019 GOA Halibut)	1-3 lbs.	40.54	40.94	52.19	82.74
	>3 lbs.	864	1145	1817	4781
	Total	904.05	1185.68	1869.01	4864.20
7% (2018 GOA Halibut)	1-3 lbs.	70.94	71.65	91.34	144.80
	>3 lbs.	864	1145	1817	4781
	Total	934.46	1216.38	1908.16	4926.26

Table 2-6 and Table 2-7 describe how sablefish landings may be impacted by the variable gear-specific DMR values described in the preceding paragraph. Landed sablefish weights are categorized similar to the analysis in the preceding section.

Table 2-6 shows the percent reduction in landed sablefish as a result of hypothetical DMRs by each gear type. The range in percent reductions in landed sablefish from 2017 thru 2020 is nearly 4 times higher for those landed by pot gear (28.1% - 54%) versus those landed by hook-and-line (7.3% - 15.4%). This disparity may be partially explained by the relatively high proportion of 1-3 lbs. sablefish caught in pot gear versus hook-and-line gear. In 2019 and 2020, approximately 42% and 30%, respectively, of total landed sablefish caught in pot gear weighted 1-3 lbs. In contrast, for hook-and-line gear in 2019 and 2020, only approximately 16% and 15%, respectively, of total landed sablefish weighed 1-3 lbs.

Table 2-6 Percent reduction in landed sablefish as a result of hypothetical DMRs

HAL - Percent reduction in landed sablefish					Pot - Percent reduction in landed sablefish				
DMR	2017	2018	2019	2020	DMR	2017	2018	2019	2020
5% (Halibut Pot)	8.7%	11.1%	15.4%	13.8%	0% (2020 GOA Halibut)	54.0%	47.2%	41.8%	30.2%
12% (Stachura et al.)	8.0%	10.2%	14.2%	12.8%	4% (2019 GOA Halibut)	51.8%	45.3%	40.1%	29.0%
16% (State of Alaska)	7.7%	9.8%	13.6%	12.2%	7% (2018 GOA Halibut)	50.2%	43.9%	38.9%	28.1%
20% (PFMC)	7.3%	9.3%	13.0%	11.6%					

Table 2-7 shows how the percent reduction in landed "small" sablefish translates into weight of sablefish "savings" that would not be attributed to the overall TAC/ ABC but could instead be repurposed for higher catches of larger, more profitable sablefish. For both gear types, we see a steady rate of increase in sablefish savings from 2017 to 2019 and as DMR values decrease. However, in 2020 we see a dramatic decrease in savings for hook-and-line (HAL) gear (37%) and an increase in savings for Pot gear (59%). This is likely not only a result of higher encounter rates of 1-3 lbs sablefish with pot gear but also a result of the substantial increase in harvest of sablefish by pot gear in 2020 (Table 2-5).

Table 2-7 Sablefish savings in sold weight under different gear-specific DMR scenarios.

HAL - Sablefish savings in sold weight (1,000 lbs.)					Pot - Sablefish savings in sold weight (1,000 lbs.)				
DMR	2017	2018	2019	2020	DMR	2017	2018	2019	2020
5% (Halibut Pot)	941.69	1372.70	1651.22	1037.37	0% (2020 GOA Halibut)	1013.41	1023.52	1304.81	2068.62
12% (Stachura et al.)	872.30	1271.55	1529.55	960.93	4% (2019 GOA Halibut)	972.88	982.58	1252.62	1985.87
16% (State of Alaska)	832.65	1213.75	1460.03	917.26	7% (2018 GOA Halibut)	942.47	951.87	1213.47	1923.81
20% (PFMC)	793.00	1155.96	1390.50	873.58					

Similar to the discussion in the previous section, an important aspect for the Council to consider is the relative difference in sablefish "savings" that is achieved between the DMRs for each gear type analyzed in this document. The range of gear-specific DMR values analyzed in this discussion paper do not generate large gear-specific differences in sablefish savings. However, there is a substantial difference in relative savings that could be realized between the range of DMRs analyzed for pot gear and those analyzed for HAL. While sablefish harvested from HAL made up ~53% of the total catch in 2020, ~66% of the 1-3 lbs. sablefish were harvested with pot gear. Proportionally, sablefish savings from the pot fishery far exceed those from the hook-and-line fishery. The Council may choose to consider how this could influence participation in the pot fishery, as this relatively large increase in savings could provide an incentive for further increase in the use of pot gear in the sablefish IFQ fishery. This also means that if a gear-specific DMR is applied, it could have greater implications on the amount of discarding that could occur; particularly if there is a large difference between the pot DMR and HAL DMR.

2.2.2 Element 2: Catch Accounting

Catch accounting for sablefish discards in the pot and hook-and-line fisheries fundamentally relies on data collected by at-sea observers. The sampling protocols followed by at-sea observers provides statistically reliable data of not only the weight and numbers of sablefish, but also independently verified location data of sablefish discarded. EM systems provide count and location data, but rely on at-sea observer data for weight estimates. 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 as reported on industry reports (e.g., fish tickets). 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 2021; Cahalan et al., 2014; Cahalan and Faunce, 2020). On a randomly selected set (haul), the observer will randomly select several portions of the gear being retrieved (samples) and record the species, number, and disposition (discard, retained) of fish caught during the sample (species composition). These species-specific counts are used to estimate the species-specific total number of fish caught (the number of fish per sample multiplied by the number of samples on the set). 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.

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. The estimated weight of a set is the product of the total number of fish estimated to be caught and the species-specific average weight of the unsorted catch, thus producing an estimate of the total catch. To obtain an estimate of discard, the proportion of fish discarded is applied to the estimated total catch weight of all sablefish estimated to be caught on a set. **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 retention 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 (discards consist of 'drop-offs', overages, and damaged catch). Hence, the estimated number of sablefish discarded is calculated by multiplying the total number of sablefish caught by the proportion of sablefish inadvertently discarded. Similarly, estimates of the number of sablefish retained on a haul are the product of the total number caught and the proportion of sablefish retained (equal to one minus the proportion discarded). Because observers sample the unsorted catch using randomized sampling methods, these estimates of the number of sablefish retained and discarded for each sampled haul are unbiased. When there is no difference in the size of discarded catch and total catch, that is, 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 smaller fish are discarded and larger fish are retained (or vice versa), 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 novel methods must be developed to avoid biased estimates of at-sea discards.

Bias - EM data

Catch estimation for the EM portion of the fleet is similar to the estimation process based on 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 and applied to EM collected data. Under this model, we assume 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 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 voluntary discarding, 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
Changing at-sea observer sampling methodology is not a viable way to account for size-dependent sablefish discards, and there are multiple reasons why appropriate data on size-dependent discards can't be captured by at-sea observers. Firstly, with no minimum size limit, a fisherman's choice to discard or retain a fish becomes highly subjective. Unlike with halibut, for which fisherman 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 fisherman to make more subjective decisions about whether or not to discard. The subjectivity of these decisions makes them highly susceptible to being biased by the presence of an observer, and that bias (or 'observer effect') would then propagate to all unobserved trips to which observer estimates are applied.

Secondly, collecting disposition-specific (retained or discarded) size information on sablefish at-sea is untenable from a logistics perspective. Sablefish are targeted mainly by small vessels, which limits the ability of crew and observers to separate catch safely and with enough space and time to not impede crew activity. In order to add collection of disposition-specific sablefish size data to the observer’s workflow, other critical data elements would need to be removed from the observer’s sampling duties. In addition, the observer database and data transmission applications are not currently able to store or transmit disposition-specific size data. Any large database and software change would involve significant resources to build, test and implement.

Because at-sea sampling methodology is not able to be changed in a way that accommodates catch accounting with size-dependent discards, if discarding were allowed for sablefish, NMFS would either need to develop novel ways of using existing data or a sampling component that collects additional data currently not collected. These novel approaches to catch accounting are the focus of sections 2.2.2.1 and 2.2.4.

2.2.2.1 Option 1: Sablefish discards will be estimated using observer and EM data with a DMR applied annually as part of the specifications process.

Under Alternative 2, operations could discard fish of any size, which would violate the assumption, under the current data collection and estimation model, that the weight distribution of discarded sablefish is similar to the weight distribution of retained sablefish. **Operationalizing size-selective 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 discard will incorporate the weight of larger retained fish.** This is currently an issue in the halibut IFQ fishery and recent work has shown that the amount of bias is not trivial (Cahalan and Gasper in review). 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. Therefore, unbiased estimation methods developed for halibut would not apply to sablefish.

In past discussion papers, there were three key data collection issues highlighted that pose significant problems with data collection for non-status quo alternatives:

- Use of the current at-sea observer sampling protocols in combination with current estimation routines would result in biased estimates of sablefish discards.

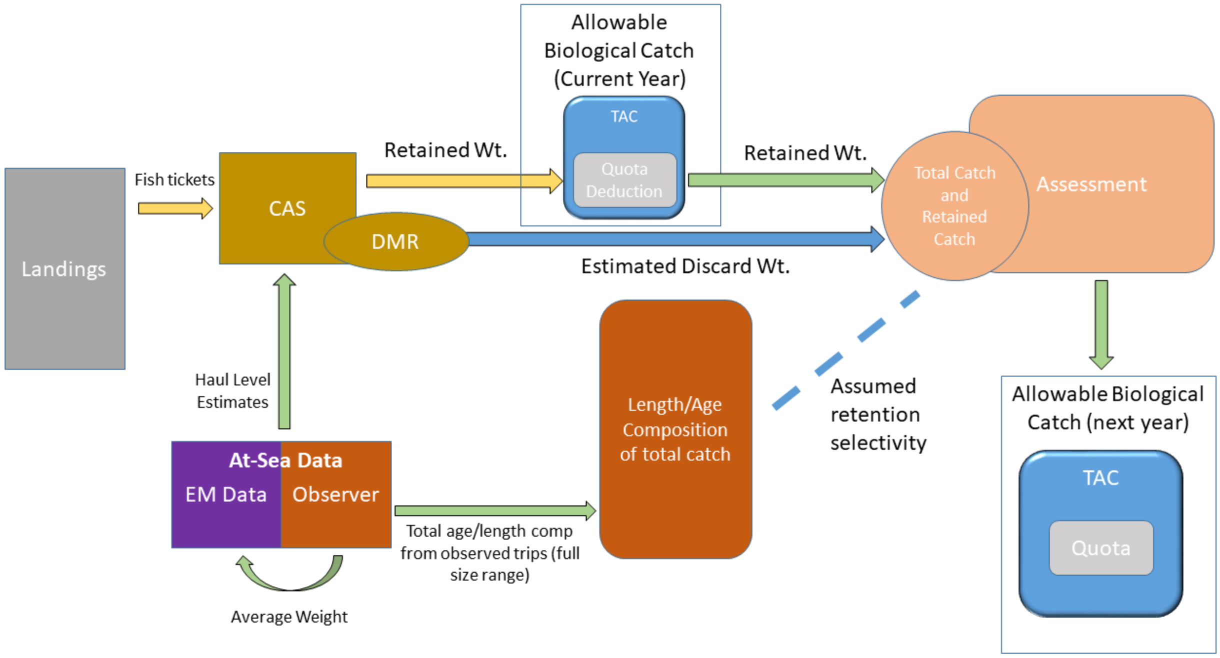
- Estimates of discard for vessels registered to fish in the EM strata would be reliant on available at-sea observer data for average weights, which are a key component of the estimation process.
- Biases in the estimation process identified above would be extrapolated to unobserved trips.

As discussed in section 2.2.2., the prospect of observers sampling the discarded and retained portions of the catch separately is unrealistic due to potential for an observer effect on discard behavior, observer safety, vessel size constraints, and current observer database constraints. Hence, given current sampling protocols and available data, estimation of at-sea discards of sablefish will rely on a greater mixing of both observer data and industry-recorded landings data. Additionally, CAS would need to be reprogrammed to estimate total catch using a simple mean design-based method rather than the current ratio estimation method (Cahalan et al 2014). The methodology change is generally described below, noting that should Alternative 2 be promulgated, a detailed documentation of methods would be produced[3].

Estimates of the at-sea discards of sablefish would 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 (Figure 1-1). Using a design-based estimator (the simple mean), 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 that will weight each set on the trip equally. This method of accounting for discards relies heavily on the ability to identify all landings for an observed trip; without a direct link between the observer and landings data, this can be challenging.

[3] Changing estimation methods will also require several new features to be defined in the catch accounting system for fixed-gear vessels fishing for sablefish, including enumeration of sampled (n) and unsampled trips (N) trips; matching of haul-level data to an observed trip; simple mean expansion from sampled to unsampled trips, including appropriate design of an post-stratification method; matching of trip identifiers to haul-level information; and calculation of average weights for EM in a way that estimates of the at-sea discards of sablefish that would 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 (Figure 2).

Figure 2-1 Data flow diagram for sablefish catch estimation using currently available data, under the condition that voluntary discarding is permitted



Estimation could occur at the trip and/or post-stratum level. If we subtract the retained catch from total catch for each monitored trip, then the estimated discards for the post-stratum is the mean discard per trip expanded to the total number of trips. Similarly, we can estimate total catch for the post-stratum by expanding mean catch per trip by the total number of trips, and then estimate discard weight for the post-stratum by subtracting the total retained catch (landings data) for those same trips from the total catch estimate (Eq. 1),

$$\widehat{D} = N\left[\frac{\sum_m \widehat{w}}{n_m}\right] - \sum_{all} R$$

Equation 1

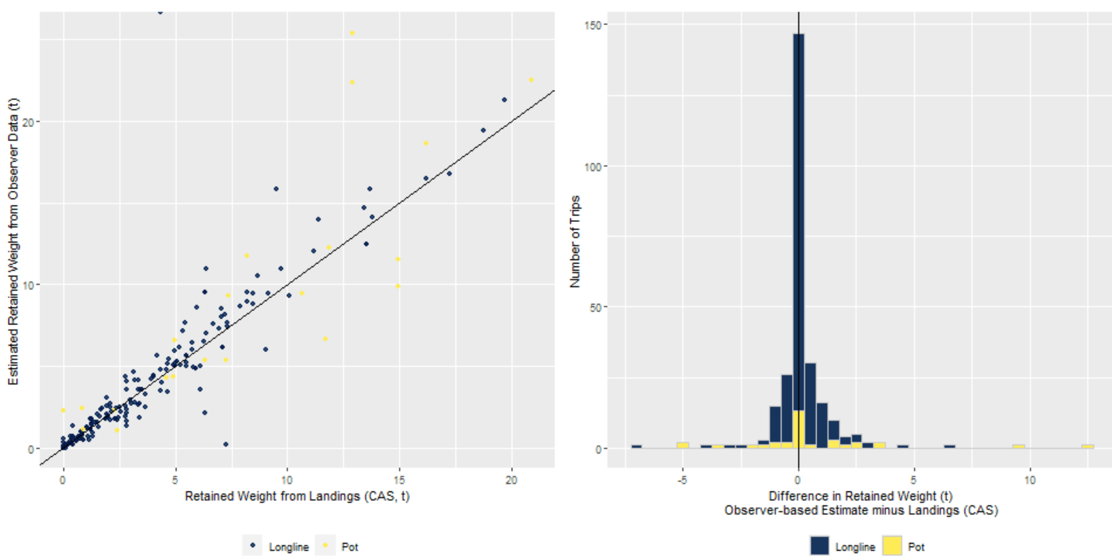
where $\hat{D}$ is the total discards for the post-stratum, N is the total number of trips in the post-stratum, $\hat{w}$ is the total weight of sablefish (summed over monitored trips), n_m is the number of monitored trips, and R is the retained catch (summed over all trips).

Estimates of at-sea discards for a given post-stratum (Eq. 1) will not provide trip- or vessel-specific estimates of at-sea discards. While it is possible to produce estimates at the trip-level, aggregate (post-stratum level) estimates will have lower amounts of associated variance and potential bias. Both of these methods assume that all landings data are accurate, can be identified with either monitored or unmonitored trips, and can be attributed to a specific post-stratum. While these appear to be reasonable assumptions, they are unverified. In particular, the landed weight recorded on fish tickets is an estimated weight that includes the application of a Product Recovery Rate (PRR) when dressed fish are delivered, corrections for ice and slime weight, and accurate reporting including identification of the covariates used to define post-strata.

The assumption that the landings data are accurate means that the landed weight of sablefish is, on average, the same as the observer-based retained weight estimate would be if retained weight were estimable from observer data in the presence of size-dependent discarding. Because size sorting of discards would only allow for an observer estimate of total catch, and not an observer estimate of retained catch, there will be no observer estimate of retained catch to compare against the landed catch. If these are not equivalent on average, then the methods outlined above will produce biased estimates of at-sea discards. For example, if landed catch is consistently higher than the observer estimate of retained catch, then discard weight will be underestimated, since the difference between total catch and landed catch is likely to be smaller than the actual difference between total catch and what was retained.

Using data from 2019 on trips where some sablefish were discarded either due to damage or because catch was in excess of available IFQ, we can compare estimated retained catch from observer data to landed weights (Figure 2-2, left panel) In this scenario, retained weight is estimable from observer data because the size distribution of discarded sablefish is assumed to be the same as the size distribution of all sablefish. While the estimates of retained weight from observer data are generally consistent with landings (Figure 2-2,, left panel), it is more common for observer-based estimates of retained weight to be larger than landed weight than vice-versa (Figure 2-2 right panel). However, the majority of differences are small.

Figure 2-2. (left panel) Comparison of trip-specific retained sablefish weight from landings (fish ticket) data (x-axis) and observer data-based estimates of retained catch (y-axis) using 2019 data. (right panel) Distribution of the differences between observer data-based estimates are higher while on the histogram, the bars to the right of the reference line are trips where the observer data-based estimates are higher.



Currently, discard ratios are based on observer data only and the estimates of retained and discarded catch used to build the discard ratio are consistent (any biases will cancel out). In the proposed method, discard estimates will be built using observer data (for total catch) and landings data (for retained catch), and any discrepancies between the two data sources could be magnified as the data are expanded from the trip level to the fishery level. The larger the discrepancy between estimated retained catch (if it were estimable from observer data in the presence of size-dependent discarding) and the landed weight, the larger the potential bias in estimates of at-sea discards. Overall, the estimates produced without sufficient observer data (i.e. without high resolution observer-based estimates of at-sea discards) will be lower quality than current estimates produced by CAS.

Product Recovery Rates

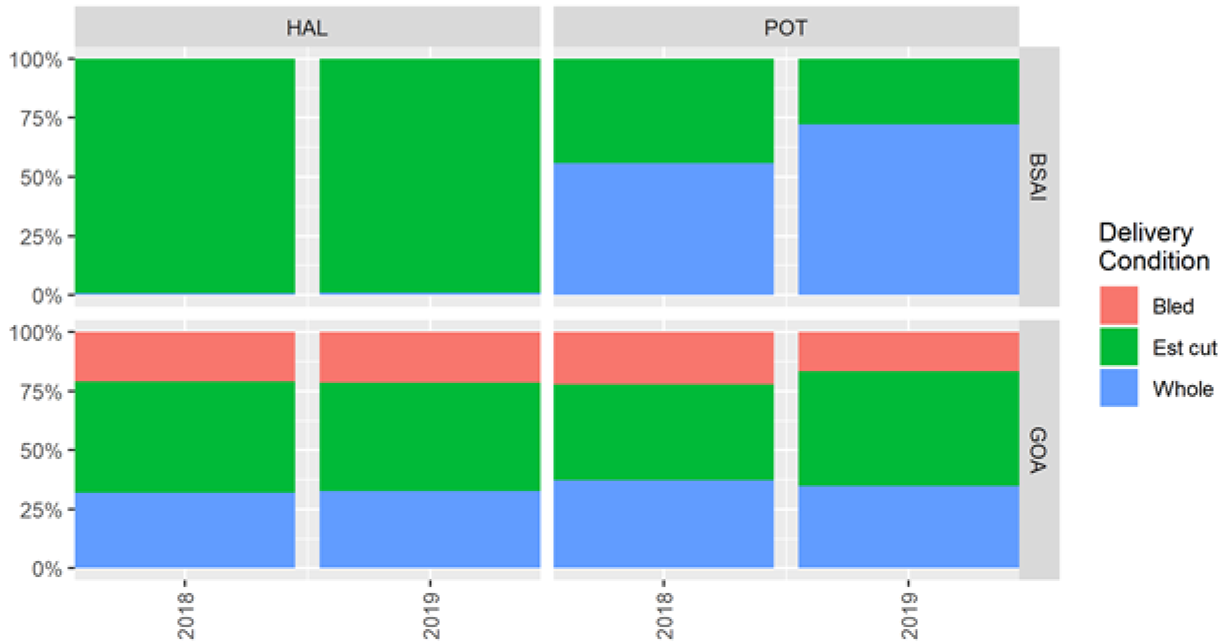
The potential biases in discard estimates originate both at shoreside processors (where landed weight is not necessarily a measured weight of whole fish landed) and at-sea (where sampling variance is incorporated into catch estimates). At-sea, sampling the catch results in variability that is associated with the estimates. In cases where the observer does not have adequate access to the entire catch, there is also the potential for bias. Both the variance and potential bias will decrease as sampling effort increases. At shoreside processing facilities, the landed catch weight is the scale weight of the offloaded catch converted to whole fish weight using Product Recovery Rates (PRRs) specific to each species and the condition of the landed catch (e.g., head and gutted fish, bled fish). PRRs for most groundfish species were evaluated for specification in 1989 (Low et al.) and an additional PRR for bled sablefish was evaluated in 2007 (see Sigler et al. 2007). Although fishing practices have likely changed over time, PRRs have not been updated. For some delivered weight condition codes, the PRR can be substantial (Table 2-8).

Table 2-8 **Proportion of landed CV catch for each condition category of landed catch for 2019. Current PRRs are specified in the Code of Federal Regulations, Table 3 to Part 679 - Product Recovery Rates for Groundfish Species and Conversion Rates for Pacific Halibut**

	Delivery Condition (Code)	Weight (t)	Percent of Total	Current PRR
BSAI Longline	Whole Fish (1)	1.01	1.0	1.0
	Eastern Cut (8)	95.57	99.0	0.63
	Total	96.58	100	
GOA Longline	Whole Fish (1)	1,990.20	32.6	1.0
	Bled (3)	1,311.92	21.5	0.98
	Eastern Cut (8)	2,804.93	45.9	0.68
	Total	6,107.05	100	
BSAI Pot	Whole Fish (1)	374.07	72.2	1.0
	Eastern Cut (8)	144.04	27.8	0.63
	Total	518.11	100	
GOA Pot	Whole Fish (1)	651.31	35.0	1.0
	Eastern Cut (8)	902.01	48.4	0.63
	Bled (3)	309.35	16.7	0.98
	Total	1,862.67	100	

An overview of eLandings data across FMP areas and gear types in 2018 and 2019 illustrates that landed catch is heavily processed (Figure 2-3). PRR's are applied to the delivery weights to estimate the pre-processed weight of catch (i.e., whole fish weight). However, since PRRs were developed and specified in federal regulations in the late 1980s, additional evaluations of their accuracy are warranted. While PRRs are currently used in the estimation of retained catch for catcher vessels delivering to shoreside processors, their use in estimation of retained catch on catcher vessels delivering processed catch to shoreside processors, their use in the estimation of retained catch for CP’s was discontinued starting in 2013 with the exception of CP’s exempted from full observer requirements (Cahalan et al. 2014).

Figure 2-3 Proportion of catches in each delivery condition by gear type and FMP area.



A study (Sigler et al. 2007) of bled sablefish highlighted that common storage methods and handling practices led to variation of PRR’s. The study examined sablefish that were directly bled, bled by gaff on landing, stored on ice or refrigerated seawater. The current PRR (0.98) was shown to be overestimating directly bled fish stored in seawater (95% confidence interval 0.982–0.985, but underestimating whole fish (1.0) which were indirectly bled (gaffed) but not accounted for (implied PRR was 0.99).

Studies into the confidence of the PRR assigned to head and gut sablefish are limited. An early study (Berger & Hare 1988) assessed PRR recovery rates from head and gut sablefish. The study showed the confidence intervals around head and gut sablefish weights to be broad, with the differences between minimum and maximum recovery percentages for the BS being approximately 18% (two standard errors was 6%).

Currently, retained catch estimates used in CAS that derive from PRRs are primarily sablefish and halibut landings of processed catches from CV. Using these data in the proposed estimation method means that this variability in the estimated retained catch will combine with sampling variability in the total catch, resulting in an overall decrease in the precision, and potentially accuracy, of estimates of at-sea discards of sablefish. Further research and/ or mitigation (e.g., requiring all catches to be landed whole for shoreside sampling) will be necessary to offset any inaccuracies.

Application to the EM Strata

The proposed method is amenable to EM data since, with the exception of the mean weight per fish, EM data contain many of the same data elements as the observer data. Haul-specific estimates of total catch are based on the total number of fish enumerated by the EM reviewer and a FMP-wide mean weight per fish generated from observer data collected in the previous year. From these data, estimates of total sablefish catch can be generated as described above. However, an important improvement to EM catch estimation methods would be to calculate mean weight from fish caught in the present year. Calculating the mean weight per sablefish from the prior year's data will lead to inaccuracies as population size structure and fishing practices change between years. A better solution would be to use a disposition-specific mean weight per fish. Once discard and retained catch weights are estimated using observer data, the mean weight per fish can be computed by dividing the weight discarded (or retained) by the observer data-based estimated number of fish discarded (or retained). Recall that current observer data allow for the estimation of numbers of fish discarded using the proportion of the number of fish discarded and the total number of fish caught. Regardless of whether mean weight is calculated from the prior year or the current year or whether the mean weight estimates are disposition-specific, there is no near-term ability to get weight data from EM. This means that catch weights for the EM strata will continue to be estimated from observer data, which assumes that the characteristics of trips (e.g., fishing locations and depths) in EM strata are equivalent for trips in the analogous observed strata.

2.2.2.2 Option 2: Sablefish discards will be estimated pre-season based on AFSC longline survey encounter rates of sub-three pound sablefish with the DMR applied annually as part of the specifications process.

The AFSC longline survey contributes valuable information to the stock assessment on abundance, length, and age structure in the population. However, survey data are used in combination with several other sources of fishery-dependent and fishery-independent data to estimate total fishing mortality in the stock assessment and develop harvest recommendations. Because fishing mortality and its impact on the population is estimated within the stock assessment (Section 2.2.3), it follows that discards would be estimated in a similar fashion. Therefore, it may be most appropriate to conduct the final sablefish discard accounting with respect to the specifications process within the stock assessment, instead of pre-season as a function of AFSC longline survey encounter rates (Section 2.2.3). Parallels may be drawn to the International Pacific Halibut Commission's (IPHC) method of estimating Pacific halibut discards using encounter rates of fish below the 32 inch minimum size limit (i.e. U32:O32) in their Fishery-Independent Setline Survey. However, unless a minimum size limit is implemented in the directed sablefish fishery, it is unreasonable to simply replicate these methods for sablefish using a subjective three pound cutoff. In this section we provide background information on the AFSC longline survey, impacts to catch accounting and in-season management under this alternative, an overview of the IPHC methods of estimating discards, and a description of the differences between survey and fishery gear selectivity. Finally, we show what the impacts may have been on landed catch in past years using longline survey length compositions if assumed fishing mortality rates were the same. Given that discards are a form of fishing mortality and make up a part of the total catch, it follows that under any discarding scenario, the landed catch will be lower than it would be under full retention.

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

The AFSC surveys are conducted annually during the summer months, which are partially concomitant with the directed fisheries. In-season management and catch accounting will require "real-time" estimates of discards in order to manage the fishery as it is executed. Discard estimates from the AFSC survey would not be available for use in estimating discards in the directed fishery until the following year. Given the high variability in size composition that has been observed over the past decade in both surveys and the directed fishery (including unprecedented large year class events), estimates of discards obtained from age and length compositions from one year may not accurately describe discards of the fishery in preceding years. Additionally, the BS and AI are sampled biannually, making these dynamics especially difficult to track. These sources of uncertainty would not be accounted for in harvest recommendations if AFSC longline survey encounter rates were used to estimate discards.

In the absence of the fishery-dependent data needed to directly estimate discards in the directed Pacific halibut fishery, the IPHC uses their survey and other indirect data sources to estimate the discarded catch of fish below the 32 inch (81.3 cm; U32) minimum size limit (Gilroy and Stewart 2016). In British Columbia, the directed fleet is required to record the number of U32 halibut in logbooks, which is then independently verified using 100% electronic monitoring and converted to weight using the average observed U32 weight in the IPHC Fishery-Independent Setline Survey. In all other IPHC areas, including Alaska, the IPHC Fishery-Independent Setline Survey is assumed a proxy for the encounter rates of sublegal halibut (i.e. U32:O32) and used to estimate fishery discards by area and year. Survey stations that produce a lower catch rate of O32 halibut than the directed fishery are removed prior to analysis in order to make the survey and fishery as comparable as possible (Gilroy and Clark 2008). The estimates of dead discarded catch is then used as a data input to the suite of stock assessment models currently used by the IPHC, meaning that the assessment models fit to and estimate discarded catch (Stewart and Webster 2021). The age distributions of U32 halibut in the survey are also used as a proxy for the discarded catch compositions and fit within the stock assessment model, although this component of the model likelihood is significantly down-weighted because these data are already included in the likelihood as part of the total survey age compositions (Stewart and Hicks 2019, Stewart and Webster 2021). Additionally, the assessment authors model discards as separate fleets within the model, which at least in theory allows for discard rates to be a function of spatial fishing effort and not strictly contact with the gear (Stewart and Hicks 2019). **The primary issue preventing the IPHC method from being replicated in the directed sablefish fishery using AFSC longline data is that there is no minimum size limit for sablefish under consideration.** It is inappropriate to assume there is a sub three pound cutoff when estimating discards if sablefish of any size can be discarded. The assumptions underpinning the IPHC method of estimating discards rely on the minimum size limit, including that the catch rate of U32 halibut is the same between the fishery and the survey and that the survey age compositions are representative of the discarded catch.

If in the future a minimum size limit is under consideration, a key assumption that should be met in order to use the survey to estimate sablefish fishery discards is that the survey and fishery selectivities are comparable. In contrast to the survey, fishing effort for the directed fishery is largely driven by economics. Because of market price differentials in the size classes of sablefish, large fish are worth much more and are preferentially targeted. This results in fishing effort being focused on habitats and depths where large, valuable fish are more common, which skews selectivity towards larger fish. This also affects sexes differently due to sexually dimorphic growth (i.e. females attain a larger size-at-age compared to males and therefore would comprise a larger portion of the catch). Because the survey samples all sablefish habitats and does not target larger/older fish, it proportionally encounters more smaller/younger sablefish than the fishery. This disparity in selectivity between the survey and the fishery would result in a larger amount of discards being estimated if strictly longline survey data were used.

Figure 2-4 Current sablefish selectivities for the sablefish IFQ fixed gear fishery (orange) and the AFSC domestic longline survey (purple) in the sablefish stock assessment by sex (females as solid lines, males dotted).

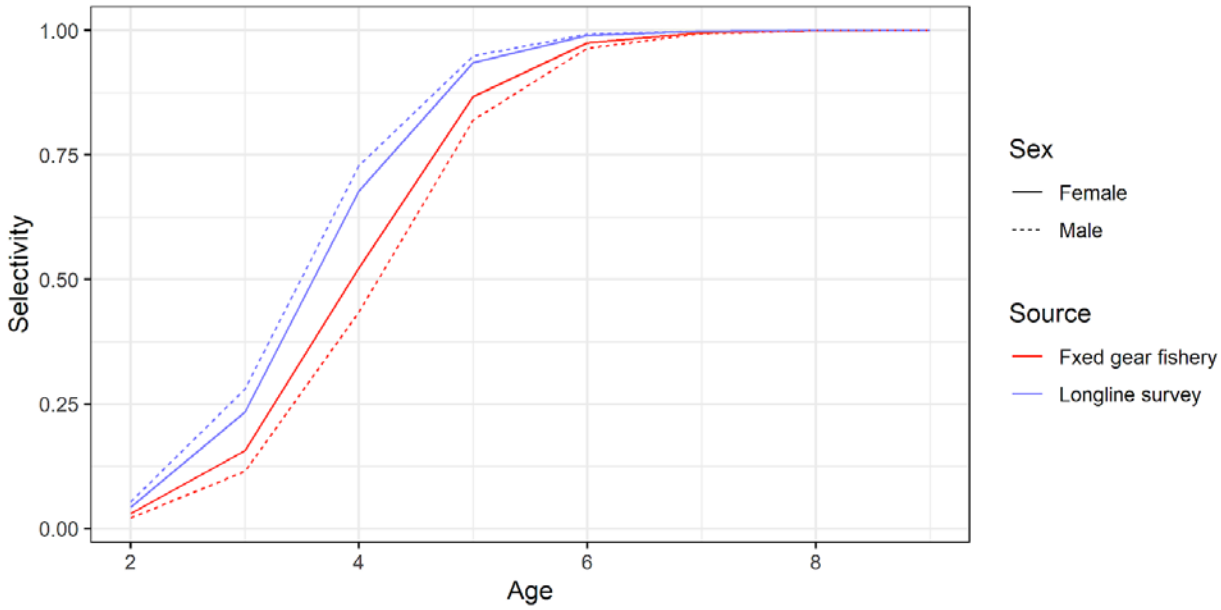


Figure 2-4 shows sablefish selectivity curves for the proportion of sablefish of a given age and sex that are caught in the ASFC longline survey and in the sablefish IFQ fishery. Although at first glance they appear quite similar, there are comparatively large differences in the proportion of selected individuals at younger ages. These differences in fishery and selectivity are likely not static over space or time. Since sablefish are assessed on an Alaska-wide basis, selectivities for both the survey and fishery are computed for the entire range in the assessment. Spatial differences exist in age/size composition, especially when large year classes move into the population (e.g. younger smaller fish are more prevalent in the western areas versus Eastern GOA). To properly account for this, separate selectivities for each management area should be considered. Additionally, selectivity differs by sex but since no sex information would be available from discarded fish in the fishery a proxy selectivity from the survey that combines sexes or assumed sex ratios would need to be used. In both the survey and fishery, selectivity likely changes due to emerging year classes or market based drivers, so estimating selectivity should not be considered static and may need to be updated annually.

Because there are inherent differences between the catch composition of sablefish caught during the AFSC surveys compared to those caught in the directed fishery, attempts to estimate discards for the latter based on the former would substantially increase uncertainty in the stock assessment model. In the current assessment model, total catch is assumed to be known with very little uncertainty (assumed coefficient of variation = 0.01). Sablefish discarding would increase variability associated with the catch estimates; however, the amount of increase is unknown and would depend on the prevalence of discarding and amount of sample data available. Although estimation methods have been developed for partial coverage strata under current fisheries operations (i.e., no size selective discards; NMFS, unpublished data) and full coverage fisheries (Cahalan et al., 2014), methods to estimate variance under new estimation procedures would need to be developed.

Aside from accurately accounting for the relationships between discards from the survey and those of the directed fishery, another consideration is how these survey-generated discards would be applied to vessels fishing with pots. Presently, no AFSC survey related to sablefish is conducted with the use of pot gear. Given the likely selectivity disparities between gear types, and differences in set times, sampling locations, bait, and other factors, estimating discards for the sablefish IFQ pot fishery from AFSC longline survey is not likely to provide an accurate representation of sablefish discards in the pot fishery. Pot gear now comprises upwards of 40% of the fixed gear catch, a trend that is expected to increase further in future years (Goethel et al. 2020). Additionally, spatial differences in whale depredation and the subsequent use of pot and longline gear may further differentiate the survey from the actual fishery and impact estimates of discards from the survey.

Although in practice discards may be best-estimated as part of the annual catch accounting and stock assessment process, past AFSC longline survey data can be informative when trying to understand the impacts and potential ABC reductions under different discarding assumptions. We used past AFSC longline survey length frequency data from 2000-2020, area-specific estimates of biomass from the stock assessment model (Table 3.15 in Goethel et al. 2020), and area-specific estimates of catch to determine the impact of alternative discarding scenarios on the retained or landed catch. The alternative discard scenarios include a scenario where only sub-three pound fish are discarded, and another scenario where any fish smaller than the premium 7+ processor grade, has a probability of being discarded. These scenarios are described in detail in Section 2.2.3.1 and were also used for comparison in a yield per recruit analysis (Section 2.2.3.4).

Annual and area-specific fishing mortalities were derived using catch and biomass estimates to account for the fact that harvest rates and available fish sizes vary over space. Assuming fishing mortality was fixed to those values for each respective year and area, we then added discarding to the fishery. Because fishing mortality is assumed constant but now includes mortality from both discarded and retained catch, the realized retained catch under each discard scenario decreases. The percent decrease in landed catch under each discard scenario from the observed catch under full retention is analogous to a percent reduction in ABC under a voluntary discard program.

Under the proposed discarding scenario where only sub-three pound fish are discarded, the resulting landed catch was on average 8.4% less than the actual catch observed between 2000-2020. Results varied between 4.4 and 10.8% depending on the abundance of small fish. Under the discarding scenario where any fish smaller than a premium 7+ grade had some probability of being discarded (Table 2-10 in Section 2.2.3.1), the resulting landed catch was on average 46.4% less than the actual catch observed between 2000-2020. Similar to the sub-three pound scenario, results varied between years from 40.1 and 52.0% based on small fish abundance. Under a third scenario based on methods used in the Chatham Strait stock assessment (Table 2-10 in Section 2.2.3.1), the resulting landed catch was on average 12.0% less than the actual catch observed between 2000-2020, with annual results ranging between 8.0 and 16.0%. These results show that under any discarding scenario, landed catches will decrease because part of the fishing mortality is allocated to discards.

2.2.3 Element 3: Discard Mortality Accounting

> **Sablefish discard 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 and specifications process.**

Attempts to account for fishery discards and their effects on marine ecosystems has been a theme of fisheries research and management for many decades (Saila 1983, Alverson 1994). Unlike landed catches, which are well-documented through the use of landing reports or fish tickets, discards are notoriously challenging to estimate because they occur at-sea. If not accounted for in stock assessments as part of the total catch, this can lead to overexploitation and stock declines. Because discards are primarily small fish, this overexploitation often comes in the form of **growth overfishing**, meaning that mortality on young fish outpaces growth leading to reductions in overall yield (Hilborn and Walters 1992). A common theme of growth overfishing is age truncation, a well-documented feature of the Alaska sablefish stock (Goethel et al. 2020), which can reduce the resiliency of fish populations to environmental fluctuations (e.g. Ottersen et al. 2006) and lead to unstable trends in population abundance (Anderson et al. 2008).

Additionally, size-selective discards that are poorly accounted for can result in a loss of the information needed to estimate stock size and bias Spawning Potential Ratio (SPR) management reference point estimates of fishing mortality by 30-40% (Williams 2011).

If adequate data were available, mortality of discards could be accounted for in the estimation of fishing mortality as part of the annual sablefish stock assessment and harvest specifications process under a voluntary discard program. We have structured this section as follows:

A. *Section 2.2.3.1. Impact of fishery discards on catch accounting and stock assessments:* Here we cover necessary background information and define key concepts like DMRs and retention selectivity in the context of stock assessment (see Figure 2-5 for a graphic demonstrating these concepts). The take home point of this section is that insufficient data or faulty assumptions about discards will impede our ability to make informed fishery management decisions. Table 2-9 shows increasing uncertainty in the stock assessment model under a range of regulatory and monitoring options. If properly accounted for, fishery discards can be managed. However, the voluntary nature of this discard program, both in the size of fish allowed to be discarded and the uncertainty about who in the IFQ fleet will participate, introduces a level of uncertainty into the assessment that can only be mitigated with new data collection programs.

B. Section 2.2.3.2. Using novel data sources to estimate discards: In this section, we discuss current methods under development to use processor size grade and pricing data to model discarding behavior. We compare contemporary processor size grade from the sablefish IFQ fishery with the State of Alaska Chatham Strait sablefish fishery, which is already managed under a voluntary discard program. These data suggest that discarding will likely impact more than just sub-three pound fish (Figure 2-8).

C. Section 2.2.3.3. How discards are incorporated into stock assessment and harvest recommendations: Here we explain how discarding enters in the estimation of fishing mortality, the key variable upon which Alaska groundfish fisheries like sablefish are managed. If adequate data were available, discards potentially could be accounted for in the ABC determination (i.e. deducted) and estimated as part of the total annual fishing mortality. We show the annual cycle of data collection, stock assessment, and harvest specifications under a voluntary discarding program with and without a supplementary shoreside sampling program (Figure 2-10). Finally, we discuss impacts to management reference points (e.g. FOFL or FABC) and recommend further research into this topic.

D. *Section 2.2.3.4. Impacts of discarding on sablefish stock status and fishery performance*: In this section we describe examples from the British Columbia sablefish fishery and Pacific halibut IFQ fishery that may be applicable to understanding the impact of discarding on sablefish spawning biomass. We also present results from a simple yield per recruit model, which can be used to evaluate tradeoffs of voluntary discarding on fishery performance. Discarding results in lower amounts of retained catch under the same harvest rate. If we are overly optimistic in our assumptions of DMR or retention selectivity, our harvest rates will be significantly higher than we think, which could lead to overfishing.

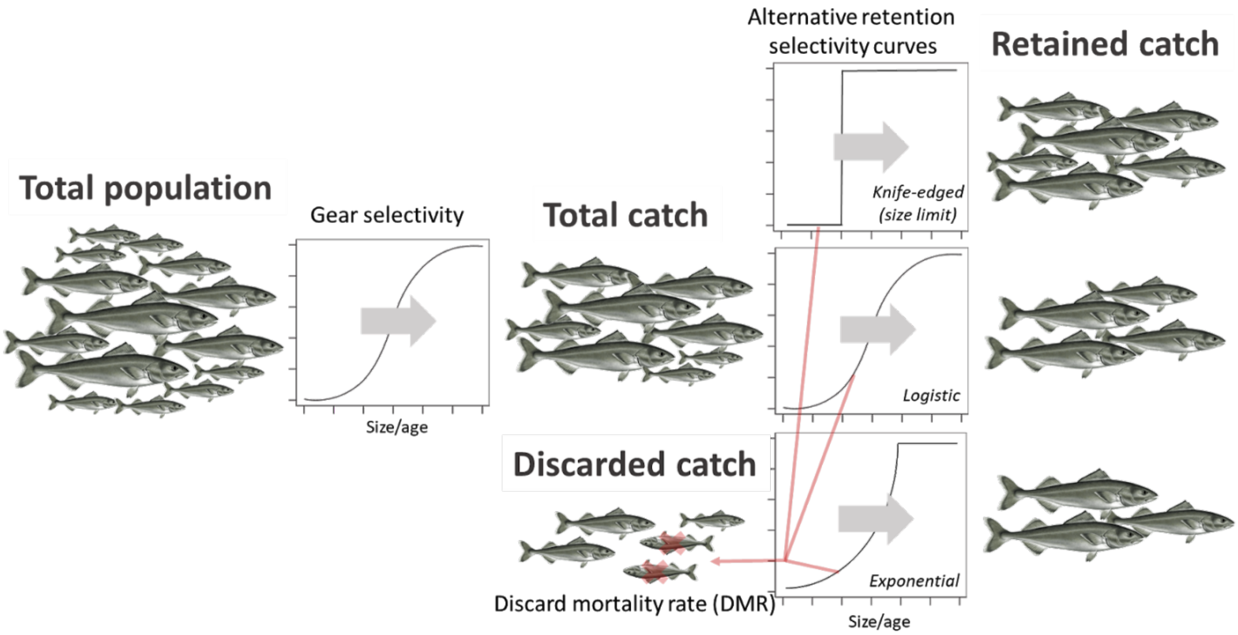
2.2.3.1 Impact of fishery discards on catch accounting and stock assessments

Two fundamental questions must be answered when evaluating the effects of a voluntary discarding program in the sablefish fishery on catch accounting and stock assessment: What sizes of fish will be discarded? And, how many of the discarded fish will die? Discussion papers to date have primarily focused on the second question by examining alternative DMRs, which are defined as the probability that a fish will die once discarded from a vessel. The DMR functions similarly to natural mortality in stock assessments, acting as a scalar for total mortality. Although there is rarely sufficient data to support an obvious choice of DMR, it will be a consequential stock assessment input under a voluntary discard program that will impact management reference points and harvest recommendations. Underestimating the DMR means underestimating harvest rates or fishing effort, which introduces the potential for overfishing.

Research to inform DMRs generally takes years of field and lab experiments and is especially challenging in sablefish, which must swim back to their preferred depth range of 200-2,500 m after being discarded. The only study in Alaska estimating sablefish DMRs used mark-recapture data from research surveys and resulted in a DMR of 11.71% for longline gear (Stachura et al. 2012). However, this estimate was based on a fixed survival of 96.5% (i.e. a DMR of 3.5%) for fish with minor hook injuries, an assumption that influenced all subsequent results in the study by scaling survival estimates of fish with other types of hook injuries to this value. To illustrate this point, we replicated the results of Stachura's study using the tag data provided in Table 3 and the equation for absolute survival rate (Eqn 2). We found that for every 1% decrease in assumed survival of fish with minor hook injuries, the resulting DMR increased by 0.91. For example, if we use the same mark-recapture data set but assume the survival of fish with minor hook injuries is only 80% rather than the 96.5% assumed in Stachura's study, the resulting DMR would be 26.81%. This finding highlights the limitations of this particular study and opens the door to think more broadly about DMR assumptions. As discussed in Section 2.2.1, DMRs may be significantly higher in areas impacted by whale depredation, another source of unobserved mortality that may bias estimates of sablefish abundance (Hanselman et al. 2016, Peterson et al., 2017, Hanselman et al. 2018). Predation on discards is a cryptic source of mortality that is not explicitly accounted for in traditional mark-recapture, laboratory, or enclosure studies on DMRs (Bohaboy et al. 2020). Using cutting-edge three-dimensional acoustic telemetry, Bohaboy et al. (2020) found that predation accounted for 83% and 100% of red snapper and gray triggerfish mortality, respectively, resulting in DMR estimates that greatly exceeded those assumed in stock assessments. Ultimately, sablefish DMRs are a complex function of predator density (e.g. killer whales), body size, injury, handling, and environmental conditions. However, cautionary tales such as these highlight the prudence of selecting a conservative DMR for stock assessment, as well as the need for further research to inform sablefish DMRs under a voluntary discard program.

While the choice of DMR presents an interesting, albeit intractable, problem when evaluating a voluntary discard program, the question of what sizes of fish will be discarded ends up having an equally large impact on discard estimates and resulting assessment uncertainty. Most fisheries mitigate this source of uncertainty through the use of minimum size limits, with the assumption that fish below the size limit will be discarded, while fish above it will be retained. In the absence of a minimum size limit, analysts are charged with determining the retention selectivity, which is defined as the size or age-specific probability that a fish is retained. Retention selectivity occurs separately from gear selectivity, which is the size or age-specific probability of capture based on gear and availability of fish in the population. Both retention selectivity and gear selectivity are sorting processes; gear selectivity splits the total catch from the available fish population, and retention selectivity splits the total catch into the retained and discarded catch (Figure 2-5). Both selectivities are important stock assessment variables that can only be estimated if adequate data are available.

Figure 2-5 A conceptual model of gear selectivity and retention selectivity as filtering or sorting processes that separate the total population into total, retained, and discarded catch. Three alternative functional forms of retention selectivity are shown, which result in different retained catch size compositions. The discarded catch is further split into fish that are assumed to survive or die based on the discard mortality rate (DMR).



The stock assessment uncertainty generated by discarding falls along a continuum based on the fishery-dependent data available under different discarding scenarios and monitoring programs (Table 2-9). If age or length composition data are available from both the retained catch and the total catch (the sum of retained and discarded), then retention selectivity can potentially be estimated in the stock assessment model (although this requires large sample sizes of size or age composition). This approach is data and modeling intensive and would require the development of a supplementary shoreside sampling program to obtain age and length samples from the retained catch (Section 2.2.4). Additionally, a shoreside sampling program could not simply replace the at-sea observer program, because observers would still be needed to obtain samples from the total catch. While expensive, the paired at-sea and shoreside sampling approach is used in the BSAI king, snow, and tanner crab stocks, which allows for direct estimation of retention selectivity in stock assessment models.

If age or length composition data are only available from the total catch, which is the case under the current observer program, then retention selectivity must be assumed or fixed in the stock assessment (Table 2-9). If the sablefish IFQ fishery moved to voluntary discarding today, leaving all else equal, this is the likely scenario we would be operating under. The result is high uncertainty in both the retention selectivity and the DMR, which would likely lead to additional uncertainty and bias in the estimation of gear selectivity because targeting behavior could change. Given fishermen currently avoid certain areas due to small fish, fishermen would likely alter how, where, and when they fish under a voluntary discard program. Any such change in targeting would likely alter gear selectivity. Finally, this scenario should also be contrasted with the State of Alaska Chatham Strait sablefish fishery in Southeast Alaska, which is managed under a voluntary discard program and relies solely on a shoreside sampling program to obtain fishery samples (Table 2-9). Because fishery-dependent age and length data come strictly from the retained catch, it is impossible to estimate gear selectivity or retention selectivity in this fishery. As such, the Chatham assessment relies on gear selectivity estimated in the federal sablefish assessment and fixes retention selectivity, which we detail in the following paragraphs. If discarding in the sablefish IFQ fishery resulted in a biased estimate of gear selectivity, under status quo methods, this bias would also filter into the Chatham assessment. In Section 2.2.3.2 we describe a method that is currently under development to leverage data from Chatham Strait and the IFQ fishery to estimate retention selectivity.

Table 2-9 Increasing stock assessment uncertainty under a range of discarding and monitoring scenarios, including mandatory full retention (status quo) and voluntary discards with at-sea observers. Results are presented in terms of the stock assessment's capability to estimate gear selectivity, retention selectivity, and discard mortality rate (DMR), where green means variables can be estimated, red means they cannot be estimated, and yellow means they can be estimated with some increased uncertainty.

Increasing stock assessment uncertainty

Scenarios	Data used in stock assessment	Ability to estimate:			Example
		Gear selectivity	*Retention selectivity*	*Discard mortality rate (DMR)*	
Mandatory retention with at-sea observers	Age or length compositions from the total catch	Yes	*Not needed*	*Not needed*	Status quo
Voluntary discarding with at-sea observers paired with shoreside sampling	Age or length compositions from the retained catch *and* the total catch (retained + discarded)	Yes	Yes	No	BSAI king, snow, and tanner crabs
Minimum size limit with at-sea observers	Age or length compositions from the total catch (retained + discarded)	Yes	Assume full retention at minimum size limit	No	--
Voluntary discards with at-sea observers only	Age or length compositions from the total catch (retained and discarded)	Yes (but may increase uncertainty)	No	No	--
Voluntary discards with shoreside sampling only	Age or length compositions from the retained catch	No	No	No	Chatham Strait sablefish

Both gear and retention selectivities are sorting or filtering processes and are incorporated into stock assessment models using various functional forms (Figure 2-5). In the absence of a minimum size limit or the data needed to estimate retention selectivity, we developed a suite of alternative retention curves to illustrate the range of discarding behavior that may arise in the sablefish IFQ fishery under a voluntary discard program. We present several alternative functional forms for retention selectivity based on minimum size limits (Knife edge), expert opinion (Logistic), or processor grade pricing data (Exponential). Discard estimates are highly sensitive to these alternatives, with the price-driven retention selectivity resulting in the highest discard estimates. Like the DMR, if we assume the wrong retention selectivity in the assessment model, it will lead to biased estimates of population size or fishing mortality.

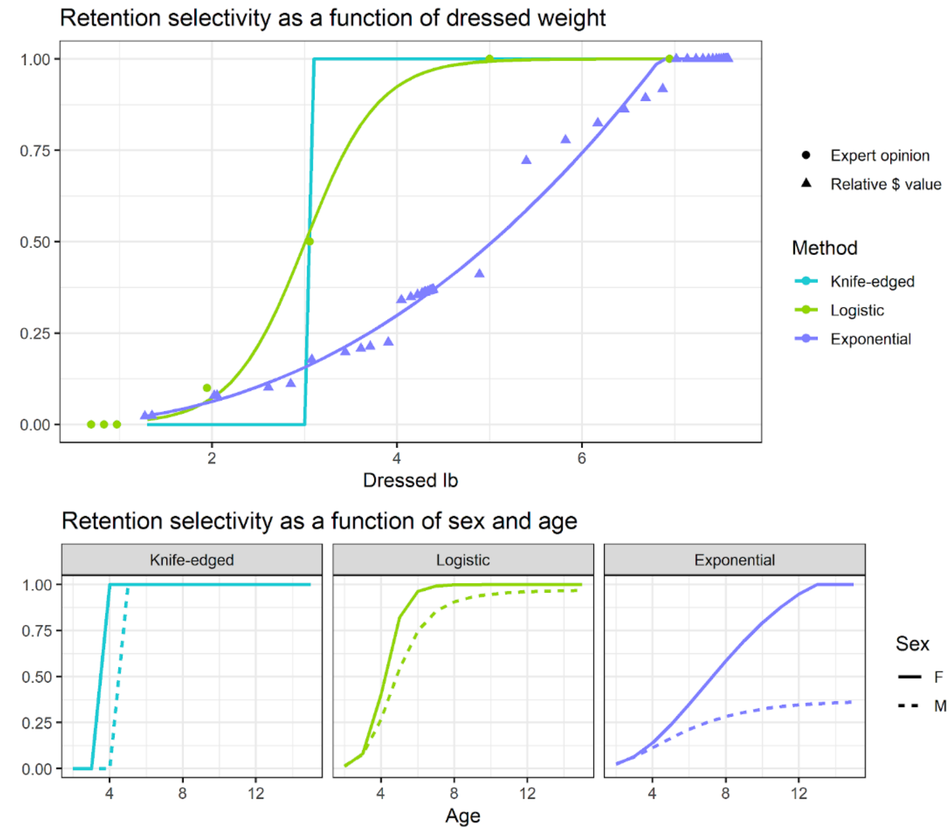
The theoretical retention selectivities presented in this analysis were developed as a function of dressed weight, the unit of measurement most commonly used by the fleet (Table 2-10). The assumed conversions between dressed weight, length, age, and sex are presented in Appendix A Conversion Table. Under status quo or "Full retention", retention selectivity is assumed to be 100% (all fish retained, regardless of size). As the motion is written, retention selectivity is 0% for fish less than or equal 3 lb and 100% for fish greater than 3 lb. This cutoff corresponds to 59 cm fork length, or age-5 for males and age-4 for females (Appendix A Conversion Table). We term this "Knife-edged" retention selectivity because there is no gradient in retention assumed across sizes (Figure 2-5 and Figure 2-6). This retention selectivity is only realistic with a minimum size limit and mandatory retention above 3 lb. In the absence of more information, we assume this represents the lower bound of potential discarding behavior that may occur under a voluntary discard program. The third retention selectivity, termed "Logistic", is based on fishery management biologist's expert opinion available in the Chatham Strait stock assessment (Sullivan et al. 2020). Under this alternative, the lower bound of processor grade 2/3 was assigned a 10% retention probability, the lower bound of grade 3/4 was assigned a 50% retention probability, and all grades 5/7 and 7+ were assigned a 100% retention probability. A logistic model was fit to these probabilities, giving this retention selectivity its name. While this option may be attractive in its simplicity, it was not developed using actual data, nor has it been validated.

Table 2-10 Alternative theoretical retention selectivities for sablefish based on status quo ("Full retention"), a minimum size limit of sub-three pound fish ("Knife-edged"), expert opinion from Chatham Strait, which operates under a voluntary discard program ("Logistic"), and a price-based model that assumes any fish below the premium 7+ grade has some probability of being discarded ("Exponential").

Retention selectivity name	Explanation	Method
Full retention	Status quo	100% retention
Knife-edged	Based on the Council motion, bookends lower bound of discarding behavior.	Retention <=3 lb = 0 Retention > 3 lb = 1
Logistic	Based on ADF&G fishery management biologists' expert opinion (Sitka and Juneau)	Expert opinion, values borrowed from Chatham Strait stock assessment
Exponential	Based on the dollar value per pound using processor size grade and pricing data	Retention >= 7 lb = 1 Value = $/lb * dressed lb (lb) Retention <7 lb = Value/(Value of 7 lb fish)

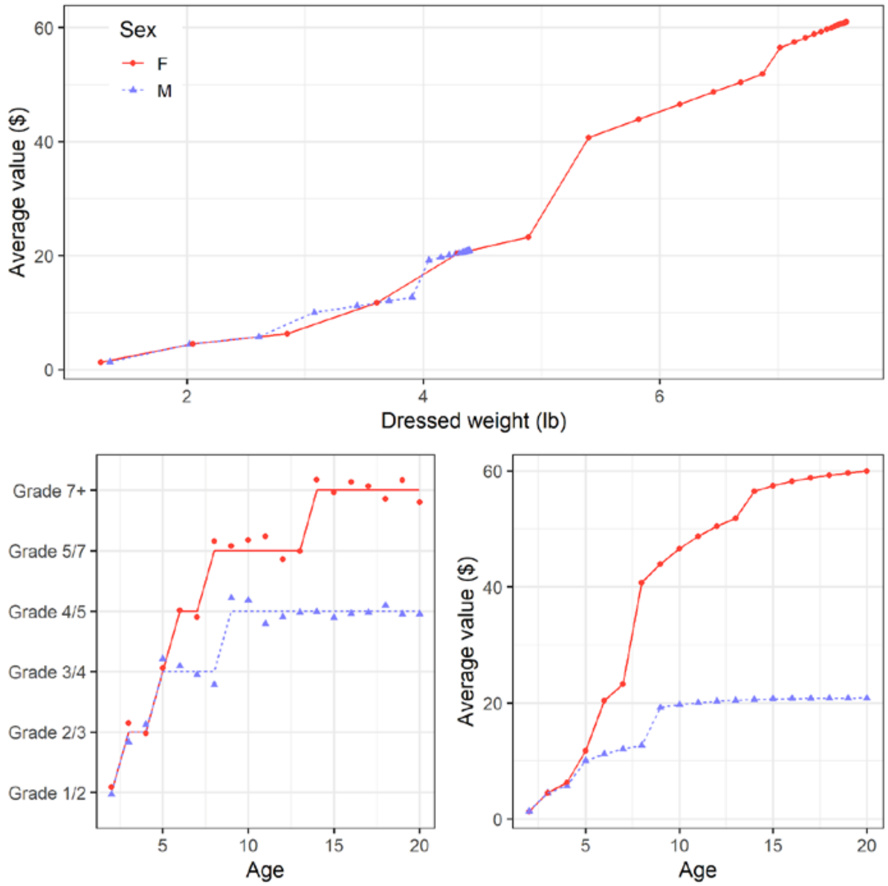
The fourth and final retention selectivity, termed "Exponential", was developed using fixed price-per-pound by processor grade data, where grade 1/2 = $1.00/lb, grade 2/3 = $2.20/lb, grade 3/4 = $3.25/lb, grade 4/5 = $4.75/lb, grade 5/7 = $7.55/lb, and 7+ = $8.05/lb. This retention selectivity was inspired by conversations with fishermen who describe their probability of discarding a fish as a function of the potential reward that comes with catching a more valuable fish. In this case, retention selectivity becomes the ratio of the dollar value of a fish (dressed weight * price-per-pound) divided by the dollar value of a 7 lb fish, above which 100% selectivity is assumed. Since this retention selectivity is a function of price, and price is highly variable in sablefish, the Exponential retention selectivity would vary by year and potentially by area, season, or processor. It would also presumably only be relevant in areas where larger fish are available.

Figure 2-6 Alternative theoretical retention selectivities as a function of dressed lb (top) and sex and age (bottom) for sablefish based on a minimum size limit of sub-three pound fish ("Knife-edged"), expert opinion from Chatham Strait, which operates under a voluntary discard program ("Logistic"), and a price-based model that assumes any fish below the premium 7+ grade has some probability of being discarded ("Exponential").



The Exponential retention selectivity is useful for bookending the upper bound of potential discarding behavior. It also illustrates the disproportionate impact discarding may have on female spawning biomass if not properly accounted for (i.e. if we don't have accurate estimates of DMR or retention selectivity). Using the Appendix A Conversion Table translated the retention selectivity in dressed lbs. to sex- and age-based retention selectivity curves that can be used as inputs to population models (Figure 2-6). Male sablefish do not grow as large as females and reach maximum sizes around 9 years old, at which point they are only grade 4/5 and worth one third of a 7 lb (dressed) female sablefish (Figure 2-7). On average, it takes 14 years for female sablefish to reach grade 7+. Female sablefish are assumed to be 95% mature at age-11, which means they are subject to discarding for several years after they are assumed to be fully mature. A yield per recruit analysis demonstrates **Exponential retention selectivity results in less than 50% of all fish caught being retained and a landed catch that is highly skewed towards mature females** (Section 2.2.3.4). Further research will be needed to evaluate the demographic impacts of this highly size-selective retention selectivity, as well as the ability of the Alaska sablefish population to recover from historically low spawning biomass levels under this scenario.

Figure 2-7 The relationship between average dollar value of sablefish by sex and dressed lb (top), processor grade size by sex and age (bottom left), and average dollar value by sex and age (bottom right). Female sablefish (red solid lines, points) grow to a larger maximum size than males (purple dotted lines, triangles), which means males do not exceed grade 4/5 on average and are worth less ($) on average by age after age-5.

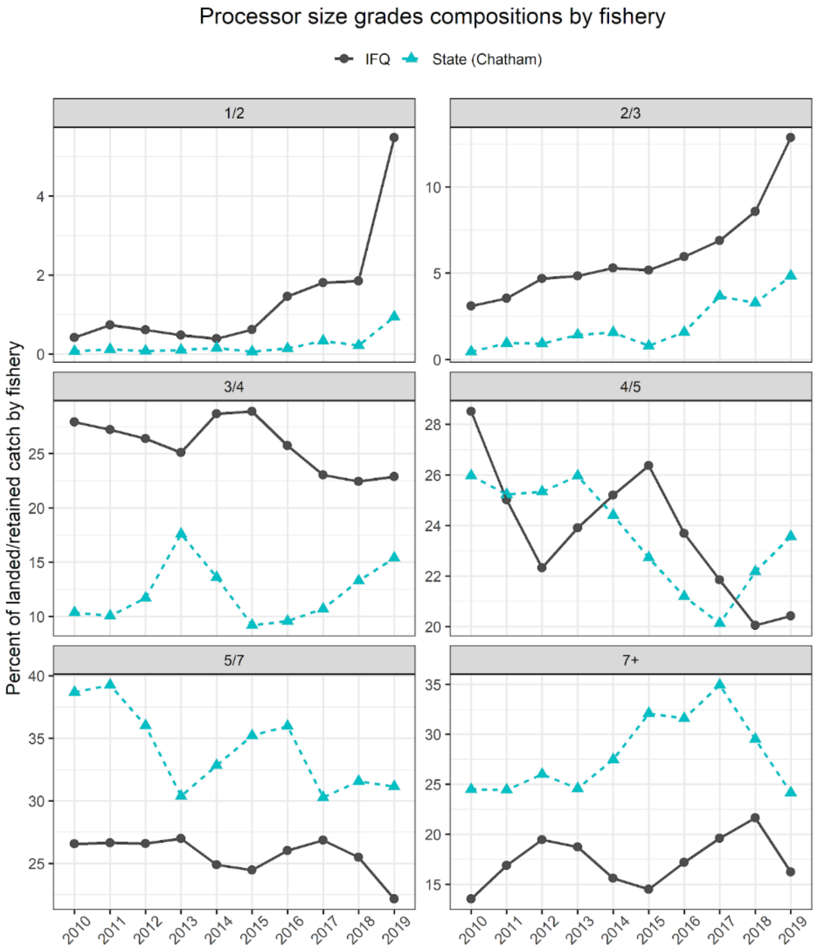


2.2.3.2 Using novel data sources to estimate discards

Discarding behavior is very challenging to model. Fisheries that discard (e.g. Bering Sea snow and tanner crab) use a paired at-sea observer and shoreside sampling programs to obtain length samples of total and retained catch, respectively (see previous section for more details). A shoreside sampling program for sablefish caught in the sablefish IFQ fishery does not currently exist, and any future program would require a substantial budget and new sampling program that accounts for the fishery's extensive range and long season (Section 2.2.4). Without adequate time and resources to develop such a program, the shoreside option may not be feasible.

We aim to address this data gap by treating processor size grade data as a proxy for retained catch in a population model. If fit jointly with age and length samples of the total catch from at-sea observers, we can get at a coarse measure of discarded catch that may allow us to estimate both gear and retention selectivity. The size grade and pricing data, which have been voluntarily recorded by processors throughout Alaska using the eLandings fish ticket software since 2006, represent a potentially valuable, under-utilized data set. Here we present preliminary size grade data collected by eLandings and stored by the Alaska Regional Office from the sablefish IFQ fishery and the State of Alaska Chatham Strait sablefish fishery to illustrate the differences in processor grade compositions between a fishery with mandatory full retention (IFQ) and a fishery already operating under a voluntary discard program in Alaska (Chatham; Figure 2-8). Before plotting, these data were grouped by a standardized processor grade definition and weighted by month and area-specific catch to adjust for seasonal and spatial differences in sablefish harvest.

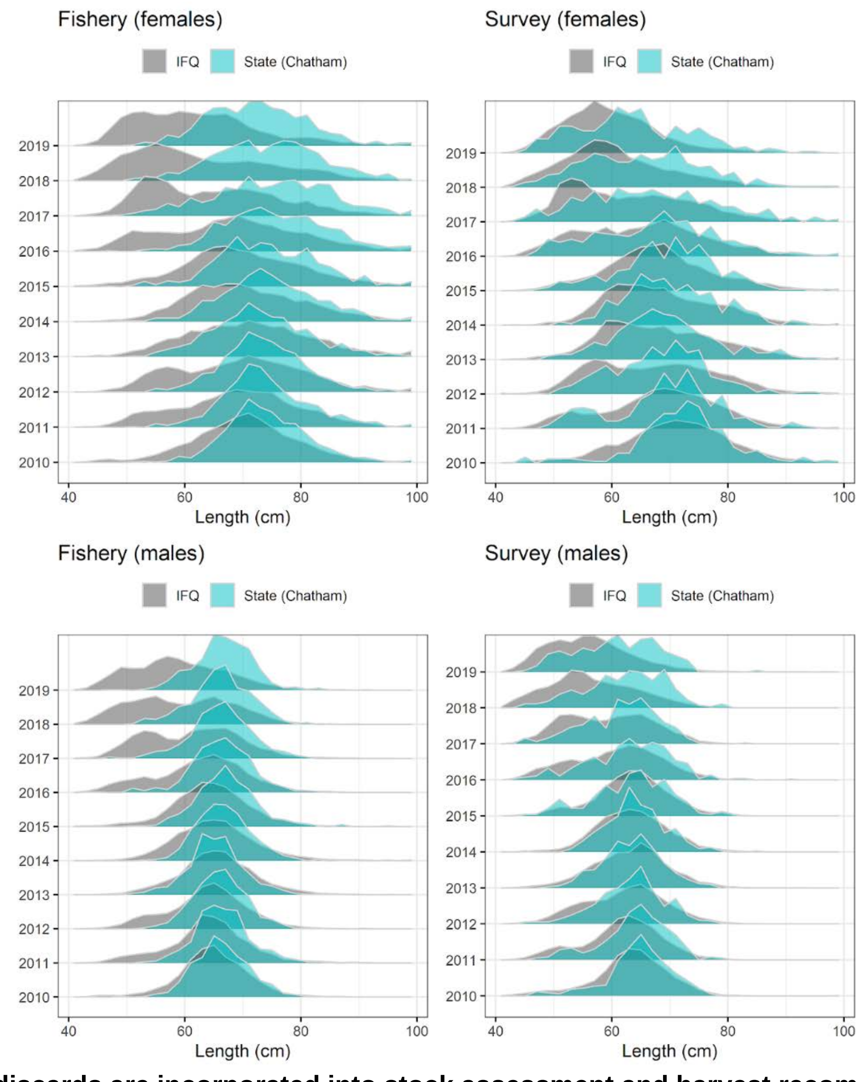
Figure 2-8 Percent of landed or retained catch by processor size grades and fishery (IFQ sablefish in black solid lines and state-water Chatham Strait sablefish in teal dashed lines), 2010-2019. Each panel represents a unique processor size grade defined in Eastern cut dressed lb with an assumed product recovery rate of 0.63 (e.g. "1/2" represents fish between 1 and 2 dressed lb).



The processor size grade compositions show that the IFQ fishery landings are composed of a higher percentage of grades 1/2, 2/3, and 3/4 fish when compared to Chatham, which suggests that considerable discarding may occur in Chatham Strait under a voluntary discard program (Figure 2-8). The differences in compositions also show that discarding is prevalent until grade 4/5, impacting fish larger than the sub three pound cutoff referenced in the Council motion. Alternatively, disparities in the grade compositions could be attributed to differences in fish availability in the two areas. For example, if size or age-based migration into Chatham is prevalent, it could manifest as higher abundance of larger fish in Chatham or higher abundance of small fish in federal waters. However, an examination of the survey and fishery length compositions in federal waters off Alaska and Chatham Strait show overlap in the availability of fish across sizes in the survey, coupled with a divergence in fishery length compositions that can only be explained by discarding behavior (Figure 2-9). Regardless, differences in fish availability or gear selectivity are factors that highlight the necessity of collecting data on the total and retained catch under any voluntary discard program.

Currently our best example of what voluntary discarding may look like in the IFQ fishery comes from the Chatham Strait sablefish fishery (Figure 2-8). Models are under development that fit to length and age composition from these fisheries with the goal of estimating retention selectivity. These models can be used to test the effectiveness of processor grade composition data to estimate retention selectivity in the absence of more traditional age and length composition data. This approach leverages relationships between dressed weight, length, and age, and may also use the accompanying price data to account for economic incentives that influence discarding behavior. Ultimately, this method may prove viable as a substitute for shoreside sampling under a voluntary discarding program, with the caveat that regulatory changes would be needed to standardize processor grade and price data reporting in order to make these data usable for stock assessments. Cooperative research with the fishing industry and eLandings developers would be needed to standardize data collection processes and understand the intricacies of processor grading and pricing for sablefish.

Figure 2-9 Length frequencies of retained catch in the Alaska sablefish IFQ (grey) and state water Chatham Strait sablefish (teal) for the respective longline surveys and fisheries by sex.



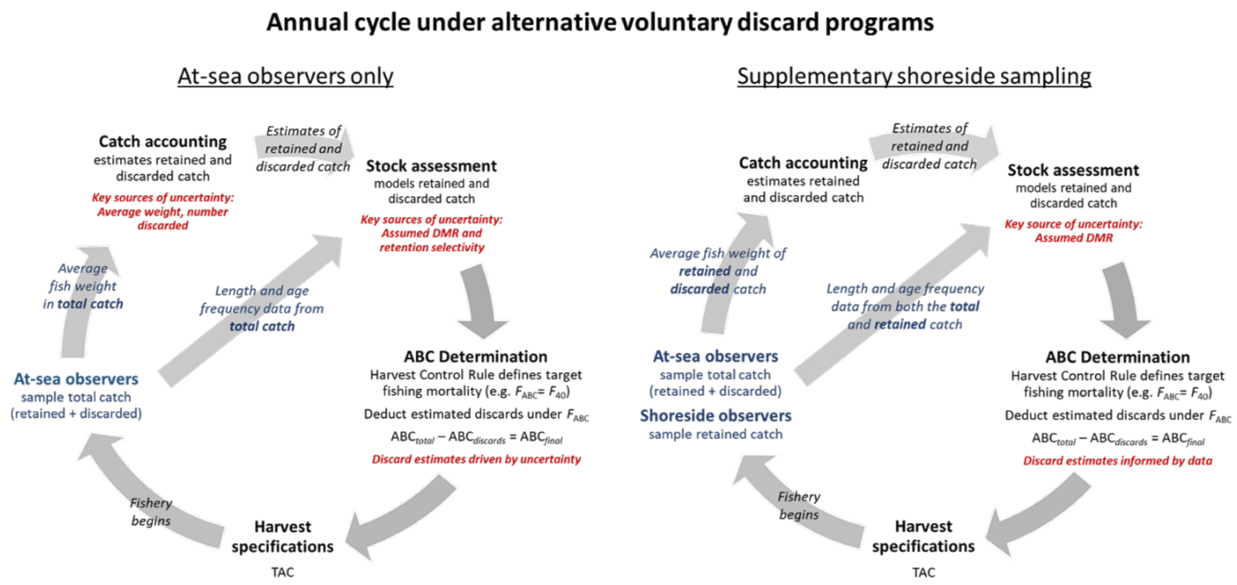
2.2.3.3 How discards are incorporated into stock assessment and harvest recommendations

Because discards form a component of total fishing mortality, it follows that they would be estimated within the stock assessment model if adequate data are available to do so. Therefore, final sablefish discard accounting with respect to the specifications process would likely occur within the stock assessment. During the estimation of the maxABC, the projected estimated discards would be deducted from the total catch under the target fishing mortality (e.g. FABC = F40%) based on the availability of fish in the population, the retention selectivity, and the discard mortality rate. **During periods of high**

abundance of smaller fish, this means discard estimates and subsequent ABC reductions will be higher.

Reductions from maxABC are difficult to evaluate given the discretion provided to the SSC in setting ABCs. However, a change to voluntary discarding under Alternative 2 will increase uncertainty in the model and projections, which may influence ABC decisions. These sources of uncertainty include the estimated average weight of discarded and retained fish used in catch accounting, the estimated number of fish discarded used in catch accounting, the sizes of fish discarded (i.e. the retention selectivity), and the number of fish that die post-release (i.e. DMR). A paired at-sea and shoreside sampling program to inform the makeup of the discarded and retained catch may decrease sources of uncertainty in the assessment (highlighted in red italics in Figure 2-10). Even with the highest quality data, the DMR will always be an important and consequential source of uncertainty for catch estimation and stock assessment.

Figure 2-10 A simplified diagram depicting the annual cycle of data collection, stock assessment, ABC determination, and harvest specifications under two alternative voluntary discard programs with only at-sea observers or at-sea observers with supplementary shoreside sampling. Data informing catch accounting and stock assessments are highlighted in dark blue and key sources of uncertainty are highlighted in red.



The questions about *what sizes* of fish will be discarded and *how many* of the discarded fish will survive can be translated into stock assessments to account for the impact of discarding on population estimates and harvest recommendations. Discarding enters stock assessments through the estimation of fishing mortality (F), or the death or removal of fish from a population due to fishing. In the absence of discarding, fishing mortality is a function of gear selectivity (s_a), or the age-specific probability of capture that depends on gear and availability of fish in the population:

$$F_a = F * s_a.$$

When discarding is added to a fishery, this equation becomes more complicated by making fishing mortality a function of gear selectivity, retention selectivity, and discard mortality rate. Retention selectivity (r_a) defines what will be discarded, and is expressed as the age-specific probability that fishermen retain a fish. The discard mortality rate (DMR), which defines how many of the discarded fish will die, is expressed as a rate that is applied to each fish and can be age-specific or not. The new fishing mortality equation is:

$$F_a = F * s_a \, (r_a + \mathrm{DMR}\,(1 - r_a)).$$

If full retention is required, the retention selectivity at all ages equals 1, and the equation collapses to the original equation for fishing mortality.

Under a voluntary discarding program, the various components of the catch can be expressed as follows, where Z represents total mortality (natural mortality M + F) and represents the total numbers-at-age in the population. The total numbers of fish encountering the gear (C_a), including those that survive after discarding, is:

$$C_a = \frac{s_a \, F}{Z} N_a \, (1 - e^{-Z}).$$

The numbers landed or retained (L_a), is the product of the retention function and C_a, or

$$L_a = \frac{r_a s_a \, F}{Z} N_a \, (1 - e^{-Z}).$$

The number of dead discards (D_a) is

$$D_a = \frac{DMR \; s_a \; F(1 - r_a)}{Z} N_a \, (1 - e^{-Z}).$$

These catch components can be translated from numbers-at-age to biomass by multiplying by weight-at-age (w_a) and summing over the ages.

Although equations for fishing mortality and the various catch components are well-defined, further analysis will be needed to determine the most appropriate management reference point calculation to use when determining OFLs and ABCs under a voluntary discard program. At this time we can summarize some pertinent background information and recommend a literature review and further analysis. A useful and relevant reference on the topic titled, “Establishing stock status determination criteria for fisheries with high discards and uncertain recruitment,” may serve as a guide for choosing a reference point for sablefish under a voluntary discard program (Goethel et al. 2018). Sablefish are particularly challenging because they have high recruitment variability, do not appear to adhere to a spawner-recruit curve, and are utilized by multiple sectors with varying selectivities. Collectively, these attributes make conventional analyses to determine optimal target reference points difficult even in the absence of discards.

Currently, the reference points used in the sablefish stock assessment in Alaska are defined by the NPFMC's Tier system's Tier 3a control rules (https://www.npfmc.org/bering-seaaleutian-islands-groundfish/). Reference points for Tier 3a include reliable point estimates of *B* (spawning stock biomass), B40%, F35%, and F40%. The F35% , and F40% are spawning potential ratio (SPR) reference points for OFL and ABC, respectively, and are defined as the fishing mortality that would reduce the virgin spawning biomass per recruit to 35% or 40% of the unfished levels (Goodyear 1993). For Alaska sablefish, the F35% and F40% are composed of both fishing mortality from the IFQ fleet and the trawl bycatch fleet, which have different selectivities. These reference points are proxies for Maximum Sustainable Yield (MSY) based on studies that show F35%-F45% to be at least 75% of MSY (Clark 1991, Clark 1993). Though MSY is a guiding principle of U.S. fishery management under the Magnuson–Stevens Fishery Conservation and Management Act, the challenge of defining it in fisheries with multiple fleets and uncertain discards can result in the unsuccessful rebuilding of spawning stock biomass, as well as allocation disputes that are poorly informed by traditional fishery science (Goethel et al. 2018, Powers 2005). However, if size-selective discards are not accounted for, it can reduce information on stock size and result in a bias of 30-40% on SPR reference points (Williams 2011).

To the best of our knowledge, there are no other federally managed groundfish fisheries in Alaska that explicitly account for size-selective discards in the assessment and ABC/harvest control rule projections. New methods would need to be developed, which may include considerable changes to assessment methodology and projection model software and require review from the SSC and possibly the Center for Independent Experts (CIE). Recent recommendations to reduce ABC for Alaska sablefish highlight multiple existing sources of uncertainty in stock status (Goethel et al. 2020). As such, we recommend research into which reference point can reliably rebuild sablefish spawning biomass if a proposed voluntary discard program is accepted.

2.2.3.4 Impacts of discarding on sablefish stock status and fishery performance

While the NPFMC considers voluntary discarding in the Alaska sablefish fishery, fisheries worldwide trend towards full retention as a strategy to reduce waste in commercial fisheries (Hall and Mainprize 2005, Chan et al. 2014, Zeller et al. 2017). Perhaps the most high profile case comes from the discard ban on all quota species in the North Sea in 2014 (Catchpole et al. 2014); however, several examples also exist closer to home. A recent analysis by the International Pacific Halibut Commission (IPHC) found that, under full retention, there was an increase in the Pacific halibut fishery yield, value, and fishery efficiency (landings/catch), as well as improved data resolution on the total fishery catch and biology (Stewart et al. 2020). While this analysis examined short term effects, a decade of Management Strategy Evaluations (MSEs) in British Columbia, where the directed sablefish fishery is managed under a minimum size limit of 55 cm (~2.5 dressed lb), identified full retention as a robust strategy for increasing the probability of rebuilding spawning stock biomass and improving average annual yield in directed sablefish fisheries (Cox et al. 2011, Cox et al. 2019). A recent update to this MSE simulation considered price premiums for large sablefish and found that mandatory retention also resulted in the highest total landed value in the directed fishery (DFO 2020). Under mandatory retention it is assumed fishing stops once TACs have been achieved, which results in less overall mortality on fish less than 55 cm and a subsequent reduction in growth overfishing (DFO 2020). Removing size limits allows sablefish body growth to outpace mortality, leading to an increase in average weight in the retained catch over time. They also found that target fishing mortality rates under mandatory retention were higher because more fish were able to recruit to fisheries and contribute to spawning stock biomass.

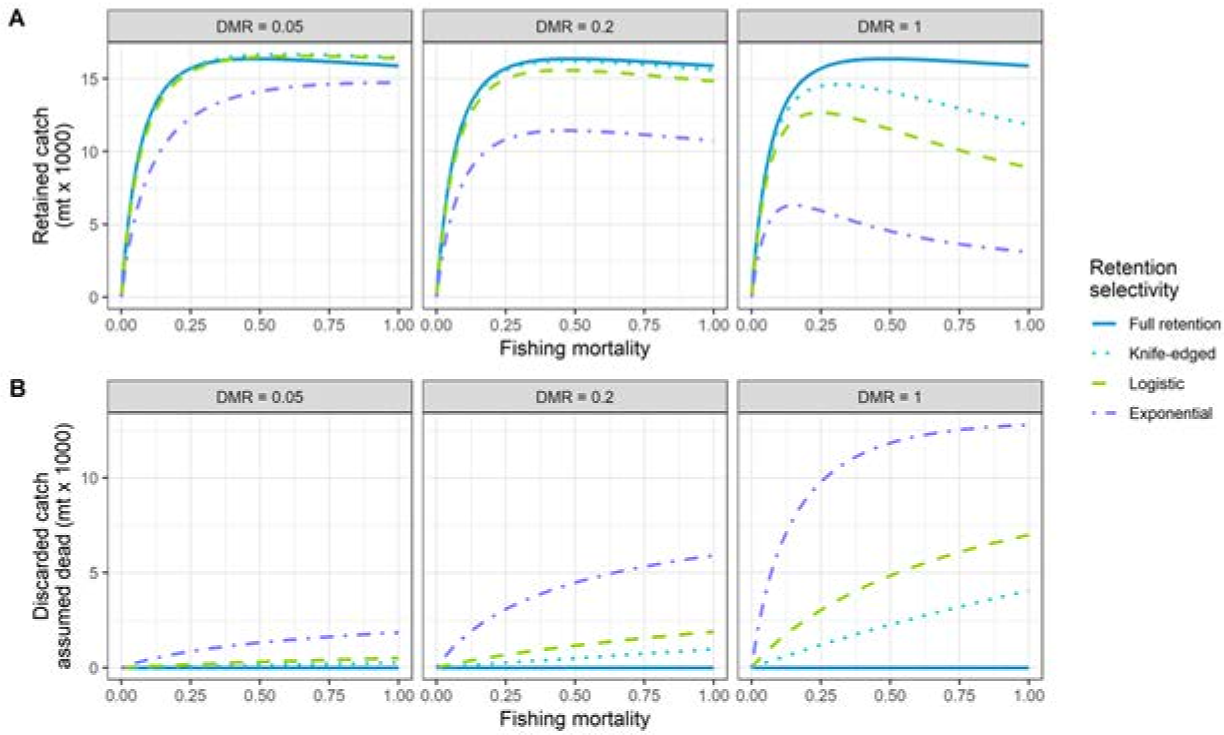
Using a simplified yield-per-recruit (YPR) model, we also found that a voluntary discard program for sablefish would reduce landings, fishery efficiency, and fishery value over time. YPR models are commonly used in fishery management to evaluate the relative impacts of various harvest strategies or management measures under constant recruitment, growth, maturity, and natural mortality (collectively called "equilibrium conditions"). In essence, if the size of every year class (i.e. recruitment) is constant over time, then the yield in any given year from all year classes is equal to the yield from a single year class over its lifetime (Lowe et al. 1991). While these assumptions are simplistic, an examination of the *relative* differences in YPR results across DMRs and retention selectivities are informative for illustrating the multiple sources of uncertainty incurred by discarding. **The results of this analysis demonstrate that while a single fishing trip may benefit from size-selective discarding, the equilibrium catch, which is analogous to an ABC or TAC under a given target harvest rate, will be lower under a voluntary discard program compared to Full retention.** The variability in the results presented in this analysis demonstrate that uncertainty in sablefish DMRs and retention selectivities translate into degraded data quality and increased uncertainty in the stock assessment (Table 2-9).

In developing the YPR model, we assumed natural mortality, fixed gear sex-specific selectivity, and sex-specific growth rates defined in the stock assessment (Goethel et al. 2020). Similar to the stock assessment, we assumed no stock recruitment relationship and an equal sex ratio at the recruitment age of age-2. We fixed equilibrium recruitment to 10 million fish, the median recruitment estimated for the 1977-2016 year classes (Goethel et al. 2020). We compared alternative retention selectivities developed in Section 2.2.3.1 (Table 2-10), including Full retention (status quo), Knife-edged (minimum size limit at 3 lb dressed, or 59 cm fork length), Logistic (expert opinion in the Chatham Strait sablefish fishery), and Exponential (price-based). The DMRs are bookended between 0.05 (5% of discards die) and 1 (100% of discards die). Results are shown across a range of fishing mortality rates using equations introduced in Section 2.2.3.3.

The model results for sablefish show that, at a given fishing mortality rate, the amount of retained and discarded catch varies considerably under different assumptions about the DMR and retention selectivity (Figure 2-11). The DMR scales model results, making this assumption critically important to understanding the impact of fishing on the stock. If most fish survive discarding (e.g. the DMR = 0.05), it follows there will be very low estimates of dead discards and little to no difference in the retained catch among retention selectivities over a range of harvest rates. However, an assumed DMR of 0.05 is likely overly optimistic, and the estimates of dead discarded catch increase quickly with increases in the DMR, resulting in a decrease in retained or landed catch under the same fishing mortality. Consequently, maximum equilibrium yields (i.e. retained catch) are shifted towards lower fishing mortality rates with more size-selective retention curves and higher DMRs.

The DMR=1 and Exponential retention selectivity, which is based on sablefish processor grade pricing (Table 2-10), are included as sensitivity scenarios aimed at evaluating the impact of incorrectly specifying the DMR and retention selectivity. In order to reach the premium 7+ grade, fish must incur years of mortality from discarding and natural causes under the Exponential retention selectivity. As demonstrated in Section 2.2.3.1, male sablefish reach maximum sizes at 9 years old, at which point they are only grade 4/5 and worth one third of a 7 lb (dressed) female sablefish (Section 2.2.3.1, Figure 2-7). As a result, there are few premium grade sablefish available in the population, and after a certain point increased fishing mortality (i.e. effort) will not increase retained catch but rather only increase the amount of dead discarded catch. If we underestimate the DMR or retention selectivity, the actual fishing mortality or harvest rate will be much higher than we may perceive. Because sablefish are a long-lived and slow growing species, this could lead to growth overfishing and inhibit rebuilding of spawning stock biomass as demonstrated in the British Columbia's sablefish MSE simulations (DFO 2020).

Figure 2-11 Results from the YPR model under equilibrium conditions, including (A) the retained fixed gear catch (thousands of mt) and (B) discarded fixed gear catch assumed dead (thousands of mt). Results are evaluated over three alternative discard mortality rates (DMR = 0.05, 0.2, or 1) and the following retention selectivities: Full retention (all fish retained; dark blue, solid lines), Knife-edged (based on a dressed sub three pound or 59 cm fork length minimum size limit; light blue, dotted lines), Logistic (based on the Chatham Strait sablefish fishery; green, long dashed lines), and Exponential (based on processor grade pricing; purple, alternating dotted and dashed lines). Table 2-10 provides a more detailed description of retention selectivity definitions.



The relative differences between the retained catch curves in Figure 2-11-A are analogous to potential ABC reductions under a voluntary sablefish discard program. For example, under a target fishing mortality (i.e., F_ABC) of 0.1, the largest equilibrium catch (i.e. ABC) would be 12.3 thousand mt and occur under Full retention. Any assumption of DMR or retention selectivity will result in a lower ABC. The theoretical percent reductions from equilibrium ABC under Full retention are presented in Table 2-11. As expected, reductions are lowest for the Knife-edged retention selectivity and the DMR of 0.05. However, the realism of these scenarios is questionable given there is no minimum size limit under consideration and a myriad of factors exist that would suggest a much higher DMR, including predation (e.g. killer whales), body size and fish condition, injury from the gear or handling, and environmental conditions. Because these results were calculated under equilibrium conditions, they do not account for variability in recruitment, growth, natural mortality, or gear selectivity. This in part explains the differences in theoretical ABC reductions presented in Table 2-11 and the theoretical percent reductions presented in the closing paragraphs of the AFSC survey section (Section 2.2.2.2). In that method we used annual AFSC survey length distributions, area-specific biomass estimates from the stock assessment, and derived area-specific fishing mortality rates to compare the relative reductions from "ABC" (in this case the realized fixed gear catch under Full retention) across a range of alternative retention selectivities scenarios. Although there are slight differences in the results from these two methods, both are intended to be illustrative of the point that any voluntary discard program will result in lower ABCs due to mortality from discards. Because abundance and population age structure varies over time, it follows that actual reductions from ABC would also vary over time. It is worth mentioning that neither approach currently accounts for the trawl bycatch fishery, which can be an influential part of estimating F_ABC and ABC. And finally, as described in Section 2.4.3.3, future research is needed to determine the most appropriate choice of management reference points under a voluntary discard program. Given the uncertainties of DMRs and retention selectivity, they may not be SPR-based.

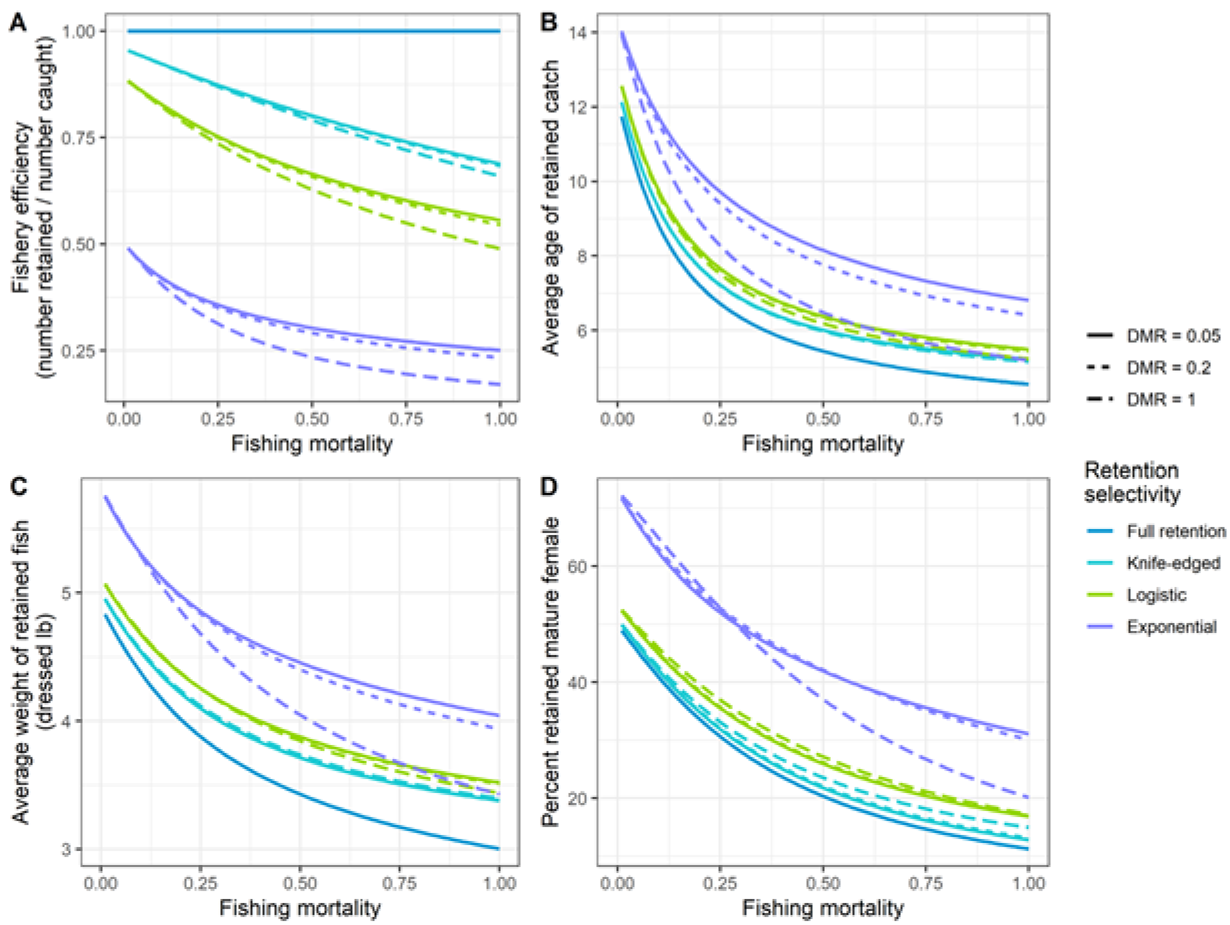
Table 2-11 Percent reductions from Full retention ABC if F_ABC=0.1 under a range of alternative retention selectivities and discard mortality rates (DMRs) assuming YPR equilibrium conditions. The retention selectivities used for comparison include Knife-edged (based on a dressed sub three pound or 59 cm fork length minimum size limit), Logistic (based on the Chatham Strait sablefish fishery), and Exponential (based on processor grade pricing). Table 2-10 provides a more detailed description of retention selectivity definitions.

ABC under Full retention if F_ABC = 0.1 (thousand mt)	Retention selectivity	DMR	ABC under Retention selectivity and DMR if F_ABC = 0.1 (thousand mt)	Percent reductions from Full retention ABC
12.3	Knife-edged	0.05	12.2	**-0.8**
12.3	Logistic	0.05	11.8	**-4.1**
12.3	Exponential	0.05	8.5	**-30.9**
12.3	Knife-edged	0.2	12.1	**-1.6**
12.3	Logistic	0.2	11.6	**-5.7**
12.3	Exponential	0.2	8	**-35**
12.3	Knife-edged	1	11.8	**-4.1**
12.3	Logistic	1	10.8	**-12.2**
12.3	Exponential	1	6	**-51.2**

In addition to comparing retained and discarded catch under various DMR and retention selectivity scenarios, there are other attributes of fishery performance and catch worthy of consideration. We found that fishery efficiency (the ratio of number of fish retained to the number of fish caught) decreased substantially with fishing mortality under all retention selectivities other than Full retention, which has an implied fishery efficiency of 1 (all fish caught are retained; Figure 2-12-A). The most size-selective retention selectivity based on processor grade pricing (Exponential) had the lowest fishery efficiency: even at low fishing mortality rates, less than 50% of fish are retained. What perhaps may be surprising is that fishery efficiency is greater at a given fishing mortality rate if we assume a higher DMR. This result occurs because if the DMR is very low, fish will be discarded multiple times before they grow to a retainable size, which manifests as a decrease in fishery efficiency. We also found that the average age of the retained catch (Figure 2-12-B) and average weight of fish in the retained catch (Figure 2-12-C) increases with the increasing size-selectivity of the retention curve. For example, at a fishing mortality rate of 0.1, the equilibrium average dressed weight of the retained catch was 3.1, 3.3, 3.4, and 3.8 lb under

Full retention, Knife-edged, Logistic, and Exponential retention selectivities, respectively. It follows that the percent of females in the retained catch that are sexually mature is also higher under more size-selective retention curves (Figure 2-12-D). At a fishing mortality rate of 0.1 under Exponential retention selectivity, the equilibrium retained catch is made up of approximately 63% mature females. This finding is concerning given the narrow range of fishing mortalities that maximize equilibrium retained catch under this retention selectivity (Figure 2-11-A), the sensitivity of equilibrium retained catch to the assumed DMR, and the existing economic incentive to discard any fish below the premium 7+ processor grade.

Figure 2-12 Results from the YPR model under equilibrium conditions, including (A) fishery efficiency (the ratio of the number of retained fish to the number of fish caught), (B) the average age of fish in the retained catch), (C) the average weight of retained fish (dressed lb, assuming the Eastern cut product recovery rate of 0.63), and (D) the percent of the retained catch in weight made up of mature females. Results are evaluated over three alternative discard mortality rates (DMR; 0.05 shown as solid lines, 0.2 shown as small dashed lines = 0.2, or 1 shown in large dashed lines) and the following retention selectivities: Full retention (all fish retained; dark blue), Knife-edged (based on a dressed sub three pound or 59 cm fork length minimum size limit; light blue), Logistic (based on the Chatham Strait sablefish fishery; green), and Exponential (based on processor grade pricing; purple). Table 2-10 provides a more detailed description of retention selectivity definitions.



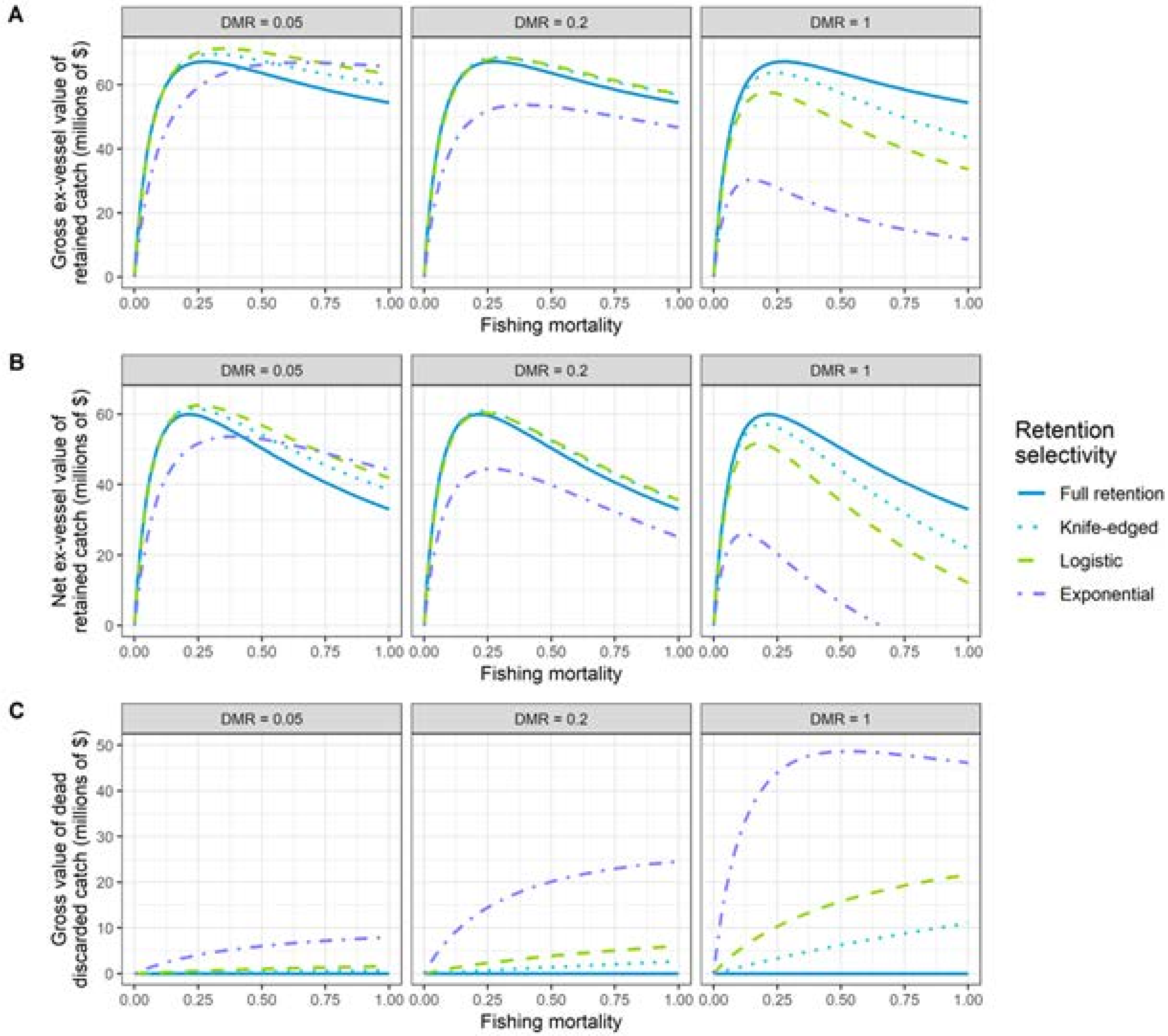
Gross ex-vessel value was calculated using the same fixed price-per-pound processor grade data used to estimate the Exponential retention selectivity curve in Section 2.2.3.1, where grade 1/2 = $1.00/lb, grade 2/3 = $2.20/lb, grade 3/4 = $3.25/lb, grade 4/5 = $4.75/lb, grade 5/7 = $7.55/lb, and 7+ = $8.05/lb. Following Lowe et al. (1991), we obtained an estimate of variable fixed gear fishing costs (C) using a cost function that assumes fishing costs are proportional to annual exploitation rate:

$$C=Cb(X/Xb),$$

where Cb is the variable cost in the base period, Xb is the annual exploitation rate in the base period, and X is the annual exploitation rate associated with each fishing mortality rate (X = 1-exp(-F)). The base period was defined as the period following implementation of the IFQ program (1995-1998), where variable fishing costs (e.g. hooks, vessel-days, fuel, gear, and bait costs) were estimated to be 5% of the landed value (Sigler and Lunsford 2001). Instead of using the estimated landed value of the fishery during the base period, we scaled these costs to the equilibrium gross ex-vessel value (47 million USD). This value was calculated using the current assessment model's average estimate of the 1995-1998 exploitation rates (Xb = 0.07) and aforementioned price-per-pound processor grade data (Cb = 0.05 * 47 million USD = 2.38 million USD). The fixed fishing costs associated with the directed sablefish fishery were ignored for the purposes of this analysis because we would not expect these costs to vary as a function of effort (Lowe et al. 1991).

Resulting equilibrium ex-vessel values for the retained and dead discarded catch are shown in Figure 2-13. For DMRs less than 0.2, we found little difference in gross or net ex-vessel value for the Full retention, Knife-edged, or Logistic retention selectivities. However, the gross and net ex-vessel values under the Exponential retention selectivity are only comparable to Full retention, Knife-edged, and Logistic retention selectivities if the DMR is very low (i.e. DMR = 0.05). As the DMR increases, more of the potential retained yield value is fated to be dead discarded catch (Figure 2-13-C). For example, at a fishing mortality of 0.1 and DMR of 0.2, the equilibrium gross ex-vessel value of the retained catch is $39 million, at least $16 million less than under Full retention. If DMRs are relatively high, a voluntary discard program will result in decreased value of the retained catch and a large amount of wastage or lost value to discarding.

Figure 2-13 Results from the YPR model under equilibrium conditions, including (A) the gross ex-vessel value of the retained fixed gear catch (millions of $), (B) the net ex-vessel value of the retained fixed gear catch once variable fishing costs were deducted (millions of $), and (C) the gross value of discarded catch assumed dead (millions of $). Results are evaluated over three alternative discard mortality rates (DMR = 0.05, 0.2, or 1) and the following retention selectivities: Full retention (all fish retained; dark blue, solid lines), Knife-edged (based on a dressed sub three pound or 59 cm fork length minimum size limit; light blue, dotted lines), Logistic (based on the Chatham Strait sablefish fishery; green, long dashed lines), and Exponential (based on processor grade pricing; purple, alternating dotted and dashed lines). Table 2-10 provides a more detailed description of retention selectivity definitions.



Results from the simplified YPR demonstrate clear tradeoffs across various scenarios (e.g. increased average individual fish weight in the retained catch but decreased total retained catch), as well as the potential consequences of mis-specifying the sablefish DMR or retention selectivity under a voluntary discard program. However, there are several limitations to this analysis that warrant discussion. The results rely on the assumption of equilibrium conditions (stable recruitment, constant growth, maturity, and natural mortality); however, sablefish exhibit high variability in recruitment, especially in recent years, and there is evidence that growth and rate of maturation may vary over space and time (Goethel et al. 2020). Discarded catch will be greater during periods of high recruitment; conversely, if recruitment is below average, there will be few fish to discard. In the latter scenario, this would ultimately result in lower than average retained catch because no recruits would exist to replace the exploited population.

Another caveat is that we did not include dynamics in the trawl bycatch fisheries; however, it's an important consideration given trawl catch and fishing mortality rates have increased substantially in recent years due to the prevalence of small fish (Goethel et al. 2020). A modified YPR analysis of Pacific halibut demonstrated a balance between directed fishery discards, trawl bycatch of small fish, and natural mortality, where less bycatch resulted in more directed fishery discards, leading to suboptimal yield as many of these fish died from discard mortality or natural mortality. (Martell et al. 2015). Complex spatial dynamics exist for sablefish, motivating an exploration of the spatial distribution of strong year classes in the trawl and fixed gear fleets related to environmental conditions and fishery behavior (November 2020 Groundfish Plan Team minutes and recommendations). Additionally, we only considered average natural mortality and growth; however, there is mounting evidence for age-dependent or time-varying natural mortality, variability in size-at-age, and reductions in size-at-age in recent years (Goethel et al. 2020). There are a suite of models that account for the variability in size-at-age and cumulative effects of size-selective fishing by splitting recruits into groups with varying growth rates (Walters and Martell 2004, Coggins et al. 2007, Pine et al. 2008). These modified YPR models have been applied to Pacific halibut to evaluate the use of minimum size limits in the directed halibut fishery and the cumulative effects of size-selective fishing effects on declines in halibut size-at-age (Martell et al. 2015, Sullivan 2016). With careful attention to assumptions related to recruitment, DMRs, and retention selectivity, a similar model could also be applied to sablefish under a proposed voluntary discard program. Finally, while this analysis accounts for requisite increases in variable fishing costs with increasing fishing effort, the methods and assumptions used were simplistic and could be improved upon through a more detailed market analysis. Additionally, the YPR includes no variability in ex-vessel prices and fishing costs, or dynamic relationships between stock size, age structure, and price, all of which may impact discarding and other fishing behavior under a voluntary discarding program (Warpinksi et al. 2016).

2.2.4 Element 4: Monitoring and Enforcement

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

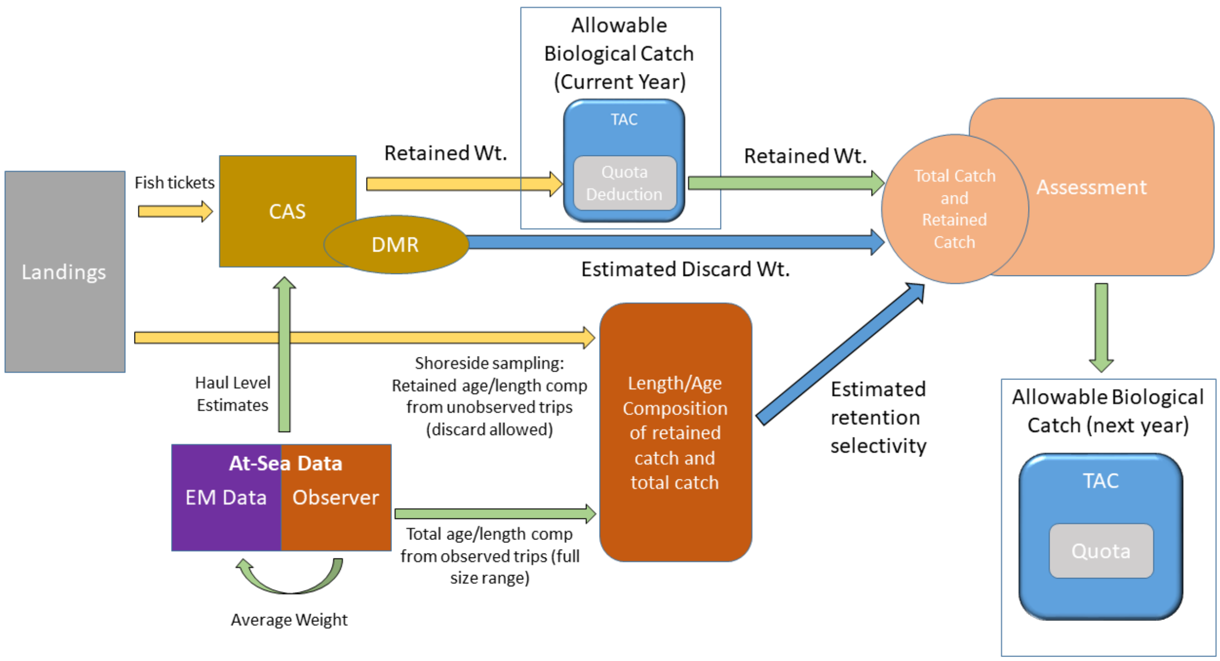
Although current data allow for basic catch estimation with higher amounts of uncertainty under a voluntary discard program, these data would not support the sablefish stock assessment at its current level of accuracy and precision. If the accuracy and precision of the sablefish stock assessment is to be retained, additional data are needed. This is because, unlike catch estimates which only seek to quantify the bulk amount of fish removed each year, stock assessments seek to capture the dynamics of the population, in part so that projections can be made. Capturing the dynamics of the population requires more granular information, such as the size and sex of fish being caught. As it relates to voluntary discards in a fishery for which discards are likely to be size-selective, the primary piece of additional information needed is the size distributions of discarded and retained fish.

Sablefish are size-graded when they are landed and this information is recorded on the fish ticket; however, inspection of these fish ticket data has shown that these data are not currently of sufficient quality or reliability for use in catch estimation or in the sablefish stock assessment. Sablefish prices are based on the size of the landed catch with larger fish yielding higher prices. 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), hence considerable collaborative efforts with industry would be needed to standardize data collection methods and existing size grade data for use in catch estimation or stock assessment (Section 2.2.3.2). Any estimates of average size of landed fish based on these data would be subject to large amounts of variability.

Under current data collection methods, at-sea observers would be able to capture the size distribution of total catch, but not the size distributions of retained and discarded fish separately. That is why the previous catch estimation sections of this analysis focused on ways in which landings could be removed from total catch estimated from observer data: because retained catch would not be estimable from observer data when retention is dependent on the size of the fish.

In the absence of being able to collect size data for retained and discarded sablefish separately at-sea, new data collection avenues would need to be established. One option is to collect size data on retained sablefish shoreside. The size distribution of retained sablefish catch (from shoreside observer data) could then be contrasted with the size distribution of total sablefish catch (from at-sea observer data) in order to estimate the size distribution of discarded sablefish (Figure 2-14).

Figure 2-14 Data flow diagram for sablefish catch estimation with an added shoreside sampling component, under the condition that voluntary discarding is permitted.

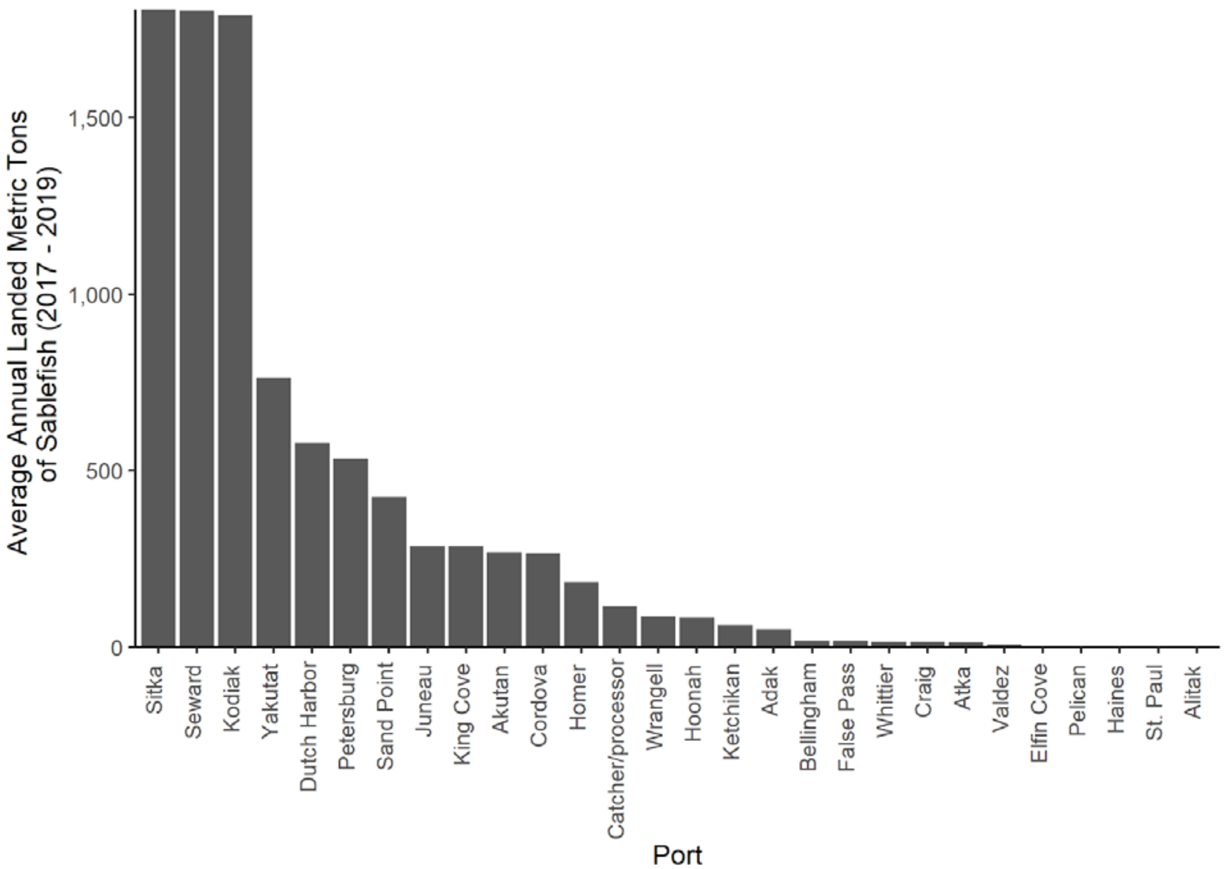


There are numerous challenges to this approach. Firstly, it would require a new sampling component to be added to the Observer Program. This new sampling component would add additional costs to the overall Observer Program budget, thus reducing the amount of funding available for other sampling components. This would result in increased areas with insufficient observer data and decreased precision in estimates of at-sea discard and stock assessment parameters. Because of the logistic and financial difficulties in implementing a change in the Observer Program on this scale, the analysts wish to make clear that this is not a scenario currently endorsed by NMFS AFSC nor is it the intent of the analysts to offer this scenario (as is) for consideration by the Council at this time. The analysts simply use this scenario to provide a comparison to other scenarios for estimating discards.

It's important to note that, because it would be collecting completely different data than at-sea observers, a shoreside sampling component would not replace any at-sea monitoring. Additionally, due to the ephemeral nature of large year-classes, it is likely that discarding may occur in some years (when large year-classes are present), but not others. This would mean that, in years for which discards are minimal, a shoreside sampling component would be duplicating at-sea observer data by collecting size information on retained catch that is equivalent to total catch.

Both ADF&G and the IPHC have port sampling programs. ADF&G already has an established shoreside data collection program for state-managed sablefish, which operates in Cordova, Homer, Juneau, Ketchikan, Petersburg, Seward, Sitka, and Whittier (Richardson and O'Connell 2003, Stahl et al. 2015, Beder et al. 2020). This list of ports overlaps considerably with the list of ports where most sablefish from federal waters are landed (Figure 2-15). If a cooperative port sampling component were constructed, sampling would likely need to take place from additional ports. The IPHC port sampling program is a halibut sampling program only and is unlikely available for sablefish sampling.

Figure 2-15 Average annual metric tons of sablefish landed by port. Only includes landings from partial-coverage observer strata in federal waters.



Regardless of where shoreside data are collected from, an additional challenge to collecting high-quality size and sex data shoreside is the fact that many sablefish are not delivered whole (Table 2-8, Figure 2-3). This means that either length data would need to be collected from whole landed fish only or conversion factors would need to be developed to estimate the fork length of headed fish, and sex composition would need to be inferred from other sources. Models can be sensitive to both length composition and sex-ratio assumptions for the fishery. For example, the lack of sex-ratio information from the halibut IFQ fishery has been an ongoing research issue for the IPHC halibut assessment. Because there was no direct information available on sex-ratios (due to dressing of fish at sea prior to observation by IPHC port samplers), the assessment has relied on sex-ratios observed in the setline survey to inform the relative selectivity for male and female halibut in the commercial fishery catch. All the models are sensitive to this assumption, particularly the coastwide models (Stewart and Martell 2014). The 2019 halibut assessment evaluated newly available sex-ratio data, which allowed for estimates of relative selectivity of males in the commercial fishery to be decoupled from survey observations for the first time (Stewart and Hicks 2019). The fishery dependent data allowed improved overall fit to the various data sources used in the models, and improved the overall stability in the models. The IPHC is using fin clips for sex-determination from landed halibut; however, this method is currently unavailable for sablefish.

If developed, a length conversion would add an additional layer of uncertainty to the comparison between retained and total size distributions. To develop length conversions, paired size data could be collected from sablefish pre- and post-dressing as part of a research effort, but this would add another complication to an already new and complex sampling component. In the absence of a method to convert dressed fish to whole fish, length data for retained catch would only be collected from whole fish, which assumes the length/age composition of undressed fish is similar to the composition of all fish landed. A more robust solution would be a requirement that all catch be landed whole (or bled) and all catch processing occur after observers have obtained their shoreside samples. There is precedent for this in the halibut fishery, where all catch is required to be landed head-on specifically so that length data can be collected.

Full Coverage EM with Shoreside Sampling

The option to allow sablefish discards only on vessels that carry EM systems at 100% coverage and complementing that with shoreside sampling may have initial appeal. However, further analysis determined that it would not replace the need for at-sea observers under current EM methods, would increase data requirements for stock assessment by splitting the sablefish IFQ fishery into multiple fleets, and would come with considerable costs and challenges for implementation. After consideration of these issues, this option did not appear to be a viable solution.

EM cannot collect the size data needed to estimate discards in catch accounting, nor can it collect the size, sex, and age data needed for stock assessment. As such, 100% EM under the current EM program would not do away with the need for at-sea observer coverage in this portion of the fleet. Specifically, catch accounting needs mean weight of fish discarded and fish retained. The mean weight of fish retained could be obtained from shoreside samplers; however, the lack of mean weights for discards would result in unreliable discard estimates. For stock assessment, size, age, and sex data are needed to model size-dependent discarding. If these data were not collected, we would lose estimates of gear selectivity and retention selectivity, important assessment parameters that account for sex- and age-specific fishing mortality and scale the catch to the total population.

In lieu of at-sea observer coverage for the voluntary discarding fleet, current EM methods would need to change. Under this scenario, vessels would be required to place all discarded sablefish on a measuring board in view of the EM cameras. This requires a change to vessel deck operations and may result in slower catch processing times at-sea. EM reviewers would then be able to read and record fish lengths. As with at-sea operations, this would require a change to EM video review methods and would result in additional video review costs.

Perhaps of even more consequence is that by splitting the sablefish IFQ fleet into distinct voluntary discarding and voluntary non-discarding fleets, it would likely result in different fishing behavior between these fleets that must be accounted for in the stock assessment. For example, there will be little incentive to employ strategies to avoid small fish in discarding fleets, meaning that these fleets will have different selectivities than non-discarding fleets. To account for this, the voluntary discarding and voluntary non-discarding fleets would need to be modeled separately in the stock assessment, greatly increasing the model's complexity. In turn, data requirements for length, age, and sex data on the total and discarded catch would increase two-fold in order to meet the absolute minimum sample sizes needed to model these fleets.

Finally, the actual implementation of a full-coverage EM voluntary discarding program in catch accounting will come with considerable challenges. First, the decision to discard sablefish would need to be made prior to logging the trip in ODDS, and those trips would constitute one or more new EM strata that would need to be included in the catch accounting system. Sablefish discard-declared trips would be monitored at a different rate (100%) and would need to be sampled by observers shoreside, hence these trips would form a new strata and estimation would occur within the strata before being combined with estimates from other sampling strata. In addition, the discard characteristics of these trips will differ from those trips where discarding is not allowed (was not declared prior to logging the trip), further necessitating that estimation be constrained to the sablefish-EM strata prior to being incorporated into estimates of total discards (all strata). For all of these reasons, full EM coverage combined with a shoreside sampling program does not solve the problem of obtaining size data to support estimation of at-sea discards or of obtaining sufficient length and sex data to support stock assessments without substantial changes to vessel operations and EM review protocols.

2.3 Comparison of Alternatives

Table 2-12 EXAMPLE from HAPC 2013 action: Summary of alternatives and major impacts.

	Alternative 1	**Alternative 2**
	Status quo. No action.	Remove prohibition on sablefish discarding
Differences in Alternatives (Sections 2.1 and 2.2)		
Area size	None	
Options	None	
Environmental Impacts		
Sablefish Population Effects	No changes. (Section 3.5)	Identification as HAPC highlights importance for consultation on drilling, dredging, laying cables, dumping, and fishing activities. (Section 3.5.1)
Skate eggs	Unobserved mortality from egg dispersal, directs impacts, and silting, and bycatch mortality. (Section 3.1.1)	Consultations could reduce egg mortality due to activities in the future. (Section 3.1.1)
Skate populations	Stable biomass for stocks in aggregate. (Section 3.1.2)	No immediate impacts. (Section 3.1.2)
Economic Impacts		
Revenue from sablefish harvest	Reduced short term	Increases in short term for some participants. Indefinite reductions for some participants

3 Environmental Assessment

There are four required components for an environmental assessment. The need for the proposal is described in Chapter 1.1, and the alternatives in Chapter 2. This chapter addresses the probable environmental impacts of the proposed action and alternatives. A list of agencies and persons consulted is included in Chapter 6.

This chapter evaluates the direct, indirect, and cumulative impacts of the alternatives and options on the various resource components. The socio-economic impacts of this action are described in detail in the Regulatory Impact Review.

Recent and relevant information, necessary to understand the affected environment for each resource component, is summarized in the relevant section. For each resource component, the analysis identifies the potential impacts of each alternative, and uses criteria to evaluate the significance of 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).

An environmental assessment must consider cumulative effects when determining whether an action significantly affects environmental quality. The Council on Environmental Quality (CEQ) regulations for implementing NEPA define cumulative effects as:

> "the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).

The concept behind cumulative effects analysis is to capture the total effects of many actions over time that would be missed if evaluating each action individually. Concurrently, the Council on Environmental Quality (CEQ) guidelines recognize that it is most practical to focus cumulative effects analysis on only those effects that are truly meaningful.

3.1 Methods

The analyses presented in the sections below focus on Sablefish (Section 3.2), incidental catch (Section 3.3), Prohibited Species Catch (PSC) (Section 3.4), marine mammals (Section 3.5), seabirds (Section 3.6), habitat (Section 3.7), and the ecosystem (Section 3.8).

3.1.1 Documents Incorporated by Reference in this Analysis

This EA 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 section.

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 BSAI 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.

Stock Assessment and Fishery Evaluation (SAFE) Report for the Groundfish Resources of the BSAI and GOA (NPFMC 2020).
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. This document is available from https://www.fisheries.noaa.gov/alaska/population-assessments/north-pacific-groundfish-stock-assessments-and-fishery-evaluation.

Assessment of the Sablefish Stock in Alaska (Goethel et al. 2020)
Annual stock assessments are prepared each year by stock assessment authors from NMFS science centers. They incorporate human and environmental impacts on fish stocks and provide estimates of biomass of each species and other biological parameters. The stock assessments calculate biomass and the ABC used by NMFS in the annual harvest specifications. This document is available from https://archive.fisheries.noaa.gov/afsc/refm/stocks/plan_team/2020/sablefish.pdf

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 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) considers 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 Supplemental Information Report from https://alaskafisheries.noaa.gov/sites/default/files/sir-pseis1115.pdf.

EA/RIR/IRFA for Amendment 101 to the FMP for Groundfish of the GOA: Allow the use of pot longline gear in the GOA Sablefish IFQ Fishery (NPFMC 2016).
This final rule authorizes the use of longline pot gear in the GOA sablefish IFQ fishery. In addition, this final rule establishes management measures to minimize potential conflicts between hook-and-line and longline pot gear used in the sablefish IFQ fisheries in the GOA. This final rule also includes regulations developed under the Northern Pacific Halibut Act of 1982 to authorize harvest of halibut IFQ caught incidentally in longline pot gear used in the GOA sablefish IFQ fishery. This final rule is necessary to improve efficiency and provide economic benefits for the sablefish IFQ fleet and minimize potential fishery interactions with whales and seabirds. This analysis is available from https://www.fisheries.noaa.gov/action/amendment-101-fmp-groundfish-gulf-alaska-management-area.

3.1.2 Resource Components Addressed in the Analysis

Table 3-1 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.

The effects of the alternatives on the resource components would be caused by changes in the distribution and/or intensity of fishing effort in the BSAI and GOA. The alternatives have the potential to affect sablefish, incidental groundfish, prohibited species, marine mammals, seabirds, and social and economic components. No effects are expected on habitat and the ecosystem.

Table 3-1 Resources potentially affected by the proposed action and alternatives.

Potentially affected resource component							
Groundfish	Prohibited Species	Ecosystem Component Species	Marine Mammals	Seabirds	Habitat	Ecosystem	Social and economic
Y	Y	N	Y	Y	N	N	Y

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

3.1.3 Cumulative Effects Analysis

This EA analyzes the cumulative effects of each alternative and the effects of past, present, and reasonably foreseeable future actions (RFFA). Based on Table 3-1, the resources with potentially meaningful cumulative effects are Sablefish, incidental catch, PSC (Pacific halibut and golden king crab), marine mammals (sperm whales and humpback whales), and seabirds. The cumulative 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 cumulative impacts analysis for those resources.

Relevant past and present actions are described in several documents and are incorporated by reference. These include the PSEIS (NMFS 2004), the EFH EIS (NMFS 2005), and the harvest specifications EIS (NMFS 2007). This analysis provides a brief review of the RFFAs that may affect environmental quality and result in cumulative effects. Future effects include harvest of federally managed fish species and current habitat protection from federal fishery management measures, harvests from state managed fisheries and their associated protection measures, efforts to protect endangered species by other federal agencies, and other non-fishing activities and natural events.

In addition, the supplemental information report (SIR) NMFS prepares to annually review the latest information since the completion of the Alaska Groundfish Harvest Specifications EIS is incorporated by reference (NMFS 2007). SIRs have been developed since 2007 and are available on the NMFS Alaska Region website[4]. 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 future actions. NMFS reviews the RFFAs 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 cumulative effects information applicable to the alternatives analyzed in this EA.

RFFAs identified as applicable to this analysis are those that are likely to have an impact on a resource component within the action area and timeframe. The term “actions” in the analyses herein is confined to

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

human actions (e.g., a regulatory change and FMP amendment that allows the GOA and BSAI sablefish IFQ fishery vessels to discard sablefish), as distinguished from natural events (e.g., anomalous sea surface temperatures in the BSAI and GOA). 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, the cumulative 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.

Ecosystem management and traditional management tools are likely to improve the protection and management of target and prohibited species, including targets of the sablefish IFQ fishery, Pacific halibut and golden king crab, and are not likely to result in significant effects when combined with the direct and indirect effects of Alternatives 2. Other government actions and private actions may increase pressure on the sustainability of target and prohibited fish stocks either through extraction or changes in the habitat or may decrease the market through aquaculture competition, but it is not clear that these would result in significant cumulative effects. Any increase in extraction of target species would likely be offset by Federal management. These are further discussed in Sections 4.1.3 and 7.3 of the Harvest Specifications EIS (NMFS 2007) and in the 2019 SIR (NMFS 2019).

Considering the direct and indirect impacts of the proposed alternatives 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 RFFAs listed above, the cumulative impacts of the proposed alternative is determined to be not significant.

3.2 Target Species - Sablefish

3.2.1 Status

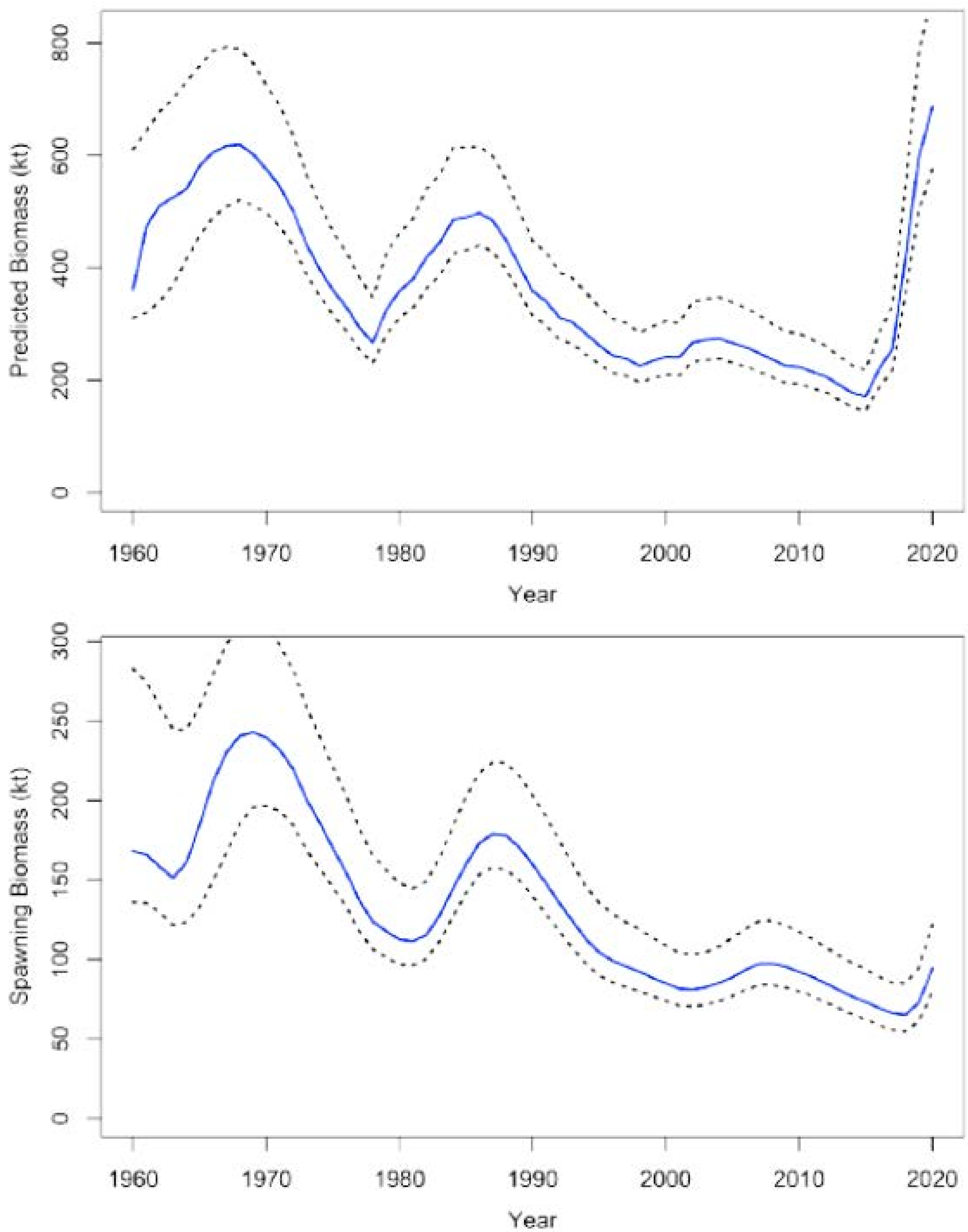
Biology:
Sablefish distribution extends from northern Mexico through the GOA, the AI and into the BS. Adult sablefish are generally found at depths greater than 200 m along the continental slope, shelf gullies and deep fjords. Juvenile sablefish (less than 40 cm) spend the first 2-3 years farther inshore along the continental shelf and begin to move out to the continental slope around age 4. Young-of-the-year sablefish feed primarily on euphausiids and copepods while adults are more opportunistic feeders, relying more heavily on pollock, Pacific herring, Pacific cod, squid and jellyfish. Coho and Chinook salmon are the main predators of young-of-the-year sablefish.

Sablefish are relatively long lived. They begin to recruit to the fishery at age 4 or 5 and longevity often reaches 40 years (the oldest recorded sablefish in Alaska was 94 years old). Female size at 50 percent maturity is around 65 cm (approximately age 6.5). Females are slightly larger than males, and natural mortality is estimated at M = 0.10. Alaskan sablefish spawn at pelagic depths near the edges of the continental slope (300-500m) between January and April.

Stock Assessment:
The sablefish assessment is based on a statistical sex-specific age-structured model. The survey indices included in the model for this assessment are the AFSC longline survey and the AFSC GOA bottom trawl survey. Sablefish fall under Tier 3a of the ABC/OFL control rule. The 2021 age 4+ biomass was estimated to be 390,000 mt for the GOA, 142,000 mt for the BS, and 175,000 for the AI. Spawning

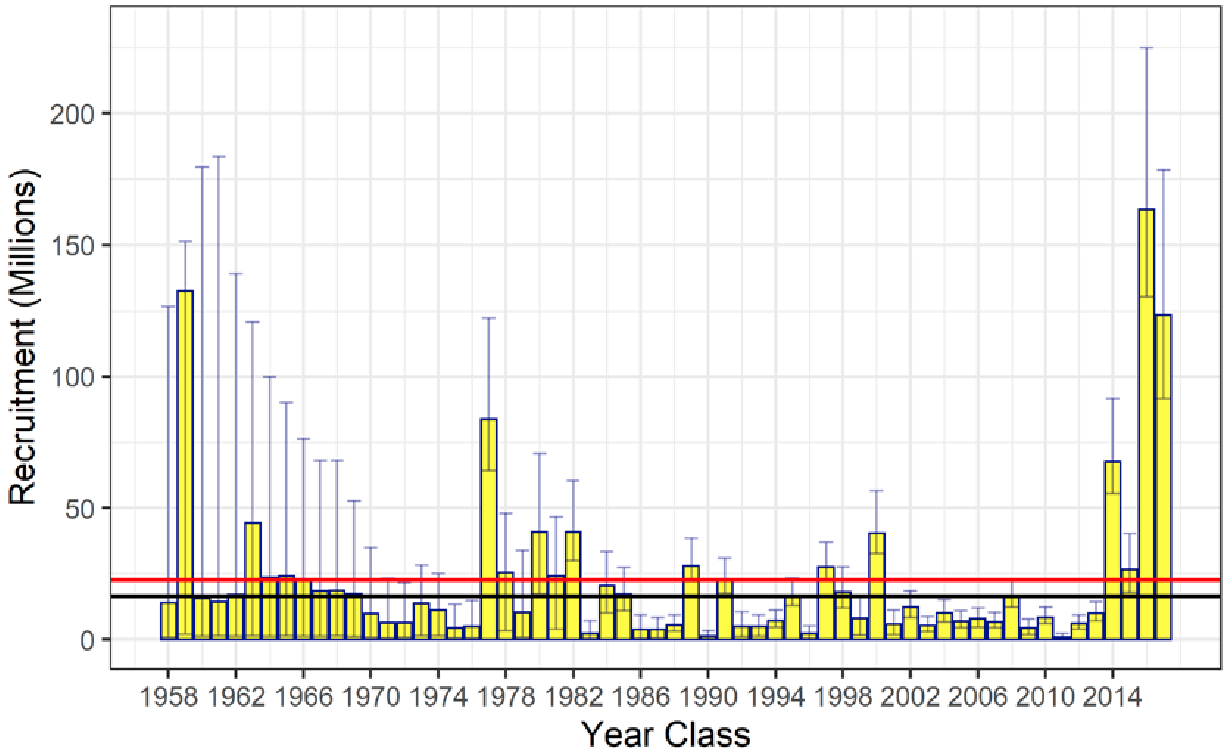
biomass has increased from a low of 32 percent of unfished biomass in 2002 to 42 percent projected for 2021 and is now trending upward (Figure 3-1). The previous two above-average year classes, 2000 and 2008, each comprise 4 percent and 5.5 percent of the projected 2021 spawning biomass, respectively. These two year classes are fully mature in 2021. The very large estimated year classes for 2014 and 2016 are expected to comprise 27 percent and 22 percent of the 2021 spawning biomass. The 2014 year class is about 60 percent mature while the 2016 year class should be less than 20 percent mature in 2021 (Figure 3-2).

Figure 3-1 Estimated sablefish total biomass (thousands t) and spawning biomass (bottom) with 95% MCMC credible intervals. Values are in kilotons.



Source: Goethel et al. 2020

Figure 3-2 Estimated recruitment of age-2 sablefish (millions of fish) with 95% credible intervals from MCMC by year class (recruitment year minus two). Red line is overall mean, while black line is recruitment from year classes between 1977 and 2017. Credible intervals are based on MCMC posteriors. The estimate for the 2018 year class (terminal year 2020 recruitment event) is omitted, because it is fixed to the estimated mean recruitment value (μr) with no deviation parameter estimated.



Source: Goethel et al. (2020).

Depredation of sablefish off of hook-and-line gear by killer whales and sperm whales has presented an emerging challenge for stock assessment authors in recent years. Sets on the AFSC longline survey impacted by killer whale depredation have always been removed from calculations because of the significant and variable impacts killer whales can have on catch rates. However, sperm whale depredation is more difficult to detect and has not previously been considered when calculating catch rates. As a result of recent increases in sperm whale presence and depredation at survey stations, as indicated by whale observations and significant results of recent studies, the stock assessment authors evaluated a statistical adjustment to survey catch rates using a general linear modeling approach (Appendix 3C, Hanselman et al. 2010). This approach had promise but had issues with variance estimation and autocorrelation between samples. A new approach has been developed using a generalized linear mixed model that resolves these issues (Hanselman et al. 2018), and was used starting in 2016 to adjust survey catch rates. For specific details on this new whale depredation estimation methods, we refer the reader to the Whale Depredation Estimation section of the 2020 sablefish stock assessment (Goethel et al. 2020).

Fishery:
The fishing fleet for sablefish in the BSAI and GOA is primarily composed of owner-operated vessels that use longline gear (hook-and-line gear and pot gear). The sablefish IFQ fishery season opening date is concurrent with the halibut fishery for the purposes of reducing bycatch and regulatory discards between the two fisheries. The IFQ Program was designed, in part, to help improve safety for fishermen, enhance efficiency, reduce excessive investment in fishing capacity, and protect the owner-operator character of the fleet. The program set caps on the amount of quota share that any one person may hold, limited

transfers to bona fide fishermen, issued quota in four vessel categories, and prohibited quota share transfers across vessel categories (Fissel et al., 2013).

Since the implementation of IFQs, the number of longline vessels with sablefish IFQ harvests experienced a substantial anticipated decline from 616 in 1995 to 362 in 2011 (NOAA 2020). This decrease was expected as shareholders have consolidated their holdings and fish them off fewer vessels to reduce costs (Fina 2011). The sablefish fishery has historically been a small boat fishery; the median vessel length in the 2011 fishery was 56ft. In recent years, approximately 30% of vessels eligible to fish in the IFQ fishery participate in both the halibut and sablefish fisheries and approximately 40% of vessels fish in more than one management area. The season dates have varied by several weeks since 1995, but the monthly pattern has been from March to November with the majority of landings occurring in May - June. The number of landings fluctuates with quota size, but in 2019 there were 1,966 landings recorded in the Alaska fishery (NOAA 2020).

The primary gear used for directed sablefish harvest in Alaska is HAL gear, which is fished on-bottom. 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. Hook-and-line gear is baited by hand or by machine, with smaller boats generally baiting by hand and larger boats generally baiting by machine. Anchors are two-prong standard 50 lbs. to 90 lbs. anchors, and groundlines are generally constructed of 3/8-inch sinking line, with 6”to 18” long gangions of #72 to #86 twine, spaced 30” to 48” apart, with 9/0-15/0 circle hooks. Some catcher vessels use snap-on gear with gangions spaced at 3 foot to 4 foot intervals. On catcher vessels, an average set consists of 20 skates of groundline, with each skate 100 fathoms to 150 fathoms long. Preferred baits are squid, pollock, and herring. Automatic baiting machines are used on many vessels. The gear usually is 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 sablefish longline fishery is prosecuted along the continental slope and deep gully areas on the shelf over gravel, cobble, and mud bottom at depths of 200 to more than 1,000 fathoms. This fishery is often a mixed halibut/sablefish fishery, with Greenland turbot, grenadiers, and shortraker, rougheye, and thornyhead rockfish also taken.

Pot fishing in the BSAI sablefish IFQ fishery landings have increased dramatically since 2000. The average percent of sablefish caught in pots from 2000-2020 was 41% of the fixed gear catch (Table 3-2). From 2000 to 2008 catch in pots had increased to 10-68% of the fixed gear catch and then decreased to ~30% from 2009-2016. Recently there was an increase from 2017-2020, with a time series high of 73% in 2020 (as of October 28, 2020). The percent of fixed gear catch in the BS in pot gear was continuously high from 2001-2020, with an average of 63% of the fixed gear catch in pots. The AI matched the overall BSAI trend more closely, with highs in 2003-2007 and from 2017-2020, with the series high in 2020 at 75%. Unlike the BS, there was a low period from 2009-2016, where the average catch in pots was only 9%. The recent uptick since 2017 in the AI could be related to a recent increase in pot gear for the purpose of avoiding killer whale depredation on hook and line gear. It could also be related to an increase in the catch of smaller fish, because small fish are more likely to be caught in pot gear than in hook and line gear and have been more abundant than in past years. In summary, in the BS the proportion of fish caught in pots is consistently high, whereas in the AI it is inconsistent and ranges from 3-75% from 2000-2020.

Because of an action taken by the NPFMC in 2015, pot fishing has been permitted in the GOA since 2017. In 2017 and 2018 pot fishing made up a small proportion of the fixed gear catch (10% and 12%, respectively). The proportion of fixed gear catch in pots in the GOA increased to 20% in 2019 and then again to 44% in 2020. The overall catch in pots in the GOA increased each year from 898 t in 2017 to 3,882 t in 2020, while hook and line catch has decreased from 8,181 t to 4,990 t (as of October 28, 2020).

Sablefish also are caught incidentally during directed trawl fisheries for other species groups such as rockfish and deepwater flatfish. Allocation of the TAC by gear group varies by management region and influences the amount of catch in each region. Five State of Alaska fisheries land sablefish outside the IFQ program; the major State fisheries occur in Prince William Sound, Chatham Strait, and Clarence Strait and the minor fisheries in the northern GOA and AI. The minor state fisheries were established by the State of Alaska in 1995, the same time as the Federal Government established the IFQ fishery, primarily to provide open-access fisheries to fishermen who could not participate in the IFQ fishery. For much of the last twenty years, trawl gear bycatch has constituted around 10% of total catch, but this proportion increased rapidly starting around 2016 and was at 31% in 2019 and 43% in 2020 (based on estimated catch; Table 3.1 in Goethel et al. 2020). A majority of these increases in proportion of total catch coming from the trawl fishery occurs in the BS and AI. In particular, the BS has seen a dramatic increase in total catch from 532 t in 2016 to around 5,000 t in 2020, much of it associated with trawl bycatch (Tables 3.1 in Goethel et al. 2020).

Table 3-2 Catch (t) in the Aleutian Islands and the Bering Sea by gear type from 1991 - 2020. Both CDQ and non-CDQ catches are included. Catches in 1991 - 1999 are averages. Catch as of October 31, 2020 (www.akfin.org).

Aleutian Islands				
Year	Pot	Trawl	Longline	Total
1991-1999	6	73	1,210	1,289
2000	103	33	913	1,049
2001	111	39	925	1,074
2002	105	39	975	1,119
2003	316	42	760	1,118
2004	384	32	539	955
2005	688	115	679	1,481
2006	461	60	629	1,151
2007	632	40	496	1,169
2008	177	76	646	899
2009	78	75	947	1,100
2010	59	74	914	1,047
2011	141	47	838	1,026
2012	77	148	979	1,205
2013	87	58	918	1,063
2014	160	26	635	821
2015	12	15	403	431
2016	21	30	298	349
2017	270	129	191	590
2018	281	179	199	660
2019	203	241	217	661
Bering Sea				
1991-1999	5	189	539	733
2000	40	284	418	742
2001	106	353	405	864
2002	382	295	467	1,144
2003	363	231	417	1,012
2004	435	293	313	1,041
2005	595	273	202	1,070
2006	621	84	373	1,078
2007	879	92	211	1,182
2008	754	183	204	1,141
2009	557	93	266	916
2010	450	30	273	753
2011	405	44	257	707
2012	432	93	218	743
2013	352	133	149	634
2014	164	34	115	314
2015	108	17	86	211
2016	158	257	116	532
2017	368	685	106	1,159
2018	379	1,067	148	1,595
2019	410	2,553	228	3,191

Fishery Management:
BSAI and GOA sablefish are managed as one population in Federal waters due to their highly migratory behavior during certain life history stages. There are four sablefish management areas in the GOA; Western (WGOA), Central (CGOA), and West Yakutat (WY) and Southeast Outside (SEO) districts in the Eastern GOA (EGOA). The BSAI, the BS and AI are managed as are two separate sablefish management areas. In 1985, Amendment 14 to the GOA FMP allocated sablefish TAC by gear type; 80 percent to fixed gear (hook-and-line and pot gear), and 20 percent to trawl in the WGOA and CGOA, 95 percent to fixed gear and 5 percent to trawl gear in the EGOA. In 1990, Amendment 15 to the BSAI FMP

also allocated sablefish TAC by gear type; 50 percent to fixed gear and 50 percent to trawl in the eastern BS, and 75 percent to fixed gear and 25 percent to trawl gear in the AI.

Amendment 15 to the BSAI FMP and Amendment 20 to the GOA FMP established IFQ management for the BSAI and GOA sablefish fishery, which began in 1995. The IFQ Program assigns the privilege of harvesting a percentage of all sablefish quota share to specific individuals with a history of harvest in the fisheries, or those that purchased quota share. The quota share originally assigned to each person was proportional to their fixed gear landings, by management area, during the qualifying period, and are represented as quota shares (QS). Under this program, only persons holding QS are allowed to make commercial landings of sablefish in the management areas identified. There are several key provisions of the program: the process for initial allocation of QS by regulatory area; assignment of shares to vessel categories; share transfer provisions; use and ownership provisions; QS blocks to ensure small allocations are available for entry; the annual process for allocating QS; and the establishment of halibut and sablefish Community Development Quotas.

To qualify for an initial allocation of QS, a person must have made legal landings of sablefish, harvested with fixed gear, during 5 years of the 6-year base period 1985 through 1990. Each person eligible to receive QS had it assigned to one of three vessel categories: “A” – catcher/processor (freezer) vessels of any length; “B” – catcher vessels greater than 60’; “C” – catcher vessels less than or equal to 60’. Restrictions on transfer, together with use and ownership caps, were designed to maintain the owner/operator characteristics of the fleet, and to prevent consolidation of QS in the hands of a few participants.

Catch History:
U.S. fishermen have harvested sablefish since the end of the 19th century as a byproduct of halibut fisheries. Harvests were relatively small, averaging 1,666 mt from 1930 through 1957. Japanese longlining began in the Eastern Bering Sea around 1958 and expanded into the AI and GOA through the 1970s. Japanese fleet catches increased throughout the 1960s, and peak sablefish catch reached 36,776 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. By 1988, U.S. fishermen took the majority of the sablefish harvested in the GOA and BSAI. Sablefish was increasingly harvested as a derby-style fishery in the late 1980s and early 1990s until the IFQ Program was implemented for the HAL fishery in 1995.

An Alaska-wide (GOA, BS, and AI) OFL of 60,426 mt was specified for 2021. Catch specifications for 2020 in the GOA are as follows; ABC = 21,475 mt, TAC = 17,991 mt. Separate ABCs and TACs are established for each GOA management area: WGOA, CGOA, WY, and SEO. Catch specifications are separated for the BSAI. Catch specifications for 2020 in the BS are as follows; ABC = 3,396 mt, TAC = 3,396 mt. Catch specifications for 2020 in the AI are as follows; ABC = 4,717 mt, TAC = 4,717 mt.

3.2.2 Effects of the Alternatives

Alternative 1
The effects of the sablefish IFQ fishery on the sablefish stock is assessed annually in the BSAI and GOA SAFE report (NPFMC 2020), the sablefish stock assessment (Goethel et al., 2020) and was also evaluated in the Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007a). Table 3-3 describes the criteria used to determine whether the impacts on target fish stocks are likely to be significant. The effects of the sablefish IFQ fishery on fish that are caught incidentally have been comprehensively analyzed in the 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 sablefish under Alternative 1 are determined not to be significant.

Table 3-3 Criteria used to determine significance of effects on target groundfish stocks.

Effect	Criteria			
	Significantly Negative	**Insignificant**	**Significantly Positive**	**Unknown**
Fishing mortality	Changes in fishing mortality are expected to jeopardize the ability of the stock to sustain itself at or above its MSST (minimum stock size threshold)	Changes in fishing mortality are expected to maintain the stock's ability to sustain itself above MSST	Changes in fishing mortality are expected to enhance the stock's ability to sustain itself at or above its MSST	Magnitude and/or direction of effects are unknown
Stock Biomass: potential for increasing and reducing stock size	Reasonably expected to jeopardize the capacity of the stock to yield sustainable biomass on a continuing basis.	Reasonably expected not to jeopardize the capacity of the stock to yield sustainable biomass on a continuing basis.	Action allows the stock to return to its unfished biomass.	Magnitude and/or direction of effects are unknown
Spatial or temporal distribution	Reasonably expected to adversely affect the distribution of harvested stocks either spatially or temporally such that it jeopardizes the ability of the stock to sustain itself.	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.	Reasonably expected to positively affect the harvested stocks through spatial or temporal increases in abundance such that it enhances the ability of the stock to sustain itself.	Magnitude and/or direction of effects are unknown

Alternative 2

Alternative 2 proposes an FMP amendment and regulatory change to allow vessels participating in the sablefish IFQ fishery to voluntarily discard sablefish in the BSAI and GOA. This could result in an increase in both the amount of gear deployed by vessels participating in the fishery and in the duration of the fishery, since vessels that choose to discard will need to increase effort to achieve the same amount of their quota.

Section 2.2.1.1 above describes how fishing effort may increase as a result of this action. When analyzing possible environmental effects of Alternative 2 in this action; 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, is the primary cause for concern. Since 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), the analysts have erred on the side of conservation and have chosen to describe the effects of what is likely the extreme upper bound in terms of increase in fishing effort. In this case, the analysts use the sablefish "savings" described in Section 2.2.1.1 from the DMR scenario that is furthest from status quo; a DMR of 5% applied to harvest data from 2020. Based on this DMR and fishing year, we assume an increase in fishing effort equal to 20.9 % as our basis for describing impacts throughout the Environmental Assessment.

Under Alternative 2, while fishing effort may increase, the sablefish IFQ fishery is still constrained by existing regulations concerning the location and timing of the fishery, PSC and bycatch limits, and all other accountability measures currently in place. While it is not possible to project how fishing effort may change from year to year under Alternative 2, using methods described above, it is reasonable to assume that effort is not likely to increase to a level that would jeopardize the continued sustainability of the sablefish stock. However, allowing vessels to discard small fish in order to increase their harvest of large fish will put increasing pressure on the stocks spawning biomass. The potential effects of Alternative 2 on sablefish biomass and spawning stock biomass are described in Section 2.2.3 . The amount and characteristics (fish size) of the discarded portion of the catch will likely be market driven and vary annually (see sections 2.2.3.1 and 2.2.3.2). Since there is no way to predict future market conditions or discarding scenarios, a more quantitative evaluation of potential impacts is not possible at this time. However, the sablefish stock is, and will continue to be, managed as a tier 3a species. This status provides a harvest control and other mechanisms to account for changes characteristics of the stock, such as changes in biomass and spawning stock biomass. The sablefish stock is evaluated annually through a rigorous scientific process and any future concerns in the stock structure as a result of Alternative 2 could be addressed at that time. Given this, it is unlikely that actions under Alternative 2 will jeopardize the continued sustainability of the sablefish stock.

Reasonably Foreseeable Effects on Target Species

Considering the potential impacts of the proposed action under the alternatives evaluated in this analysis together with the effects of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of reasonably foreseeable future actions, the overall potential impacts of the proposed action are determined to be not significant. Catch of non-target species and prohibited species in the sablefish IFQ fishery is described in the RIR.

3.3 Prohibited Species Catch

3.3.1 Status

Golden King Crab

The predominant prohibited species caught in sablefish fisheries is golden king crab (13,981 individuals/year on average in the BSAI and 88 in the GOA; Table 3-4). 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. It should be noted that they 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.

The directed fishery for golden king crab has been prosecuted annually since the 1981/82 season. Management based on a formally established GHL began with the 1996/97 season. The Alaska Board of Fisheries adopted an abundance-based harvest strategy for the stock in March 2019. This fishery has been managed under the Crab Rationalization Program since 2005. Total mortality of golden king crab includes retained catch in the directed fishery, mortality of discarded catch, and bycatch in fixed-gear and trawl groundfish fisheries, though bycatch in other fisheries is low compared to mortality in the directed fishery. Total mortality in the post-rationalized fishery has ranged from 2,506 t in 2006/07 to 3,735 t in 2019/20. Crab catches 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. There was an anomalous high catch of golden king crab of 38,905 individuals in 2018, due to catch in the BSAI pot fishery, but it decreased the next year and was 5,374 in 2020 (Table 3.7, see “other” gear).

Pacific Halibut

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). 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. 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 (together with the sablefish IFQ fishery) has been managed under an IFQ Program since 1995; the IFQ Program is summarized under section 4.5.2

Estimates of Pacific halibut bycatch in the sablefish IFQ fishery were high in past SAFE reports because all Pacific halibut caught in the sablefish IFQ fishery were included in PSC estimates, regardless of if the Pacific halibut was caught in the directed fishery when the vessel had available halibut IFQ on-board. Because legally retained IFQ halibut cannot be separated from halibut bycatch or discarded halibut (if the vessel does not have any remaining IFQ) in the CAS, previous reports of Pacific halibut “bycatch” have included all halibut (directed fishing, discarded, or PSC) in their estimates. In the 2020 stock assessment, the estimates of Pacific halibut in Table 3-4 are only for non-IFQ sablefish sets (halibut that is discarded or landed as PSC), defined as those sets where sablefish had the greatest weight. Pacific halibut PSC in Table 13 is in all gear and areas, with the majority in “other” gear.

Table 3-4 Prohibited Species Catch (PSC) estimates (in tons for halibut and numbers of animals for crab and salmon) by year and fisheries management plan (BSAI or GOA) for the sablefish fishery. Other is defined as pot and trawl gears combined because of confidentiality. Source: NMFS Alaska Regional Office Catch Accounting System PSCNQ via AKFIN (www.akfin.org), accessed on October 31, 2020.

				BSAI				
Hook and	Year	Bairdi	Chinook	Golden	Halibut (t)*	Other	Opilio	Red KC
	2013	-	15	600	5	-	-	-
	2014	-	-	576	6	-	-	40
	2015	-	9	177	0	-	-	206
	2016	22	0	49	0	0	27	5
	2017	3	0	0	0	0	4	1
	2018	8	0	0	0	0	17	10
	2019	3	0	3	0	0	12	0
	2020	2	0	0	2	0	11	0
	Mean	5	3	176	2	0	9	33
Other	2013	365	-	858	4	-	315	-
	2014	-	-	3,573	1	-	1,689	-
	2015	-	-	29,038	0	-	26	-
	2016	142	-	11,696	5	-	14	18
	2017	689	-	16,034	7	-	465	51
	2018	525	98	38,905	32	-	261	1,060
	2019	171	-	4,965	7	-	122	6
	2020	213	-	5,374	3	-	375	25
	Mean	263	12	13,805	7	-	408	145
Sum	**BSAI**	268	15	13,981	9	0	417	178

				GOA				
HAL	2013	78	-	93	4	-	-	24
	2014	6	-	39	0	-	-	-
	2015	166	-	38	6	-	-	12
	2016	0	-	39	3	-	0	0
	2017	20	-	72	3	-	-	-
	2018	-		71	1	-	-	-
	2019	59	-	82	1	-	-	-
	2020	-	-	49	-	-	-	-
	Mean	41	-	60	2	-	0	5
Other	2013	-	-	-	11	-	-	-
	2014	-	-	18	2	-	-	-
	2015	25	-	-	3	-	-	-
	2016	-	-	47	11	-	-	-
	2017	150	-	26	4	-	-	-
	2018	2,760	-	-	40	-	-	-
	2019	200	-	92	10	-	-	-
	2020	101	-	38	4	-	2	-
	Mean	405	-	28	11	-	0	-
Sum	**GOA**	446	-	88	13	-	0	5

*The Pacific halibut bycatch only includes sets determined to be sablefish targets that are not in the IFQ fishery.

3.3.2 Effects of the Alternatives

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 Groundfish PSEIS (NOAA 2004), and the Harvest Specifications Environmental Assessment (NMFS 2007) 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 fishery to voluntarily discard sablefish in the BSAI and GOA. This could result in an increase in both the amount of gear deployed by vessels participating in the fishery and in the duration of the fishery, since vessels that choose to discard will need to increase effort to achieve the same amount of their quota.

Under Alternative 2, while fishing effort may increase, the sablefish IFQ fishery is still constrained by existing regulations concerning the location and timing of the fishery, PSC and bycatch limits, and all other accountability measures currently in place. While it is not possible to project how fishing effort may change from year to year under Alternative 2, using methods described above, it is reasonable to assume that effort is not likely to increase to a level that would jeopardize the continued sustainability of these PSC stocks. The 2020 BSAI Crab SAFE[5] reports that total mortality of golden king crab (mortality from the directed fishery, discards, and bycatch) has been much less than OFL and below ABC for every year analysed in the SAFE (Table 3-5). While no PSC limit has been established for golden king crab, even if the increase in fishing effort as a result of Alternative 2 were to result in a 20% increase in golden king crab bycatch (total catch - retained catch), total mortality would still remain well below OFL and ABC for this stock.

Table 3-5 Status and catch specifications (1000 t) for Aleutian Islands golden king crab. Shaded values are new estimates or projections based on the current assessment.

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2016/17	N/A	N/A	2.515	2.593	2.947	5.69	4.26
2017/18	6.044	14.205	2.515	2.585	2.942	6.048	4.536
2018/19	5.880	17.848	2.883	2.965	3.355	5.514	4.136
2019/20	5.909	16.323	3.257	3.319	3.735	5.249	3.937
2020/21		14.774				4.798	3.599

Further, current halibut PSC limits which already constrain this fishery will not be changed. As such, if actions under Alternative 2 were to result in greater harvest of PSC species, the fishery would still be closed once existing PSC limits were reached, preventing any impact on the PSC stocks beyond those that have already been evaluated in the Groundfish PSEIS (NOAA 2004) and the Harvest Specifications Environmental Assessment (NMFS 2007), and 2020 BSAI Crab SAFE.

Reasonably Foreseeable **Effects on PSC**

[5] https://meetings.npfmc.org/CommentReview/DownloadFile?p=fc204423-906a-4eaf-b3ef-ae275d1ab76f.pdf&fileName=C1%20BSAI%20Crab%20SAFE%20Intro.pdf

Neither of the alternatives the Council is considering would substantially change PSC catch for the sablefish IFQ fishery. Considering the potential impacts of the proposed action under the alternatives evaluated in this analysis together with the effects of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of reasonably foreseeable future actions, the overall potential impacts of the proposed action are determined to be not significant.

3.4 Non-target species

3.4.1 Status

Groundfish species that are managed under the GOA FMP and BSAI FMP and caught incidentally in the sablefish IFQ fishery are listed in Table 3-6 and Table 3-7. None of these species are either overfished or experiencing overfishing. 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 3-6 shows the average bycatch of GOA FMP and BSAI FMP groundfish species in the sablefish IFQ fishery from 2013-2020. GOA thornyhead (610 t/year; 187 t discarded) and shark (637 t/year; 636 t discarded) are the highest bycatch species groups. There is also substantial bycatch of GOA shortraker and rougheye/blackspotted rockfish, GOA skate, “other” rockfish, and Pacific cod, ranging from 103-265 t/year for each group. Bycatch of several species have decreased in recent years; for example, the total catch of BSAI skate has decreased every year from 2013-2020, starting at 121 t and decreasing to 5 t. Despite having the highest average catch in the sablefish fishery, catch of thornyhead rockfish has been decreasing nearly every year, from 938 t in 2013 to 234 t in 2020. “Other” rockfish follow the same trend, decreasing from 209 t to 32 t, and Pacific cod bycatch decreased from 209 t to 32 t. Conversely, there are some higher catches in recent years: there was an anomalous high catch of 1,136 t of sharks in 2018; catches of GOA shortraker rockfish were on average 361 t from 2018-2019 but the average for the time series was only 181 t; and there were 429 t of arrowtooth flounder caught in 2018, whereas the average of the series is 230 t.

Table 3-6 Mean bycatch (t) of FMP groundfish species in the targeted sablefish fishery from 2013 - 2020. Other = pot and trawl combined due to confidentiality. D =Discarded, R = Retained. Source: NMFS Alaskan Regional Office Catch Accounting System via AKFIN (www.akfin.org), accessed on October 31, 2020.

	Hook and line			Other			All gears		
Species	D	R	Total	D	R	Total	D	R	Total
GOA Thornyhead	179	402	581	8	21	29	187	423	610
Shark	551	0	552	6	0	6	636	0	637
GOA Shortraker Rockfish	175	78	253	9	3	12	184	81	265
Arrowtooth Flounder	116	8	124	89	17	106	205	25	230
GOA Skate, Other	176	1	177	4	0	4	180	1	181
GOA Skate, Longnose	156	6	162	1	0	1	179	7	186
GOA Rougheye Rockfish	98	80	178	1	3	3	112	95	207
Other Rockfish	55	42	98	2	5	7	65	54	119
Pacific Cod	53	25	78	2	10	12	63	41	103
BSAI Skate	36	1	37	0	0	0	42	1	42
Greenland Turbot	13	5	18	3	4	7	18	10	28
GOA Skate, Big	16	0	16	0	0	0	19	0	19
Sculpin	12	0	12	1	0	1	14	0	14
GOA Demersal Shelf	1	10	12	0	0	0	2	12	14
BSAI Kamchatka	8	1	10	4	12	16	14	15	29
GOA Deep Water Flatfish	10	0	10	19	5	24	33	6	39
BSAI Shortraker Rockfish	5	1	6	0	1	1	5	2	8
Octopus	5	0	5	2	0	2	7	0	7
BSAI Other Flatfish	4	0	4	0	9	9	5	10	15
GOA Shallow Water	3	0	3	1	1	2	6	1	7
Pollock	2	0	2	11	12	22	14	13	27
Pacific Ocean Perch	2	0	2	1	7	8	3	9	11
Flathead Sole	1	0	1	1	6	8	3	7	10

Source: page 97 in Goethel et al. 2020

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 (Table 3-7). The highest bycatch of giant grenadier in recent years was 15,053 t in 2013, but has remained below 9,333 t since then. Starting in 2017, bycatch of grenadiers has been on the decrease and in 2019 it was 3,927 t; so far in 2020 it is only 2,379 t. Other nontarget taxa that typically have catches over one ton per year are corals (bryozoans), eelpouts, miscellaneous fishes and crabs, sea anemone, sea stars, and snails (Table 3-7).

Table 3-7 Bycatch of nontarget species and HAPC biota in the targeted sablefish fishery. Source: NMFS AKRO Blend/Catch Accounting System via AKFIN, October 31, 2020.

Group Name	2012	2013	2014	2015	2016	2017	2018	2019	2020
Benthic urochordata	1.3	0.0	0.0	0.5	0.0	1.0	1.0	0.1	0.0
Brittle star unidentified	4.7	0.1	0.7	2.1	0.3	0.6	0.6	0.4	0.4
Corals Bryozoans	7.7	12.8	5.2	4.6	5.9	2.2	10.2	3.6	1.4
Eelpouts	0.6	1.1	0.8	0.2	1.1	2.4	7.6	0.2	0.1
Grenadiers	9,769	15,035	7,338	7,297	9,332	6,799	5,697	3,927	2,379
Invertebrate unidentified	7.9	0.3	0.1	0.5	0.2	0.8	0.5	0.4	0.1
Misc. crabs	6.9	6.0	6.4	3.6	5.2	5.2	4.0	2.9	5.0
Misc. fish	11.5	31.3	28.4	17.2	15.6	24.1	30.2	152.6	51.6
Scypho jellies	0.0	0.0	5.5	0.2	0.2	0.0	0.6	0.7	0.2
Sea anemone unidentified	1.0	1.0	3.1	14.1	1.8	2.0	14.5	1.9	1.2
Sea pens whips	0.3	0.4	2.3	2.8	1.3	1.1	0.4	0.6	0.7
Sea star	3.2	15.7	11.6	9.6	9.3	21.6	13.7	6.3	8.3
Snails	12.1	8.8	3.7	3.4	0.2	2.9	2.9	7.9	3.6
Sponge unidentified	1.0	3.4	1.7	3.5	0.5	0.7	0.3	0.3	0.4
State-managed Rockfish	0.0	0.1	0.1	0.1	0.2	0.4	0.0	0.1	0.0
Urchins, dollars, cucumbers	0.8	0.9	0.8	2.5	0.2	0.2	1.2	1.3	0.4

Source: page 97 in Goethel et al. 2020

3.4.2 Effects of the Alternatives

Alternative 1

The effects of the sablefish IFQ fishery on the sablefish stock is assessed annually in the BSAI and GOA SAFE report (NPFMC 2020), the sablefish stock assessment (Goethel et al. 2020) and was also evaluated in the Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007a). Table 3-8 describes the criteria used to determine whether the impacts on target fish stocks are likely to be significant. The effects of the sablefish IFQ fishery on fish that are caught incidentally have been comprehensively analyzed in the annually BSAI and GOA SAFE reports (NPFMC 2020), and was also evaluated in the Groundfish PSEIS (NOAA 2004), 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 of groundfish under Alternative 1 are determined not to be significant.

Table 3-8 Criteria used to estimate the significance of impacts on incidental catch of Chinook salmon.

No impact	No incidental take of the prohibited species in question.
Adverse impact	There are incidental takes of the prohibited species in question
Beneficial impact	Natural at-sea mortality of the prohibited species in question would be reduced — perhaps by the harvest of a predator or by the harvest of a species that competes for prey.
Significantly adverse impact	An action that diminishes protections afforded to prohibited species in the groundfish fisheries.
Significantly beneficial impact	No benchmarks are available for significantly beneficial impact of the groundfish fishery on the prohibited species, and significantly beneficial impacts are not defined for these species.
Unknown impact	Not applicable

Alternative 2

Alternative 2 proposes an FMP amendment and regulatory change to allow vessels participating in the sablefish IFQ fishery to voluntarily discard sablefish in the BSAI and GOA. This could result in an increase in both the amount of gear deployed by vessels participating in the fishery and in the duration of the fishery, since vessels that choose to discard will need to increase effort to achieve the same amount of their quota.

Under Alternative 2, while fishing effort may increase, the sablefish IFQ fishery is still constrained by existing regulations concerning the location and timing of the fishery, PSC and bycatch limits, and all other accountability measures currently in place. While it is not possible to project how fishing effort may change from year to year under Alternative 2, using methods described above, it is reasonable to assume that effort is not likely to increase to a level that would jeopardize the continued sustainability of groundfish species. As such, 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).

Reasonably Foreseeable Effects on Non-Target Species

Considering the potential impacts of the proposed action under the alternatives evaluated in this analysis together with the effects of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of reasonably foreseeable future actions, the overall potential impacts of the proposed action are determined to be not significant

3.5 Marine Mammals

3.5.1 Status

Alaska supports one of the richest assemblages of marine mammals in the world. Twenty-two species are present from the order Carnivora, superfamilies Pinnipedia (seals, sea lions, and walrus), Ursoidea (polar bears), and Musteloidea (sea otters), and from the order Artiodactyla, infraorder Cetacea (whales, dolphins, and porpoises). Some marine mammal species are resident in waters off Alaska throughout the year, while others migrate into or out of Alaska fisheries management areas. Marine mammals occur in diverse habitats, including deep oceanic waters, the continental slope, and the continental shelf, including inshore waters. The National Marine Fisheries Service (NMFS) maintains management authority for all marine mammal species in Alaska, while the U.S. Fish and Wildlife Service (USFWS) is the designated management authority for northern polar bears, Pacific walrus, and northern sea otter.

The Marine Mammal Protection Act, the Endangered Species Act, and the Fur Seal Act are the relevant statutes for managing marine mammal interactions with human activities, including commercial fishing operations. The Marine Mammal Protection Act (MMPA) was enacted in 1972 with the ideal of ensuring that marine mammal populations continue to be functioning elements of the ecosystems of which they are a part. The one of the incentives for enacting the MMPA was to reduce take of marine mammals incidental to commercial fishing operations. While marine mammals may be lawfully taken incidentally in the course of commercial fishing operations, the 1994 MMPA Amendments 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). ZMRG is considered to be met for a marine mammal stock when the M/SI level from all commercial fisheries is 10 percent or below the Potential Biological Removal level (PBR) of that marine mammal stock (69 FR 43338, July 20, 2004). Likewise, the Endangered Species Act (ESA) was enacted to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve such conservation. In practice, the ESA outlines a program to protect endangered species on the brink of extinction and threatened species that are likely to be on the brink of extinction in the near future and pursue their recovery. The ESA also requires designation of any habitat of endangered or threatened species, which is then considered to have physical or biological features essential to the conservation of the species and which may require special management considerations or protection.

Under the MMPA a “population stock” is the fundamental unit of legally-mandated conservation and is defined as “a group of marine mammals of the same species or smaller taxa in a common spatial arrangement, which interbreed when mature.” Stocks are identified in a manner consistent with the management goals of the MMPA which include 1) preventing stocks from diminishing such that they cease to be a significant functioning element in the ecosystem of which they are a part or below their optimum sustainable population keeping the carrying capacity of the habitat in mind; and 2) maintaining the health and stability of the marine ecosystem. Therefore, a stock is also recognized as being a management unit that identifies a demographically isolated biological population. While many types of information can be used to identify stocks of a species, it is recognized that some identified stocks may fall short of that threshold due to a lack of information.

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 [NMFS 2016]. 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. The SARs identify sources of human-caused mortality, including serious injury and mortality in commercial fishery operations, by fishery, and whether the stock has met ZMRG for all fisheries. The SARs also include the stock's ESA listing status and MMPA depleted and strategic designations. Strategic stock SARs are updated annually (Steller sea lions, northern fur seals, bearded seals, ringed seals, Cook Inlet beluga whales, AT1 Transient killer whales, harbor porpoise, sperm whales, humpback whales, fin whales, North Pacific right whales, and bowhead whales). SARs for non-strategic stocks are updated every three years or when significant new information is available.

Under the ESA species, subspecies, and distinct population segments (DPS) are eligible for listing as a threatened or endangered species. The ESA defines a species as ''any subspecies of fish or wildlife or plants, and any DPS of any species of vertebrate fish or wildlife which interbreeds when mature.'' The joint USFWS /NMFS DPS policy (61 FR 4722; February 7, 1996) establishes two criteria that must be met for a population or group of populations to be considered a DPS: (1) The population segment must be discrete in relation to the remainder of the species (or subspecies) to which it belongs; and (2) the population segment must be significant to the remainder of the species (or subspecies) to which it belongs.

A population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions: 1) it is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors; or 2) it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the ESA. Significance determinations are made using available scientific evidence of the population's biological and ecological importance to the taxon to which it belongs. This may include, but is not limited to, one or more of the following: 1) Persistence of the discrete population segment in an ecological setting unusual or unique for the taxon; 2) evidence that loss of the discrete population segment would result in a significant gap in the range of the taxon; 3) evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic range; or 4) evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics. It is important to note that the MMPA stock designations and ESA DPS designations for a given species do not necessarily overlap due to differences in the defining criteria for each.

Marine mammals have been given various levels of protection under the current fishery management plans of the Council, and several species are the subjects of continuing research and monitoring to further define the nature and extent of fishery impacts on them. A number of conservation concerns and/or management determinations may be related to marine mammals and the potential impacts of fishing. For individual species, these concerns or determinations may include—

- Protection under the ESA:
  - listed as endangered or threatened
  - placed on NMFS' list of "species of concern" or designated as a "candidate species" for ESA listings;
- Protection under the MMPA:
  - designated as depleted or strategic;
  - focus of a Take Reduction Plan;
- Other:
  - declining or depressed populations in a manner of concern to State or Federal agencies;
  - large bycatch or other mortality related to fishing activities; or
  - vulnerability to direct or indirect adverse effects from some fishing activities.

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 new methods to assess impacts. The information from the PSEIS and the SARs is 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 are listed in Table 3-9Table 3-10, and Table 3-11. 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, 2014). Of the species listed under the ESA or stocks designated as depleted or strategic under the MMPA and present in the action area, several species may be more vulnerable than others to being adversely affected by commercial groundfish fishing. These include Steller sea lions, bearded seals, humpback whales, fin whales, and sperm whales. Stocks designated as depleted or strategic under the MMPA, but not listed as threatened or endangered under the ESA, that may be vulnerable to being adversely affected by commercial groundfish fishing include northern fur seals and harbor porpoise.

Table 3-9 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 U.S	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***	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	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	Met
	Harbor porpoise *(Phocoena phocoena)*	Southeast Alaska	None	Not Met
		Gulf of Alaska	None	Met
	Dall's porpoise (*Phocoenoides dalli*)	Alaska	None	Met
	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‡	Endangered, Depleted, Strategic	Not Met
		Central North Pacific‡‡	Mexico DPS: Threatened, Depleted, Strategic‡‡ Hawaii DPS: None	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: Muto et al 2019; List of Fisheries for 2020 (April 16, 2020 85 FR 21079) .
*Unknown due to unknown abundance estimate and PBR.
**Unknown due to inadequate observer coverage,
*** This stock is found in the Pacific, rather than in the Alaska, SAR.
† The Steller sea lion EDPS was removed from the ESA list of endangered and threatened wildlife on November 4, 2013.
†† On September 8, 2016, NMFS published a final decision revising the status of humpback whales under the ESA (81 FR 62259), effective October 11, 2016. In the 2016 decision, NMFS recognized the existence of 14 DPSs, classified several as endangered and one as threatened, and determined the remaining DPSs do not warrant protection under the ESA. Three DPSs of humpback whales occur in waters off the coast of Alaska: the Asia/2nd Western North Pacific (WNP) DPS (endangered), the Mexico DPS (threatened), and the Hawaii DPS, which is not protected under the ESA. Whales from these three DPSs overlap to some extent on feeding grounds off Alaska. As of October 2016, the MMPA stock designations of humpback whales found in Alaska have not been updated to reflect the newly-designated DPSs.
‡ Corresponds to the new Asia/ 2nd WDPS (endangered)
‡‡ Includes the new Mexico (threatened) and Hawaii DPSs (not protected under the ESA).

Table 3-10 Marine mammals known to occur in the Aleutian Islands subarea

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)*	Aleutian Islands	None	Met
	Ribbon seal *(Phoca fasciata)*	Alaska	None	Met
	Northern elephant seal *(Mirounga angustirostris)*	California***	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	Met
		Offshore***	None	Unknown*
	Pacific White-sided dolphin (*Lagenorhynchus obliquidens*)	North Pacific	None	Met
	Harbor porpoise *(Phocoena phoecena)*	Bering Sea	None	Met
	Dall's porpoise (*Phocoenoides dalli*)	Alaska	None	Met
	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‡	Endangered, Depleted, Strategic	Not Met
		Central North Pacific ‡‡	Mexico DPS-Threatened, Depleted, Strategic Hawaii DPS - None	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)*	Southwest Alaska	Threatened, Depleted, Strategic	Unknown**

Sources: Muto et al 2019; Carretta et al 2019; List of Fisheries for 2019 (May 16, 2019 84 FR 22052)
*Unknown due to unknown abundance estimate and PBR.
** Unknown due to inadequate observer coverage;
*** This stock is found in the Pacific, rather than in the Alaska, SAR.
† On September 8, 2016, NMFS published a final decision revising the status of humpback whales under the ESA (81 FR 62259), effective October 11, 2016. In the 2016 decision, NMFS recognized the existence of 14 DPSs, classified several as endangered and one as threatened, and determined that the remaining DPSs do not warrant protection under the ESA. Three DPSs of humpback whales occur in waters off the coast of Alaska: the Asia/2nd Western North Pacific (WNP) DPS, which is endangered, the Mexico DPS, which is threatened, and the Hawaii DPS, which is not protected under the ESA. Whales from these three DPSs overlap to some extent on feeding grounds off Alaska. As of October 2016, the MMPA stock designations of humpback whales found in Alaska have not been updated to reflect the newly-designated DPSs.
‡ Corresponds to the new Asia/ 2nd WDPS (endangered)
‡‡ Includes the Mexico (threatened) and Hawaii DPSs (not protected under the ESA).

Table 3-11 Marine mammals known to occur in the Bering Sea

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)*	Alaska [a]	Threatened, Depleted, Strategic	Met
	Spotted seal *(Phoca largha)*	Alaska [b]	None	Met
	Ringed seal *(Phoca hispida)*	Alaska [c]	Threatened, Depleted, Strategic	Met
	Pacific Walrus *(Odobenus rosmarus divergens)*	Alaska [d]	Strategic	Met
Cetacea	Killer whale *(Orcinus orca)*	Eastern North Pacific Alaska Resident	None	Met
		Eastern North Pacific GOA, Aleutian Islands, and Bering Sea transient	None	Met
		Offshore***	None	Unknown*
	Pacific White-sided dolphin (*Lagenorhynchus obliquidens*)	North Pacific	None	Met
	Harbor porpoise *(Phocoena phoecena)*	Bering Sea	None	Met
	Dall's porpoise (*Phocoenoides dalli*)	Alaska	None	Met
	Beluga whale *(Delphinapterus leucas)*	Beaufort Sea	None	Met
		Eastern Chukchi Sea	None	Met
		Eastern Bering Sea	None	Unknown*
		Bristol Bay	None	Unknown**
	Baird's beaked whale (*Berardius bairdii*)	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 (Also known as Bering-Chukchi-Beaufort stock)	Endangered, Depleted, Strategic	Met
	Humpback whale *(Megaptera novaeangliae)* †	Western North Pacific‡	Endangered, Depleted, Strategic	Not Met
		Central North Pacific ‡‡	Mexico DPS-Threatened, Depleted, Strategic Hawaii DPS - None	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
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: Muto et al 2019; Carretta et al 2019; List of Fisheries for 2019 (May 16, 2019 84 FR 22052)
* Unknown due to unknown abundance estimate and PBR.
** Unknown due to inadequate observer coverage or unreliable SI/M estimate.
*** This stock is found in the Pacific, rather than in the Alaska, SAR.
† On September 8, 2016, NMFS published a final decision revising the status of humpback whales under the ESA (81 FR 62259), effective October 11, 2016. In the 2016 decision, NMFS recognized the existence of 14 DPSs, classified several as endangered and one as threatened, and determined that the remaining DPSs do not warrant protection under the ESA. Three DPSs of humpback whales occur in waters off the coast of Alaska: the Asia/2nd Western North Pacific (WNP) DPS, which is endangered, the Mexico DPS, which is threatened, and the Hawaii DPS, which is not protected under the ESA. Whales from these three DPSs overlap to some extent on feeding grounds off Alaska. As of October 2016, the MMPA stock designations of humpback whales found in Alaska have not been updated to reflect the newly-designated DPSs.
‡ Corresponds to the new Asia/ 2nd WDPS (endangered).
‡‡ Includes the new Mexico (threatened) and Hawaii DPSs (not protected under the ESA).
[a] Bearded seals: Two DPSs are identified for this subspecies, but only the Beringia DPS occurs in US waters. Therefore, the Alaska stock identified under the MMPA SAR consists entirely of the Beringia DPS. Critical habitat for the Beringia DPS was proposed in January 2021.
[b] Spotted seals: Three DPSs are identified, but only the Bering DPS occurs in US waters. Therefore, the Alaska stock identified under the MMPA SAR consists entirely of the Bering DPS.
[c] Ringed seals were listed as threatened under the ESA in December 2012. Critical habitat for ringed seals was proposed in January 2021.
[d] Walrus – A petition to list walrus under the ESA was determined to be warranted, but precluded by higher priorities (76 FR 7634, February 10, 2011). As of October 5, 2017, NMFS determined that listing is no longer warranted for the Pacific walrus.

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 Supplemental Information Reports (SIRs) (NMFS 2020). These documents are also incorporated by reference. Direct and indirect interactions between marine mammals and fishing vessels may occur due to temporal and spatial overlap in marine mammal occurrence and commercial fishing activities, as well as overlap between the size and species of fish harvested that are also important marine mammal prey. The BSAI and GOA groundfish FMPs contain measures to protect marine mammals from potential effects of fishing, and several species are the subjects of continuing research and monitoring to further define the nature and extent of fishery impacts on them.

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 HAL 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 North Atlantic right whales, humpback whales, fin whales, and grey whales, are particularly susceptible to becoming entangled in trap or pot gear due to spatial overlap with fisheries and their feeding behavior. Baleen whale entanglements in fishing gear generally involve humpback whales, though incidental take of other baleen whale species have occurred. 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.

The following paragraphs describe the reasoning behind which species were not expected to be affected by the alternatives and therefore were not analyzed. Not all species listed in Table 3-9Table 3-10, and Table 3-11 are likely to be affected by this action, and any potential impacts that do occur are expected to be minimal due to the anticipated increase in effort of the sablefish fishery. Many of these species do not generally overlap with the action area or the fishery, or they are not known to directly interact with HAL and pot gear. Additionally, the effects of this action expected on certain marine mammal species from Table 3-9Table 3-10, and Table 3-11 have been considered in previous NEPA analyses, which are outlined here.

NMFS has completed ESA section 7 consultations for the Federal BSAI and GOA groundfish fisheries for all ESA-listed species, either individually or in groups. The last programmatic ESA section 7 consultation on the effects of the groundfish fisheries, as authorized by the BSAI groundfish FMP, was initiated in 2006 (NMFS 2006) and completed in 2010 (NMFS 2010). On June 21, 2006, NMFS Alaska Region Protected Resources Division agreed with the determination by the Sustainable Fisheries Division that the groundfish fisheries were not likely to adversely affect the following listed marine mammal species or designated critical habitat: blue whale, right whale or designated right whale critical habitat, sei whale, or fin whale (NMFS 2006). Additionally, the general habitat and ranges of blue and sei whales is not likely to overlap with areas where GOA and BSAI sablefish IFQ gear is deployed and therefore would not be expected to be affected by this action.

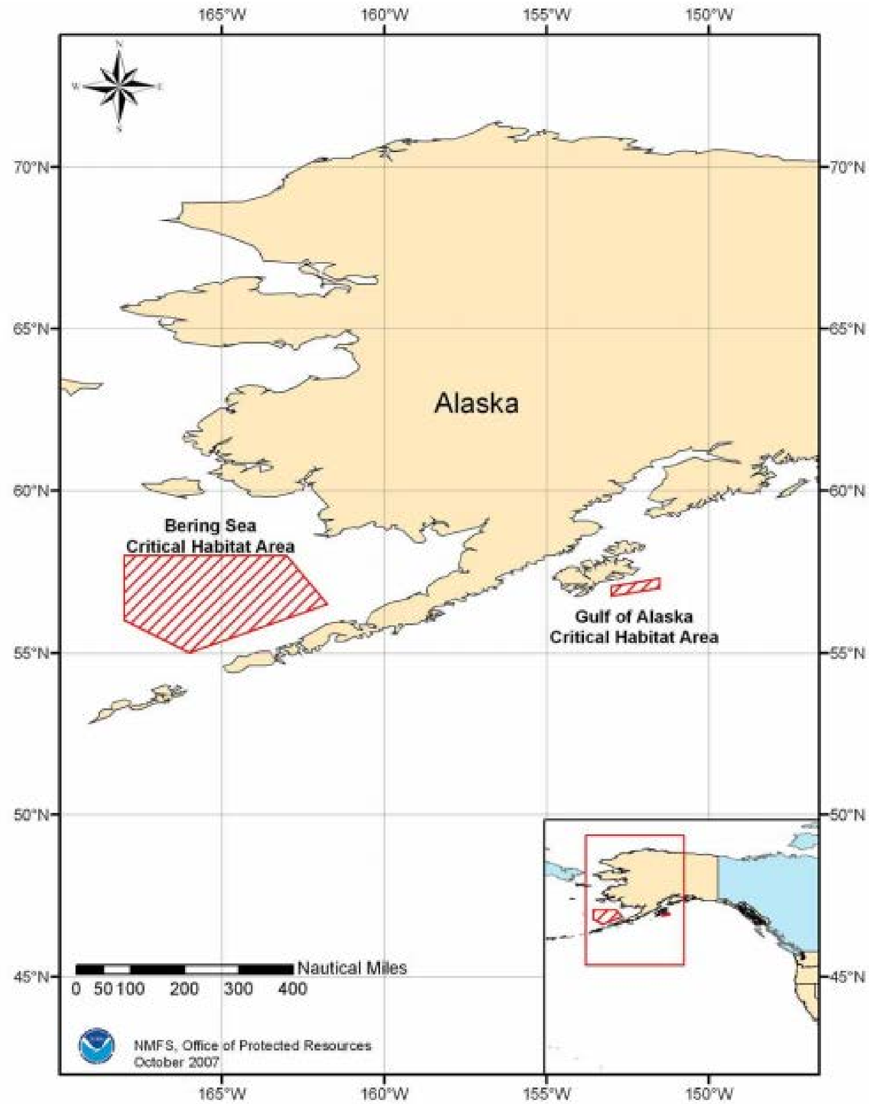
The 2010 biological opinion (NMFS 2010) concluded that the BSAI and GOA groundfish fisheries were not likely to jeopardize the continued existence of the eastern DPS of Steller sea lion, humpback whales, sperm whales or fin whales. However, the 2010 biological opinion also concluded that NMFS could not ensure that the BSAI and GOA groundfish fisheries were not likely to jeopardize the continued existence of the Steller sea lion western DPS of (WDPS) or adversely modify its designated critical habitat. Additional protection measures to conserve prey for Steller sea lions in the western and central Aleutian Islands to ensure that the fisheries were not likely to jeopardize the continued existence of the Steller sea lion WDPS or adversely modify its designated critical habitat were implemented in the fisheries in 2011 (76 FR 2027, January 12, 2011) and amended again in 2015 (79 FR 70286, November 25, 2014) following the completion of a biological opinion on 2015 management measures (NMFS 2014).

The USFWS listed the southwest Alaska DPS of the northern sea otter (northern sea otter SWDPS) as threatened under the ESA in 2005. In 2013, NMFS and the USFWS consulted on the effects of the BSAI and GOA groundfish fisheries on the northern sea otter SWDPS and determined that the BSAI and GOA groundfish fisheries were not likely to adversely affect the endangered southwest Alaska DPS of the northern sea otter or designated critical habitat (NMFS 2013).

Although some northern fur seals are caught incidental to commercial fisheries, the number is low compared to the PBR. Based on currently available data, the minimum estimate of the mean annual U.S. commercial fishery related mortality and serious injury rate for this stock (2.2 fur seals) is less than 10% of the calculated PBR (10% of PBR = 1,140) and is therefore considered to be insignificant and approaching a zero mortality and serious injury rate. The total estimated annual level of human-caused mortality and serious injury (399 fur seals) does not exceed the PBR (11,295) for this stock (Muto et al. 2019). This action is not likely to adversely affect the Eastern Pacific stock of northern fur seals.

NMFS designated critical habitat for the North Pacific right whale on April 8, 2008 (73 FR 19000; Figure 3-3) and concluded on April 30, 2008 (NMFS 2008) that fisheries in the BSAI and GOA were not likely to adversely affect the right whale or its critical habitat. NMFS reached this conclusion because the density of fishing effort in the areas comprising North Pacific right whale critical habitat is low compared with regions outside Alaska where right whale interactions have occurred, the low numbers of right whales in Alaska, and that most of the right whales appear to migrate from Alaska waters seasonally (though a few may come early or stay late or even over-winter) (Muto et al. 2019).

Figure 3-3 North Pacific Right Whale Critical Habitat



At its April 2018 meeting, the Council voiced a question regarding bowhead whale entanglements with pot gear in the BSAI. Reports of bowhead whales with entanglement scars or with pot gear attached are impacted by pot gear in areas that are unlikely to be affected by this action. Bowhead whales are generally in the Bering Sea during winter, as they are associated strongly with the ice edge. This edge is north of where the anticipated IFQ fishing would occur. Additionally, since the sablefish IFQ fishery is closed during the winter months, overlap during this time would be unlikely. In summer, the Bering-Chukchi-Beaufort Sea (BCBS) bowheads migrate to the Beaufort Sea and are not found where the sablefish fishery would occur, as sablefish are not found that far north. The Human-Caused Mortality and Injury of NMFS-Managed Alaska Marine Mammal Stocks reports show that one bowhead whale was entangled in commercial pot gear between 2013 and 2017, in the BSAI commercial blue king crab pot fishery (Muto et al. 2019).

Table 3-12 contains the significance criteria for analyzing the effects of the proposed action on marine mammals. Significantly beneficial impacts are not possible with the management of groundfish fisheries as few, if any beneficial impacts to marine mammals are likely with groundfish 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, as described in section 3.5. In this example, the prey availability is enhanced for these animals, because they need less energy for foraging. However, that benefit may be offset by adverse effect from an increased potential for entanglement in the gear or swallowing hooks.

Table 3-12 Criteria for determining significance of impacts to marine mammals.

	Incidental take / Entanglement in marine debris	Prey availability	Disturbance
Adverse impact	Mammals are taken incidentally to fishing operations or become entangled in marine debris.	Fisheries reduce the availability of marine mammal prey.	Fishing operations disturb marine mammals.
Beneficial impact	There is no beneficial impact.	Generally, there is no beneficial impacts, with the possible exception for certain net or hook and line fisheries, of increased prey availability from removals from gear.	There is no beneficial impact.
Significantly adverse impact	Incidental take is more than PBR or is considered major in relation to estimated population when PBR is undefined.	Competition for key prey species likely to constrain foraging success of marine mammal species causing population decline.	Disturbance of mammal is such that population is likely to decrease.
Significantly beneficial impact	Not applicable	Not applicable	Not applicable
Unknown impact	Insufficient information available on take rates.	Insufficient information as to what constitutes a key area or important time of year.	Insufficient information as to what constitutes disturbance.

According to the List of Fisheries (84 FR 54543, October 10, 2019) the sablefish IFQ fishery has the potential to interact with the following marine mammal species: Steller sea lions and sperm whales. Due to the potential range overlap and entanglement record in other HAL 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 (Table 3-13 and Table 3-14).The reported interactions between this fishery and marine mammals are shown in Table 3-15.

Table 3-13 Status of pinniped, mustelid, or ursid stocks/DPSs potentially affected by the action. (Source: 2017 Alaska Marine Mammal Stock Assessment Reports unless otherwise noted)

Marine Mammal Stock/DPS	Population Trends	Distribution in Action Area
Steller sea lion — Western DPS	Using survey counts from 1987-2018, western Steller sea lion pup and non-pup counts in Alaska in 2018 were modeled to be 53,624. Modeled count data collected from 1978 through 2018 indicates that pup and non-pup counts of western stock Steller sea lions in Alaska were at their lowest levels in 2002 and have increased at 1.52% y-1 and 2.05% y-1, respectively, between 2002 and 2018. However, there are strong regional differences across the range in Alaska, with positive trends in the GOA and the eastern Aleutian Islands region and generally negative trends to the west of Samalga Pass. Survey effort was focused in the Aleutian Islands in 2018. Non-pup and pup counts in the western Aleutians have been in a steep decline overall. However, modeled realized counts show that there was a period of stability in this region from 2014 to 2016 (and potentially an increase in pup counts), followed by a decline between 2016 and 2018. Pup counts in the eastern (-33%) and central (-18%) GOA declined sharply between 2015 and 2017, counter to the continuous increases observed in both regions since 2002.	WDPS inhabits Alaska waters from Prince William Sound (stock boundary = 144°W) westward to the end of the Aleutian Island chain and into Russian waters Occur throughout Alaska waters, terrestrial haulouts and rookeries on Pribilof Islands, Aleutian Islands, St. Lawrence Island, and off the mainland. Use marine areas for foraging. Critical habitat designated around major rookeries, haulouts, and foraging areas.

Sources: Muto et al 2019; List of Fisheries for 2019 (May 16, 2019 84 FR 22052).

Table 3-14 Status of cetacean stocks potentially affected by the action

Cetacean Stock/DPS	Population Trends	Distribution in Action Area
Killer whale - Eastern North Pacific Alaska resident stock	The minimum population estimate (NMIN) for the Alaska Resident stock of killer whales based on photo-identification studies conducted between 2005-2009 is 2,084 animals. Data from Matkin et al. (2003) indicate that the component of the Alaska Resident stock that summers in the Prince William Sound and Kenai Fjords area is increasing. With the exception of AB pod, which declined drastically after the Exxon Valdez oil spill and has not yet recovered, the component of the Alaska Resident stock in the Prince William Sound and Kenai Fjords area increased 3.2% (95% CI = 1.94 to 4.36%) per year from 1990 to 2005 (Matkin et al. 2008).	Alaska resident whales are found from southeastern Alaska to the Aleutian Islands and Bering Sea. Intermixing of Alaska residents have been documented among the three areas, at least as far west as the eastern Aleutian Islands.
Killer whale - Eastern North Pacific Northern resident stock	The minimum population estimate (NMIN) for the Northern Resident stock of killer whales is 302 whales, which includes whales found in Canadian waters. From the mid-1970s to the 1990s, the Northern Resident killer whale population increased at an annual rate of 2.6% (i.e., from 122 whales in 1974 to 218 in 1997). A decline was reported from 1998 to 2001 at a rate of 7% per year. The increased mortality that drove this decline coincided with a period of reduced range-wide Chinook salmon abundance, their primary prey (Ford et al. 2010). Then, after 2001, the growth was positive again with the population increasing at an average rate of 2.9% per year from 2002 to 2014. This represents an average annual increase of 2.2% over the 40-year time series. However, annual 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.	The Eastern North Pacific Northern Resident stock is a transboundary stock and includes killer whales that frequent British Columbia, Canada, and Southeast Alaska (Dahlheim et al. 1997, Ford et al. 2000). They have been seen infrequently in Washington State waters. Members of the Northern Resident population have been documented in Southeast Alaska; however, they have not been seen to intermix with Alaska Residents
Humpback whale - Western North Pacific (primarily Western DPS)	Using the SPLASH population estimate (N) of 1,107 and an assumed conservative CV(N) of 0.300 would result in an Nmin for this humpback whale stock of 865. The SPLASH abundance estimate for Asia/2nd western N Pacific population represents a 6.7% annual rate of increase over the 1991-1993 abundance estimate (Calambokidis et al. 2008). However, the 1991-1993 estimate was for Ogasawara and Okinawa breeding grounds only, whereas the SPLASH estimate includes the Philippines, so the annual rate of increase is biased high to an unknown degree.	The winter distribution of humpback whales in the Western stock includes several island chains in the western North Pacific, including the Ogasawara Islands, the Okinawa region, and in the Philippines. Humpback whales are reported to also occur in the South China Sea north of the Philippines near Taiwan, and east of Ogasawara in the Marshall and Mariana Islands. Humpback whales are increasingly seen north of the Bering Strait into the northeastern Chukchi Sea, with some indication that more humpback whales are seen on the Russian side north of the Bering Strait. A large area of overlap with the western North Pacific stock in the summer occurs in Southcentral Alaska and along the Aleutian Islands to about Umnak Island, as well as in Southwestern Alaska and Bristol Bay to approximately Cape Newenham.
Humpback whale - Central North Pacific (primarily Mexico and Hawaii DPS)	The best minimum population estimate for the population is 7,891. Overall, the abundance trend is increasing and from SPLASH estimates the North Pacific represents an annual increase of 4.9% since 1991–1993. SPLASH abundance estimates for Hawaii show annual increases of 5.5% to 6.0% since 1991–1993 (Calambokidis et al. 2008). Reliable trend information for the Mexico DPS, part of which constitutes a part of the Central North Pacific stock, is not available at this time due to variability in the estimates from the early 1990s. A 6.9% increase might be indicated across the entire Mexico DPS. However the Mexico DPS is listed as threatened due to a low abundance estimate and the ongoing threat of entanglement in fishing gear.	The winter distribution of the Central North Pacific stock is primarily in the Hawaiian archipelago and a smaller percentage along the Pacific Mexican coast of mainland Mexico, the Baja Peninsula, and the Revillagigedos Islands. In summer, the majority of whales from the Central North Pacific stock are found in the Aleutian Islands, Bering Sea, Gulf of Alaska, and Southeast Alaska/northern British Columbia. A large area of overlap with the western North Pacific stock in the summer occurs in Southcentral Alaska and along the Aleutian Islands to about Umnak Island, as well as in Southwestern Alaska and Bristol Bay to approximately Cape Newenham.

Cetacean Stock/DPS	Population Trends	Distribution in Action Area
Sperm whale – North Pacific	Reliable abundance and population trends in Alaska waters are unavailable.	The sperm whale is one of the most widely distributed marine mammal species. In the North Pacific, sperm whales are distributed widely, with the northernmost boundary extending from Cape Navarin (62°N) to the Pribilof Islands and may move to higher latitudes in summer and to lower latitudes in winter. Sperm whales are found year-round in the Gulf of Alaska, although they appear to be more common in summer than in winter. Female sperm whales have been found above 50°N, in the western Bering Sea and in the western Aleutian Islands with movements into the Gulf of Alaska and western Aleutians. Males are found in the summer in the Gulf of Alaska, Bering Sea, and waters around the Aleutian Islands. Sperm whales are known to inhabit waters 600 m or more depth.

Sources: Muto et al 2019; List of Fisheries for 2019 (May 16, 2019 84 FR 22052).

Table 3-15 Reported mortalities between the sablefish IFQ fishery in GOA and BSAI and marine mammals from 2013-2017. (Source: 2019 List of Fisheries, Muto et al. 2019, and Delean et al. 2020)

Marine Mammal	Year	Observed mortality in that year	Extrapolated mortality in that year	Estimated Mean annual Mortality
WDPS Steller Sea Lion	None	None	None	None
Sperm Whale	2013	0.75 (+0.75)[a]	6.8[b]	2.5[c]
	2016	0.75	5.7	
Humpback Whale	None	None	None	None
Killer Whale	None	None	None	None

[a]Total mortality and serious injury observed in 2013: 0.75 whales in sampled hauls + 0.75 whales in an unsampled haul.
[b]Total estimate of mortality and serious injury in 2013: 6.8 whales (extrapolated estimate from 0.75 whales observed in sampled hauls). An additional whale was observed in an unsampled haul and is not included in the extrapolated mortality.
[c]Mean annual mortality and serious injury for fishery: 12.5 extrapolated mortalities over 5 years

Steller Sea Lion Stock Status

The Steller sea lion range extends from California and associated waters to Alaska, including the GOA and Aleutian Islands, and into the Bering Sea and North Pacific and into Russian waters and territory. In 1997, based on biological information collected since the species was listed as threatened in 1990 (60 FR 51968), NMFS reclassified Steller sea lions as two distinct population segments under the ESA (62 FR 24345, May 5, 1997). The Eastern Distinct Population Segment (EDPS) of Steller sea lion (east of 144° W. longitude, a line near Cape Suckling, Alaska) was delisted in 2013 (78 FR 66140, November 4, 2013). The Western Distinct Population Segment (WDPS) Steller sea lion (west of 144° W. longitude) is currently listed as endangered. Steller sea lion critical habitat includes all rookeries, major haul-outs, and specific aquatic foraging habitats of the BSAI and GOA.

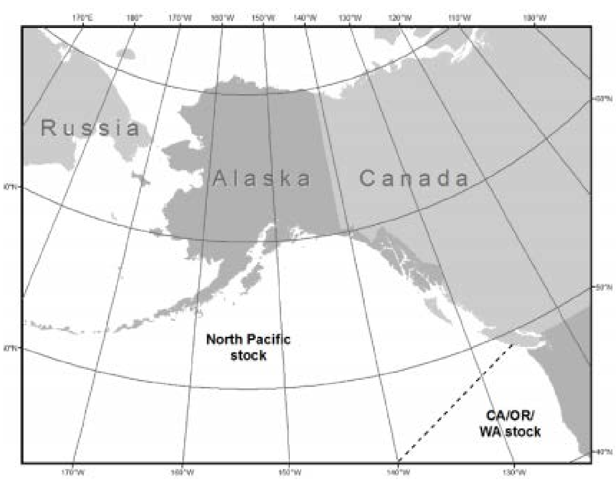
Steller sea lions forage at the sea surface to depths of ~400m, with maximum durations of dives 2-6 minutes depending on age (Pitcher et al. 2005). Steller sea lions are generalist predators that eat a variety of fishes and cephalopods distributed from nearshore demersal to epi-pelagic habitats; occasionally, other marine mammals and birds are consumed as well (Sinclair and Zeppelin 2002; Womble and Sigler 2006). While there are regional and temporal differences in the main prey consumed by Steller sea lions the most dominant prey are Atka mackerel, walleye pollock, salmon, Pacific cod, Pacific sand lance, arrowtooth flounder, Irish lords, rock sole, capelin, eulachon, Pacific sandfish, Pacific herring, rockfish, smooth lumpsucker, and Pacific hake and cephalopods.

Using survey counts from 1987-2018, western Steller sea lion pup and non-pup counts in Alaska in 2018 were modeled to be 53,624. Modeled count data collected from 1978 through 2018 indicates that pup and non-pup counts of western stock Steller sea lions in Alaska were at their lowest levels in 2002 and have increased at 1.52% y-1 and 2.05% y-1, respectively, between 2002 and 2018. However, there are strong regional differences across the range in Alaska, with positive trends in the Gulf of Alaska and the eastern Aleutian Islands region and generally negative trends to the west of Samalga Pass. Survey effort was focused in the Aleutian Islands in 2018. Non-pup and pup counts in the western Aleutians have been in a steep decline overall. However, modeled realized counts show that there was a period of stability in this region from 2014 to 2016 (and potentially an increase in pup counts), followed by a decline between 2016 and 2018. Pup counts in the eastern (-33%) and central (-18%) Gulf of Alaska declined sharply between 2015 and 2017, counter to the continuous increases observed in both regions since 2002.

In 2006, NMFS reinitiated an FMP-level Section 7 consultation on the effects of the groundfish fisheries on Steller sea lions, humpback whales, fin whales, and sperm whales to consider new information on these species and their interactions with the fisheries. The final biological opinion was released in October 2010. NMFS released an additional biological opinion in 2014 on the effects on Steller sea lions of the Federal groundfish fisheries and State of Alaska parallel groundfish fisheries for Atka mackerel, Pacific cod, and pollock primarily in the Aleutian Islands subarea (NMFS 2014). From the 2014 biological opinion an incidental take statement for Steller sea lions was issued for commercial fishing operations for incidental mortality and serious injury of up to 42 WDPS Steller sea lions every three years.

Sperm Whale Stock Status

Figure - Sperm whale distribution and stock delineation.

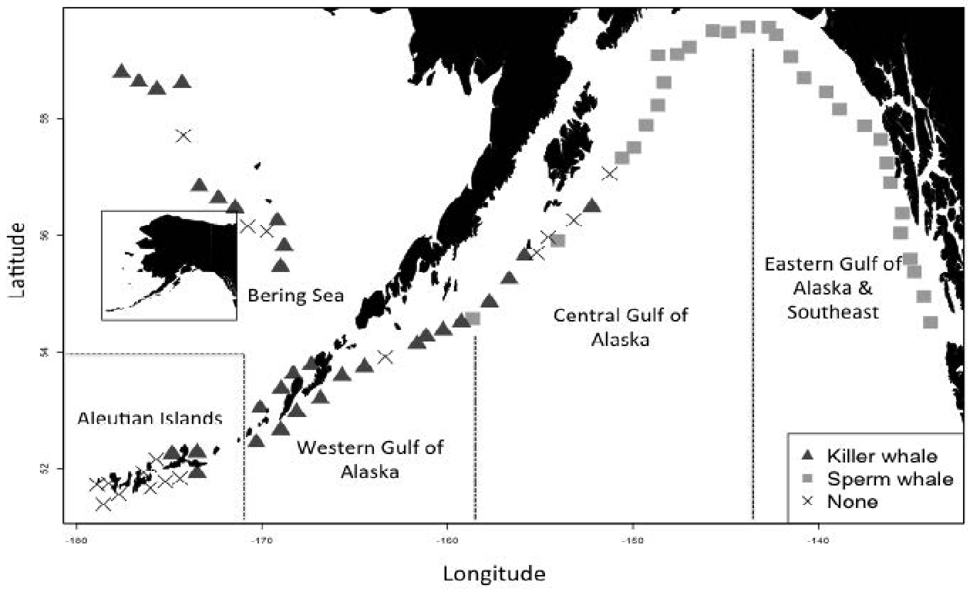


In the North Pacific, sperm whales are distributed widely with males and females concentrated seasonally in the Subtropical Frontal Zone (ca. 28ºN–34ºN) and the Subarctic Frontal Zone (ca. 40ºN–43ºN), and males also concentrated seasonally near the Aleutian Islands and along the Bering Sea shelf edge (Mizroch and Rice 2013) (). Sperm whales generally inhabit waters 600m and deeper. While females and young generally stay in tropical and temperate waters, males may be seen during the summer in the GOA and BSAI (ADF&G n.d.), where they feed on the rich biomass of the North Pacific. Sperm whales feed on medium to large-size squids and large demersal and mesopelagic sharks, skates, and fishes, such as sablefish (Rice 1989; Wild et al. 2020). Abundance and populations trends of sperm whales in Alaska waters are unknown. No information on trend is available because historical estimates of the abundance of sperm whales in the North Pacific are considered unreliable. Kato and Miyashita (1998) reported 102,112 sperm whales (CV = 0.155) in the western North Pacific, with the caveat that their estimate is likely positively biased. A more recent estimate for the GOA indicates a population size of about 345 sperm whales (Rone et al. 2017). However, this estimate is for a subarea of stock distribution, was unlikely to include females and juveniles in tropical and subtropical waters, and does not account for animals missed on the trackline; therefore, it is not considered a reliable estimate. Sighting surveys conducted by the AFSC's Marine Mammal Laboratory (MML) in the summer months between 2001 and 2010 found sperm whales to be the most frequently sighted large cetacean in the coastal waters around the central and western Aleutian Islands (MML, unpubl. data). A mean annual serious injury and mortality rate of 2.5 for sperm whale in the Gulf of Alaska sablefish IFQ fishery is estimated for the 2013-2017 timeframe, the most recent period for which data are available, with an estimated annual serious injury and mortality rate of 4.5 for all fisheries (Muto et al. 2019; Delean et al. 2020). Because the most recent PBR of 0.5 animals for the North Pacific sperm whale stock is derived from the 2017 GOA estimate of 345 for only a small portion of the stock's range and which does not account for females and juveniles in tropical and subtropical waters, it is not considered a reliable index for the entire stock. Overall, incidence of sperm whale entanglement in Alaska appears to be low, and, despite uncertainties in the assessment of the North Pacific stock of sperm whales, including the broad-scale distribution of sperm whales in Alaska waters, current abundance estimate, Nmin, PBR level, or trend in abundance for the entire stock, would not be expected to reach a level that would have population-level consequences (NMFS 2010). According to the 2010 Biological Opinion (NMFS 2010), the potential for ship strikes is minimal and unlikely to result in an adverse population level effect for sperm whales in Alaska and is further corroborated by the 2019 SAR report where 0.2 ship strikes are reported annual (none from sablefish fleet). On the basis of total abundance, current distribution, and regulatory measures that are currently in place, it is unlikely that this stock is in danger of extinction (Braham 1992, as cited in Muto et al. 2017).

Depredation by sperm whales is common in the Alaska sablefish IFQ fishery (Sigler et al. 2008; Peterson & Hanselman 2017; Peterson et al. 2014). Fishery participants have stated that whale depredation of sablefish hooked on longlines is an increasing problem (personal communication, R. Hanson 2018; personal communication, J. Kauffman 2018). In a study conducted by Peterson and Carothers (2013), 87% of longline fishermen surveyed perceived whale depredation as worsening between 1990 and 2010. Because Alternative 2 will potentially increase fishing effort in the sablefish IFQ fishery a discussion of whale depredation in the fishery is important to set the stage for potential effects of this action.

Sperm whale depredation tends to be most prevalent in the Central and Eastern GOA (Figure 3-4) Of the stations sampled by in the AFSC longline survey, all instances of sperm whale depredation in the BSAI have occurred in the Aleutian Islands (NMFS 2010; Hanselman et al. 2018). In 1995, the sablefish and Pacific halibut longline fisheries transitioned to an Individual Fishing Quota (IFQ) management system and extended their fishing season from quick "derby-style" openers to full nine-month seasons. The lengthened sablefish season may have provided more opportunities for sperm whales to learn to depredate on fishing gear and rehearse the behavior (Hill et al. 1999; Thode et al. 2005; Sigler et al. 2008; Peterson and Carothers 2013). Sperm whales were also likely to be present when CPUE is high, revealing that whales and fishers both know the most productive fishing areas, but confounding the use of CPUE as a metric for depredation (Straley et al. 2015). Results from a recent study on sperm whale depredation suggest much higher percentage CPUE reductions when sperm whales are depredating (15%) than previous studies in the Alaska region (Hanselman et al. 2018). This reduces fishery catch rates and decreases the accuracy of stock assessments. Although no reliable estimate of sperm whale abundance in the GOA exists (Muto et al. 2019), an increasing number of interactions in most regions suggest that sperm whale numbers may be increasing in some areas. Sperm whales experienced heavy exploitation from commercial whaling in the North Pacific through the late 1970s (Mizroch and Rice 2013; Ivashchenko et al. 2014), but their numbers may be recovering in the GOA since the cessation of commercial whaling pressure in the 1980s.

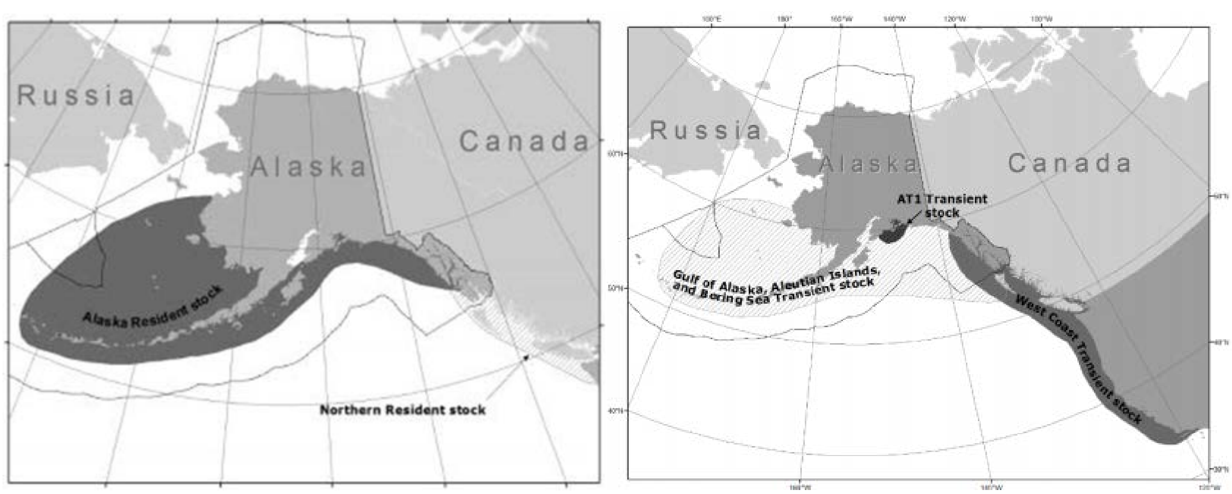
Figure 3-4 Depredation by whale species and sablefish management area based on NMFS longline survey, 1998-2011



Killer Whale Stock Status

Alaska resident and transient killer whales are found from southeastern Alaska to the Aleutian Islands and Bering Sea (Figure 3-5); these stocks overlap with the action area. Resident killer whales in Western Alaska show strong long-term associations consistent with a matrilineal pattern and have been shown to exhibit a high degree of site fidelity over time, with ranges generally limited to around 200 km (Ford and Ellis 2006; Forney and Wade 2006). Resident 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. Fisheries observers report that large groups of killer whales in the Bering Sea follow vessels for days at a time, actively consuming the processing waste, particularly on trawl vessels (NMFSAFSC, Fishery Observer Program, unpubl. data).

Figure 3-5 Approximate distribution of resident and transient killer whales in the eastern North Pacific



Abundance estimates for Alaska resident killer whales based on photo-identification studies conducted between 2005-2009 is 2,084 animals. Data from Matkin et al. (2003) indicate that the component of the Alaska Resident stock that summers in the Prince William Sound and Kenai Fjords area is increasing (Matkin et al. 2003). With the exception of AB pod, which declined drastically after the Exxon Valdez oil spill and has not yet recovered, the component of the Alaska Resident stock in the Prince William Sound and Kenai Fjords area increased 3.2% (95% CI = 1.94 to 4.36%) per year from 1990 to 2005 (Matkin et al. 2008). Abundance estimates for Northern resident killer whales for 2018 is 302 whales, which includes whales found in Canadian waters. From the mid-1970s to the 1990s, the Northern Resident killer whale population increased at an annual rate of 2.6% (i.e., from 122 whales in 1974 to 218 in 1997). A decline was reported from 1998 to 2001 at a rate of 7% per year. The increased mortality that drove this decline coincided with a period of reduced range-wide Chinook salmon abundance, their primary prey (Ford et al. 2010). Then, after 2001, the growth was positive again with the population increasing at an average rate of 2.9% per year from 2002 to 2014. This represents an average annual increase of 2.2% over the 40-year time series. However, annual 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. Seasonal and year-round occurrence has been noted for killer whales throughout Alaska (Consiglieri et al. 1982).

Based on currently available data, a minimum estimate of the mean annual mortality and serious injury rate due to U.S. commercial fisheries for the Eastern North Pacific Alaska Resident stock of killer whales (1 whale) is less than 10% of the PBR (10% of PBR = 2.4) and, therefore, is considered to be insignificant and approaching zero mortality and serious injury rate. A minimum estimate of the total annual level of human-caused mortality and serious injury (1 whale) is not known to exceed the PBR (24). Likewise for the Eastern North Pacific Northern Resident stock, the minimum estimated mean annual U.S. commercial fishery-related mortality and serious injury rate is zero, which does not exceed 10% of the PBR (10% of PBR = 0.22) and, therefore, is considered to be insignificant and approaching a zero mortality and serious injury rate. The minimum estimated mean annual level of human-caused mortality and serious injury (0.2) is not known to exceed the PBR (2.2) (Muto et al. 2019).

Depredation by killer whales is common in the Alaska sablefish IFQ fishery (Sigler et al. 2008; Peterson and Hanselman 2017; Peterson et al. 2014). Fishery participants have stated that whale depredation of sablefish hooked on longlines is an increasing problem (personal communication, R. Hanson 2018; personal communication, J. Kauffman 2018). In a study conducted by Peterson and Carothers (2013), 87% of longline fishermen surveyed perceived whale depredation as worsening between 1990 and 2010. Because Alternative 2 will potential increase fishing effort in the sablefish IFQ fishery a discussion of whale depredation in the HAL fishery is important to set the stage for potential effects of this action.

Killer whale depredation of sablefish generally occurs in the BS, AI, and WGOA management areas (Figure 3-4). 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 and Carothers 2013). Killer whales prey upon several groundfish species that are caught on longline gear in Western Alaska, including sablefish, Greenland turbot, arrowtooth flounder and Pacific halibut (Yano and Dahlheim 1995; Peterson et al. 2013). This reduces fishery catch rates and decreases the accuracy of stock assessments.

In a survey of Alaska longliners carried out by Peterson & Carothers (2013), the majority of respondents (70.7%) that reported interactions with killer whales (primarily western Alaska) estimated that depredation rates exceeded 40% of catch. In 2013, Peterson et al. used NMFS sablefish longline survey data to explore spatial and temporal trends in killer whale depredation and to quantify the effect of killer whale depredation on catches of groundfish species in the BS, AI, and WGOA. When killer whales were present during survey gear retrieval, whales removed an estimated 54% to 72% of sablefish, 41% to 84% of arrowtooth flounder and 73% of Greenland turbot. Overall sablefish catches (depredated and non-depredated sets) were lower by between 11% and 29% in all three management areas. During the study period from 1998-2011, the frequency of killer whale interactions remained stable in the BS while increasing in the AI and WG. The proportion of skates preyed upon significantly increased in the AI, and data in the BS showed no significant trend.

In follow-up studies by Peterson et al. (2014, 2017), the authors extended their analysis to evaluate the impacts of killer whale depredation on commercial longline fisheries in Western Alaska (Peterson et al. 2014; Peterson and Hanselman 2017). Those studies applied a statistical modeling approach to NMFS observer data and fishermen-collected depredation data to: (1) estimate the frequency of killer whale depredation of commercial longlines; (2) estimate depredation-related catch per unit effort reductions; and (3) assess direct costs and opportunity costs incurred by commercial longline fleets in Western Alaska as a result of killer whale interactions. The percentage of commercial fishery sets affected by killer whales was highest for sablefish in the BS (13%) and was relatively low in the AI and WGOA (approximately 2%).

Humpback Whale Stock Status

Humpback whales were initially listed in 1969 with the Endangered Species Conservation Act, and maintained in the status of endangered when the ESA passed into law in 1973. A Recovery Plan for Humpback whales was also adopted in 1991(NMFS 1991). On September 8, 2016, NMFS published a final rule that revised the listing of humpback whales under the ESA by removing the original, taxonomic-level species listing, and in its place listing four DPSs as endangered and one DPS as threatened (81 FR 62260). Although the ESA was later amended to require the designation of critical habitat for listed species, when humpback whales were originally listed, there was no statutory requirement to designate critical habitat for this species. Section 4(a)(3)(A) of the ESA now requires that, to the maximum extent prudent and determinable, critical habitat be designated at the time of listing (16 U.S.C. 1533(a)(3)(A)). Thus, the listing of DPSs of humpback whales under the ESA in 2016 triggered the requirement to designate critical habitat, to the maximum extent prudent and determinable, for those DPSs occurring in areas under U.S. jurisdiction, including the Western North Pacific, Mexico, Hawaii and Central America DPSs. The critical habitat that has been proposed for humpback whales overlaps with the sablefish IFQ fishery (84 FR 54354, October 9, 2019). The historic summering range in the North Pacific encompasses coastal and inland waters around the Pacific Rim from Point Conception, California, north to the GOA and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk. The humpback whale population in much of this range was considerably reduced as a result of intensive commercial exploitation during this century.

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). For the area that comprised the action area Figure 3-6(humpback whales from the Hawaii DPS comprise a majority of the whales present, followed by whales from the Mexico DPS and then the Western North Pacific DPS (Wade et al. 2016) (Figure 3-7 and Figure 3-6). However, as there is overlap in the feeding range for these three stocks of humpbacks, it is nearly impossible to distinguish an individual from one stock from another.

Figure 3-6. Approximate distribution of Western North Pacific humpback whales

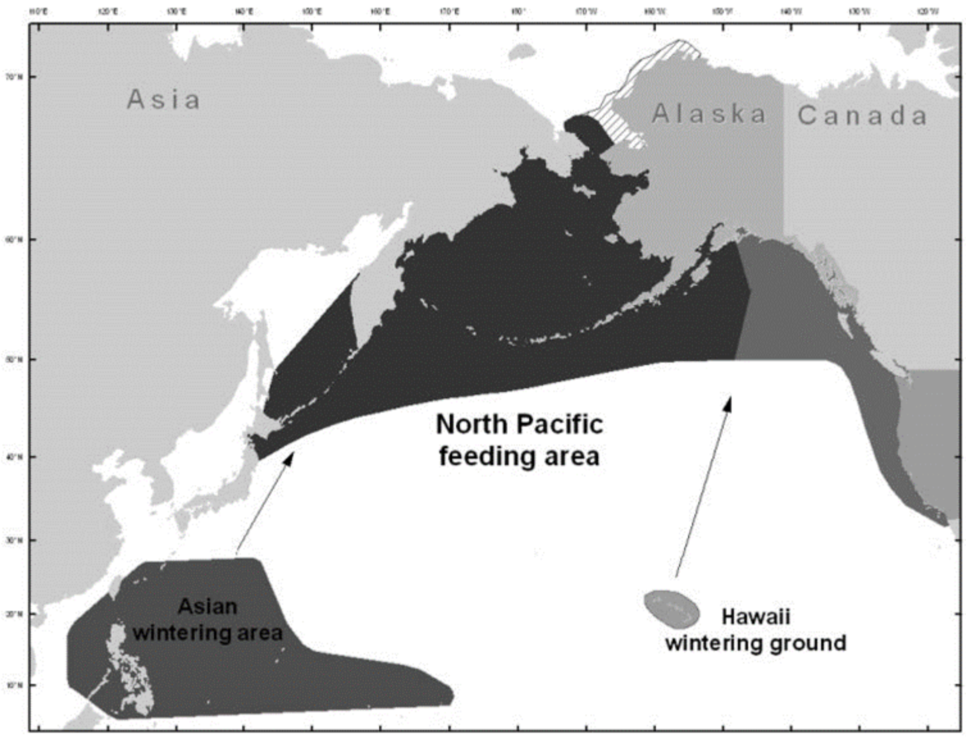
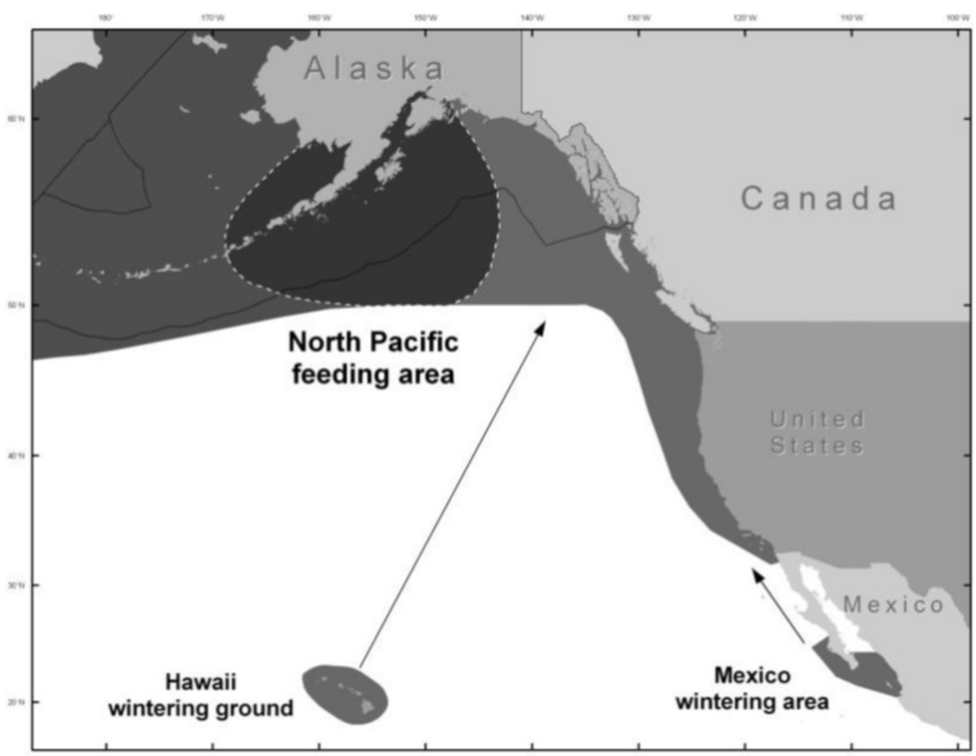


Figure 3-7 Approximate distribution of Western North Pacific humpback whales



These three DPS of humpback whales migrate to Alaska to feed. While humpbacks may be present at any time of the year in Alaska, they are most prevalent in the summer. Humpback whales forage at the sea surface to depths of ~200m (Goldbogen et al. 2008) and are limited to very short durations despite their large body size (Croll et al., 2005; Panigada et al., 1999), due to the energetic cost of lunge feeding (Acevedo-Gutierrez et al., 2002). Humpback whales primarily feed on euphausiids, such as krill, small forage fish such as herring, capelin and sand lance and occasionally juvenile salmon (Dolphin 1987; Witteveen et al. 2012; Chenoweth et al. 2017). Recent population estimates for humpback whales place the Central North Pacific stock (primarily Hawaii and Mexico DPS) at 7,891 individuals and the Western North Pacific stock (primarily Western North Pacific DPS) at 865 individuals, for a total of 8,756 humpbacks potentially feeding in Alaskan waters (Muto et al. 2019).

NMFS has determined that for humpback whales, the mortality and serious injury incidental to commercial fishing operations will have a negligible impact (60 FR 45399; August 31, 1995). A 'negligible impact' is defined as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through an effect on annual rates of recruitment or survival. Section 7 consultation was completed in 2010 and included issuance of an incidental take Statement for humpback whales for commercial fishing operations of an average annual incidental mortality and serious injury in commercial fishery of up to 2 humpback whales from the Central North Pacific stock and 1 humpback whale from the Western North Pacific stock per year (NMFS 2010). All humpback whale stocks that range into Alaska have increasing populations (Muto et al. 2019).

Effects on Marine Mammals

No beneficial impacts to marine mammals are likely with groundfish 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. 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 fishing gear currently used in the sablefish IFQ fishery in the GOA. This analysis considers potential impacts on Steller sea lions, humpback whales, sperm whales and killer whales, the latter two of which are known to depredate fish caught in the sablefish IFQ fishery. 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. Any potential impacts that do occur are expected to be minimal due to the small predicted increase in effort of the sablefish IFQ fishery.

Alternative 1

Maintaining the current prohibition on the discard of sablefish in the sablefish IFQ fishery is the status quo or no action alternative. Requiring sablefish IFQ fishery participants to continue to retain sablefish would not address the purpose and need statement for the action, which stresses providing operational flexibility to carefully release sablefish to increase the value of the commercial harvest and to allow small fish to contribute to the stock biomass.

Under Alternative 1, there would be no expected changes in incidental take, prey availability, or disturbance effects.

<u>Incidental Take Effects</u>

The GOA sablefish HAL fishery is listed in the List of Fisheries for 2020 as Category II, with occasional incidental mortality and serious injury of marine mammals.

The GOA sablefish HAL fishery, BSAI sablefish HAL fishery, and BSAI sablefish pot fishery are listed in the List of Fisheries for 2020 as Category III, with a remote likelihood of or no known interaction with any marine mammal species.

Adult sablefish are generally found at depths greater than 200 m along the continental slope, shelf gullies and deep fjords, whereas juvenile sablefish (less than 40 cm) spend the first 2-3 years farther inshore along the continental shelf and begin to move out to the continental slope around age 4. The season dates for the sablefish IFQ fishery have varied by several weeks since 1995, but the monthly pattern has been from March to November with the majority of landings occurring in May – June, with a majority of the fishery fishing at depths from 200-1000m.

Steller Sea Lions
While there have been no reported interactions with the sablefish IFQ fishery and Steller sea lions from 2013-2017, there was one reported take in 2012 in the GOA sablefish HAL fishery (Muto et al. 2016). The minimum estimated mean annual U.S. commercial fishery-related mortality and serious injury rate (36 sea lions) is more than 10% of the PBR (10% of PBR = 32) and, therefore, cannot be considered insignificant and approaching a zero mortality and serious injury rate (Muto et al. 2019)as defined by implementing regulations for the MMPA . While the PBR for Steller sea lions, cannot be considered insignificant and approaching a zero mortality and serious injury rate, serious injury and mortality in the sablefish IFQ fisheries equates to 0% of the PBR from 2013-2017. Most takes of Steller sea lions occur in trawl fisheries, as such, 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.

Sperm Whales
The estimated serious injury and mortality rate of sperm whalesin the sablefish IFQ fishery from 2013-2017 (Muto et al. 2019; Delean et al. 2020) is 2.5.. However, because the NMIN is for only a small portion of the stock's range and does not account for females and juveniles in tropical and subtropical waters, the calculated PBR is not a reliable index for the entire stock. A minimum estimate of the mean annual level of fishery-caused mortality and serious injury for North Pacific sperm whales for all federally-managed fisheries between 2013 and 2017 is 4.7 whales. (NMFS 2010)Under the status quo in the GOA, sperm whales interfere with HAL fishing operations when they prey upon fish that are hooked. Due to this behavior, sperm whales 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 and sperm whales seem to be adept at separating fish from that gear type when comparing whale entanglement and depredation levels (Goethel et al. 2020). Overall, The likelihood of sperm whale entanglement in longline gear is very low (Dalla Rosa and Sechi 2007). While the minimum estimate for the total annual level of human-caused mortality and serious injury exceeds the PBR for a portion of the North Pacific sperm whale stock, as stated previously, NMFS considers that PBR unreliable and not applicable to the entire stock. As such, the 2019 SAR stated that this population is not likely in danger of extinction 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.

Killer Whales
There have been no observed mortality events between killer whales and the sablefish IFQ fishery from 2013-2017 (Muto et al. 2019; Delean et al. 2020). PBR is calculated to be 24 for Eastern North Pacific Alaska Resident stock and 2.2 for the Eastern North Pacific Northern Resident stock. A minimum estimate of the estimated mean annual level of fishery-caused mortality and serious injury between 2013 and 2017 is 1 and 0.2 for the Eastern North Pacific Alaska Resident stock and Eastern North Pacific Northern Resident stock respectively. Under the status quo in the BSAI, killer whales interfere with HAL fishing operations when they prey upon fish that are hooked. Due to this behavior, killer whales 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. The likelihood of

killer whale entanglement in longline gear is very low (Dalla Rosa and Sechi 2007). For killer whales, the minimum estimate of the total annual level of human-caused mortality and serious injury 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.

Humpbacks

While there have been no reported interactions with the sablefish IFQ fishery and humpback whales, the 2020 List of Fisheries (84 FR 54543, October 10, 2019) reports interactions between humpback whales and other commercial pot gear fisheries in the GOA and BSAI. Between 2013 and 2017, mortality and serious injury of humpback whales occurred with BSAI commercial pot gear (1) and Alaska State-managed commercial cod pot gear (parallel fishery) (1) (Muto et al. 2019). The minimum estimate of the mean annual and serious injury rate of humpback whales incidental to U.S. commercial fisheries in Alaska for both the Central North Pacific stock and the Western North Pacific stock from 2013-2017 is 0.65 whales (Muto et al. 2019). The PBR for the WNP stock, using the minimum population estimate of 865, is calculated to be 3 whales, whereas the PBR for the CNP stock, using the minimum population estimate of 7,891, is 83 animals (Muto et al. 2019). For humpback whales, the minimum estimate of the total annual level of human-caused mortality and serious injury 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 any significant population-level impacts as a result of Alternative 1.

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.

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.

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 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.

Alternative 2
Alternative 2 proposes an FMP amendment and regulatory change to allow vessels participating in the sablefish IFQ fishery to voluntarily discard sablefish in the BSAI and GOA. This could result in an increase in both the amount of gear deployed by vessels participating in the fishery and in the duration of the fishery, since vessels that choose to discard will need to increase effort to achieve the same amount of their quota. Compared to the status quo (alternative one), a slight negative effect may be expected from allowing the IFQ fleet to voluntarily discard sablefish in the BSAI and GOA. Under Alternative 2, while fishing effort may increase, the sablefish IFQ fishery is still constrained by existing regulations concerning the location and timing of the fishery, PSC and bycatch limits, and all other accountability measures currently in place.

<u>Incidental Take Effects</u>

Steller Sea Lions
From 2007 to 2017 there was one reported take of a Steller sea lion in the GOA sablefish longline IFQ fishery and none reported for the BSAI sablefish IFQ fishery (April 16, 2020 85 FR 21079). 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). As discussed in section 3.2.2, Alternative 2 could result in an increase in fishing effort equal to 20.9 %. Therefore a potential effect to Steller sea lions over a five year period (2013-2017) could be calculated as the existing effect of the sablefish IFQ fishery (0 documented interactions), plus a 20.9% increase of the current effect (0 + (0* 20.9%) =0). Over, 5 years this would equate to 0 takes per year. As there is little likelihood that the sablefish IFQ fishery would contribute significantly to the incidental take for Steller sea lions, an increase in effort in the sablefish IFQ fishery is not likely to have any impact on Steller sea lions.

Sperm Whales
Sperm whales that depredate on longline 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). Removing hooked sablefish from longline gear does not represent natural foraging for sperm 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. Under the preferred alternative, 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).

Sperm whales that depredate on longline gear may be at greater risk of vessel strike and/or entanglement in fishing gear. Although cetacean entanglements in longline fishing gear are relatively rare, there are reports of sperm whales becoming entangled in longline fishing gear in Alaska (Muto et al. 2019) . From 2013 to 2017 the estimated annual serious injury and mortality rate for sperm whales in the GOA sablefish IFQ fishery is 2.5. Recent studies have postulated that as the North Pacific sperm whale population recovers from commercial whaling, that depredation events may become even more common (Hanselman et al. 2018). As discussed in section 3.2.2, Alternative 2 could result in an increase in fishing effort equal to 20.9 %. Therefore a potential maximum effect to sperm whales over a five year period (2013 to 2017) would be the existing effect of the sablefish IFQ fishery (2.5 estimated annual serious injury and mortality), plus a 20.9% increase of the current effect (2.5 + (2.5* 0.209) = 3.01). this would be considered a maximum for any potential additional effect, since entanglement is thought to be primarily due to depredation right off the HAL gear, and impacts from depredating on discards may not translate as directly to entanglement. While this potential additional impact is above the estimated PBR for the population, NMFS considers the PBR set for sperm whales to be unreliable due to the fact that it omits females and juveniles from its calculation, so can be considered a minimum. This potential increase in sablefish IFQ 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 significant impact on sperm whales.

Killer Whales
Killer whales that depredate on longline fishing gear could be negatively impacted under Alternative 2. 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 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). 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. For instance, using photo-identification, Tixier et al. (2010) demonstrated that four out of eleven pods (35 out of 97 individuals) were involved in over 80 percent of the documented interactions with longline fisheries in the Crozet Exclusive Economic Zone (EEZ), indicating a degree of specialization. Whales that specialize in the depredation behavior could be at greater risk of negative impacts associated with the unnatural foraging behavior. Under the preferred alternative, there would be an increased risk of modifying marine mammal foraging behavior towards an unnaturally available and unreliable prey resource (Roche et al. 2007).

Killer whales that depredate on longline gear may be at greater risk of vessel strike and/or entanglement in fishing gear. The likelihood of killer whale entanglements in longline gear is very low; however, one female killer whale was incidentally captured in July 2004 off Brazil (Dalla Rosa and Sechi 2007). From 2013 to 2017 there were 0 observed interactions with killer whales in the sablefish IFQ fishery. As discussed in section 3.2.2, Alternative 2 could result in an increase in fishing effort equal to 20.9 %. Therefore the calculated effect to killer whales over a five year period (2013 to 2017) would be the existing effect of the sablefish IFQ fishery (0 documented interactions), plus a 20.9% increase of the current effect (0 + (0* 0.209) = 0). Over, 5 years this would equate to 0 takes per year. 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 interactions with the sablefish IFQ fishery and killer whales, an increase in effort is not likely to have a significant impact on killer whales.

Humpback Whales
There have been no reported interactions between humpback whales and the sablefish IFQ fishery (April 16, 2020 85 FR 21079). This is likely do to the fact that the sablefish IFQ 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. As discussed in section 3.2.2, Alternative 2 could result in an increase in fishing effort equal to 20.9 %. Therefore the calculated effect to humpback whales would be the existing effect of the sablefish IFQ fishery (0 documented interactions), plus a 20.9% increase of the current effect (0 + (0*

20.9%) = 0). Therefore, as there have been no documented interactions with the sablefish IFQ fishery and humpback whales, an increase in effort is not likely to have a significant impact on humpback 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, the preferred alternative has some potential expected to result in slight negative impacts on killer whales, sperm whales, and potentially humpback whales compared with the status quo.

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 20.9% 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 to do 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 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). Because disturbances to marine mammals under the status quo fishery are not likely to cause population level effects, it is unlikely that the effort increase expected under Alternative 2 will significantly disturb marine mammal species.

Reasonably Foreseeable Effects on Marine Mammals

Considering the potential impacts of the proposed action under the alternatives evaluated in this analysis together with the effects of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of reasonably foreseeable future actions, the overall potential impacts of the proposed action are determined to be not significant

3.6 Seabirds

3.6.1 Status

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 3-16; 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 3-16; 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 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 3-16 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	
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	

More information on seabirds in Alaska's EEZ may be found in several NMFS, Council, and USFWS documents:

- The URL for the USFWS Migratory Bird Management program is at http://alaska.fws.gov/mbsp/mbm/index.htm.
- Section 3.7 of the PSEIS (NMFS 2004) provides background on seabirds in the action area and their interactions with the fisheries. This may be accessed at https://alaskafisheries.noaa.gov/sites/default/files/pseis0604-chpt_3_7.pdf.
- The annual Ecosystem Status Reports have a chapter on seabird bycatch: https://access.afsc.noaa.gov/reem/ecoweb/index.php.
- The Seabird Fishery Interaction Research webpage of the Alaska Fisheries Science Center: http://www.afsc.noaa.gov/REFM/REEM/Seabirds/Default.php.

- The NMFS Alaska Region's Seabird Bycatch webpage: https://www.fisheries.noaa.gov/alaska/bycatch/seabird-bycatch-alaska.
- The BSAI and GOA groundfish FMPs each contain an "Appendix I" dealing with marine mammal and seabird populations that interact with the fisheries. The FMPs may be accessed from the Council's home page at http://www.alaskafisheries.noaa.gov/npfmc/default.htm.
- Washington Sea Grant has several publications on seabird takes, and technologies and practices for reducing them: https://wsg.washington.edu/seabird-bycatch-prevention-in-fisheries/
- The seabird component of the environment affected by the groundfish FMPs is described in detail in Section 3.7 of the PSEIS (NMFS 2004) and updated in the PSEIS Supplemental Information Report (NPFMC and NMFS 2015).
- Seabirds and fishery impacts are also described in Chapter 9 of the Alaska Groundfish Harvest Specifications EIS (NMFS 2007).
- USFWS. 2015. Biological Opinion for the Effects of the Fishery Management Plans for the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish Fisheries and the State of Alaska Parallel Groundfish Fisheries. Anchorage, AK: 52 pp. Document available at: https://alaskafisheries.noaa.gov/sites/default/files/analyses/usfws-biop-122315.pdf
- NMFS. 2015. Programmatic Biological Assessment on the Effects of the Fishery Management Plans for the Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish Fisheries and the State of Alaska Parallel Groundfish Fisheries on the Endangered Short-tailed Albatross (Phoebastria albatrus) and the Threatened Alaska-breeding Population of the Steller's Eider (Polysticta stelleri). Document available at: https://alaskafisheries.noaa.gov/sites/default/files/analyses/seabirdba0815.pdf
- Seabird Bycatch and Mitigation Efforts in Alaska Fisheries Summary Report: 2007 through 2015 (Eich et al. 2016). Document available at: https://repository.library.noaa.gov/view/noaa/12695
- Seabird Bycatch Estimates for Alaska Groundfish Fisheries Annual Report: 2015 (Eich et al. 2017). Document available at: https://repository.library.noaa.gov/view/noaa/16993
- Seabird Bycatch Estimates for Alaska Groundfish Fisheries 2016 through 2017 (Eich et al. 2018). Document available at: https://doi.org/10.25923/vb9g-s503
- Seabird Bycatch Estimates for Alaska Groundfish Fisheries 2018 (Krieger et al., 2019). Document available at: https://repository.library.noaa.gov/view/noaa/20231
- Seabird Bycatch Estimates for Alaska Groundfish Fisheries 2019 (Krieger and Eich 2020). Document available at: https://repository.library.noaa.gov/view/noaa/25244

3.6.2 Effects on Seabirds

Table 3-17 explains the criteria used in this analysis to evaluate the significant of the effects of fisheries on seabird populations.

Table 3-17 Criteria used to determine significance of impacts on seabirds.

	Incidental take	Prey availability	Benthic habitat
Insignificant	No substantive change in takes of seabirds during the operation of fishing gear.	No substantive change in forage available to seabird populations.	No substantive change in gear impact on benthic habitat used by seabirds for foraging.
Adverse impact	Non-zero take of seabirds by fishing gear.	Reduction in forage fish populations, or the availability of forage fish, to seabird populations.	Gear contact with benthic habitat used by benthic feeding seabirds reduces amount or availability of prey.
Beneficial impact	No beneficial impact can be identified.	Availability of offal from fishing operations or plants may provide additional, readily accessible, sources of food.	No beneficial impact can be identified.
Significantly adverse impact	Trawl and hook-and-line take levels increase substantially from the baseline level, or level of take is likely to have population level impact on species.	Food availability decreased substantially from baseline such that seabird population level survival or reproduction success is likely to decrease.	Impact to benthic habitat decreases seabird prey base substantially from baseline such that seabird population level survival or reproductive success is likely to decrease. (ESA-listed eider impacts may be evaluated at the population level).
Significantly beneficial impact	No threshold can be identified.	Food availability increased substantially from baseline such that seabird population level survival or reproduction success is likely to increase.	No threshold can be identified.
Unknown impacts	Insufficient information available on take rates or population levels.	Insufficient information available on abundance of key prey species or the scope of fishery impacts on prey.	Insufficient information available on the scope or mechanism of benthic habitat impacts on food web.

Short-tailed albatross are listed as endangered under the ESA. 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. In its 2015 biological opinion, the USFWS determined the groundfish fisheries off Alaska are likely to adversely affect short-tailed albatross, but they are not likely to jeopardize its continued existence (USFWS 2015). This biological opinion included an incidental take limit of six short-tailed albatross every two years in the groundfish fisheries off Alaska, either by hook-and-line gear or trawl gear.

Alternative 1

Incidental Take

Table 3-18 and Table 3-19 show estimates of incidental take of seabirds in the BSAI and GOA sablefish IFQ fishery, respectively, from 2010 through 2019. We refer the reader to Krieger and Eich (2020) for a description of how seabird bycatch estimates are calculated. In the BSAI, incidental take has historically been predominantly made up of Laysan albatross, and Northern fulmar. However, since 2016 virtually no seabirds are estimated to have been taken in the BSAI by the sablefish IFQ fishery.

Table 3-18 Estimated seabird bycatch in the sablefish IFQ fishery operating in the BSAI, 2010 through 2019. The * denotes seabirds taken in pot gear. All other estimates are for seabirds taken using HAL (data from Krieger and Eich 2020).

Species/Species Group	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Grand Total	Ann Avg.
Black-footed Albatross	0	7	0	13	0	21	0	0	0	0	41	4
Gulls	90	28	13	12	0	37	0	0	0	0	180	18
Laysan Albatross	96	9	90	110	54	123	75	0	0	0	557	56
Northern Fulmar	28	21	0	30	58	92	0	0	0	0	229	23
Shearwaters	6	35	0	0	71	27	0	0	0	0	139	14
Unidentified Albatrosses	0	0	0	0	23	0	0	0	0	0	23	2
Unidentified Birds	6	0	0	0	0	0	0	0	0	0	6	1
Northern Fulmar*	0	0	0	0	0	0	0	13	0	0	13	1
Total	226	100	103	165	206	300	75	13	0	0	1188	119

Incidental take of seabirds in the sablefish IFQ fishery is generally far greater in the GOA (Table 3-19). Here, incidental take has historically been predominantly made up of black-footed albatross, gulls, and Northern fulmar. Although take estimates have declined in recent years, the 2010 - 2019 average has remained relatively consistent throughout this time series.

Table 3-19 Estimated seabird bycatch in the sablefish IFQ fishery operating in the GOA, 2010 through 2019. All estimates are for seabirds taken using HAL. No takes of seabirds using pot gear occurred during this time series (data from Krieger and Eich 2020).

Species/Species Group	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Grand Total	Ann Avg.
Black-footed Albatross	53	204	82	385	228	343	171	423	269	243	2,401	240
Cormorants	0	0	0	0	0	28	0	0	0	0	28	3
Gulls	134	549	26	35	8	111	90	250	55	21	1,279	128
Laysan Albatross	76	166	17	69	24	22	44	0	22	36	476	48
Northern Fulmar	19	810	0	109	0	36	19	64	136	87	1,280	128
Shearwaters	0	62	0	0	0	5	20	0	0	41	128	13
Unidentified Albatrosses	0	0	0	28	0	0	0	0	52	14	94	9
Unidentified Birds	0	9	0	0	0	28	19	0	0	0	56	6
Total	282	1800	125	626	260	573	363	737	534	442	5742	575

Surface feeders, such as albatrosses, fulmars, shearwaters, and gulls, are attracted to fishing vessels' offal discharge and bait on HAL gear. Nearshore foragers, such as cormorants, terns, guillemots, murrelets, and puffins, are less likely to interact with offshore groundfish and halibut fisheries. Mostly Northern fulmar, shearwaters, gulls, and various alcid species are taken by pot gear.

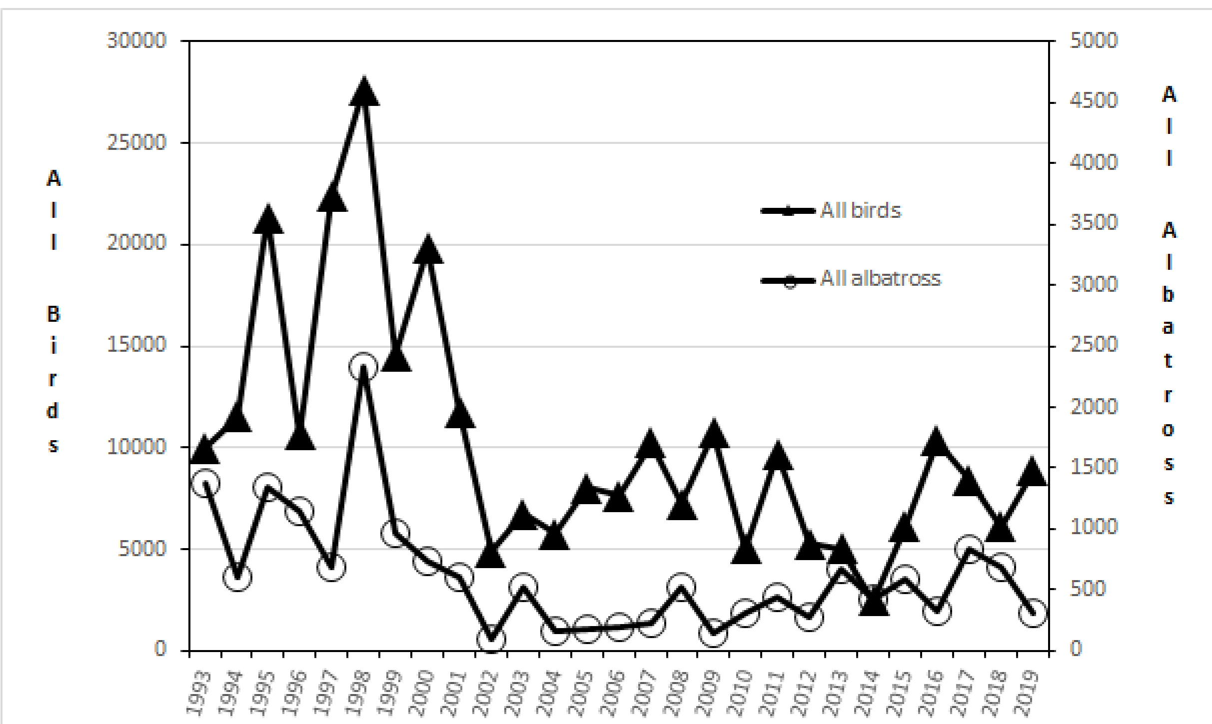
Of specific concern is the short-tailed albatross which is listed as endangered under the ESA. The USFWS consulted with NOAA Fisheries Alaska Region under Section 7 of the ESA on the effects of the groundfish fisheries on the endangered short-tailed albatross. In its 2015 biological opinion, the USFWS determined the groundfish fisheries off Alaska are likely to adversely affect short-tailed albatross, but they are not likely to jeopardize its continued existence (USFWS 2015). This biological opinion included an incidental take limit of six short-tailed albatross every two years in the groundfish fisheries off Alaska, either by hook-and-line gear or trawl gear. To date, no short-tailed albatross have been observed taken in the sablefish IFQ fishery.

In 1996, the Council established mandatory seabird avoidance measures for the longline fisheries, and approved more stringent requirements in 2001 (50 CFR Part 679.24(e)(2)). Seabird deterrent devices such as buoy bags or streamer lines are required for most groundfish longline fishing vessels. The Council has encouraged fishing industry initiatives to conduct research on new seabird avoidance measures, including studies on the effectiveness of paired streamer lines and integrated weight ground lines, and the development of techniques for minimizing seabird strikes with trawl warps and sonar transducer cables.

These research efforts, which were largely prompted by voluntary action on the part of the longline sector of the industry, indicated that paired streamer lines were nearly 100% effective at eliminating the catch of albatrosses and other surface-feeding birds. The sablefish and Pacific cod longline fishing fleets adopted this new technology two years before it was required, resulting in an eight-fold decrease in seabird mortality.

Implemented in January 2008, the Council's action specified that the use of seabird avoidance measures would not be required in Prince William Sound, Cook Inlet, and inside waters in Southeast Alaska except in outer Chatham Strait, Dixon Entrance, and outer Cross Sound. The Council action also identified performance standards for small vessels (those greater than 26 feet and less than or equal to 55 feet length overall) fishing in outside waters, and modified how seabird deterrent devices be used by small vessels. These efforts have resulted in a substantial reduction overall seabird bycatch estimates in fisheries operating off Alaska (Figure 3-8).

Figure 3-8 Seabird bycatch in Alaska groundfish fisheries (demersal longline, trawl, and pot) from 1993 through 2019 and halibut fisheries from 2013 through 2019, noting bycatch estimates for all birds (left indices; black triangles) and for albatrosses only (right indices; hollow circles). Note the difference in scale. Different data analysis methodologies were used (data from 1993 through 2006 are described in Fitzgerald et al. 2008; data from 2007 through 2019 are from the CAS).



The Groundfish PSEIS (NMFS 2004) found that the current management regime is effective at providing protection to ESA-listed seabirds and non-ESA listed seabirds, and that current fishing practices are not likely to result in significantly adverse impacts to seabirds. Direct and indirect interactions of seabirds with the sablefish IFQ fisheries are not likely to create a population-level impact on these species. Alternative 1 is not considered to have a significant impact on the incidental take of seabirds.

<u>Prey Availability</u>

The status quo groundfish 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 are expected, and impacts are expected to be negligible. Alternative 1 is not considered to have a significant impact on prey availability for seabirds.

Disturbance of Benthic Habitat

Several seabird species may be impacted indirectly by effects that fishing gear may have on benthic habitat used by seabird prey species. However, the EFH EIS states that very little information exists regarding the effects of longline gear on benthic habitat, and published literature is essentially nonexistent (NMFS 2005). Under the status quo alternative, there are presumed to be no impacts to the benthic habitat enough to decrease seabird prey base to the extent that it would impact survival rates or reproductive success. Alternative 1 is not considered to have a significant impact on benthic habitat for seabirds.

Alternative 2

Alternative 2 proposes an FMP amendment and regulatory change to allow vessels participating in the sablefish IFQ fishery to voluntarily discard sablefish in the BSAI and GOA. This could result in an increase in both the amount of gear deployed by vessels participating in the fishery and in the duration of the fishery, since vessels that choose to discard will need to increase effort to achieve the same amount of their quota.

Under Alternative 2, while fishing effort may increase, the sablefish IFQ fishery is still constrained by existing regulations concerning the location and timing of the fishery, PSC and bycatch limits, and all other accountability measures currently in place. While it is not possible to project how fishing effort may change from year to year under Alternative 2, using methods described above, it is reasonable to assume that effort is not likely to increase to a level that would have substantial impacts on seabirds.

Incidental Take

Based on methods described in Section 2.2.1.1 and Section 3.3.2, we assume an increase in fishing effort by as much as ~ 21% under Alternative 2. As stated above, this is likely an overestimate of the actual level of increased fishing that would occur but it provides an upper boundary for analysis.

From 2010 thru 2019, the three most common seabirds taken in the sablefish IFQ fishery are black-footed albatross, gulls, and northern fulmar (71.4% of total seabird bycatch in BSAI and GOA; Table 13 in Krieger and Eich 2020). Gulls and northern fulmars are among the most common seabirds found throughout Alaska with populations numbering into the hundreds of thousands (Krieger and Eich 2020). If we assume an increase in fishing effort would translate into a corresponding increase in takes of seabirds, we would expect an annual increase in the take of 27 individuals of both seabird species.

Black-footed albatross is the seabird with the most takes in the sablefish IFQ fishery (annual average of 240 birds). If we assume an increase in fishing effort would translate into a corresponding increase in takes of seabirds, we would expect an annual increase in the take of 50 birds. However, the black-footed albatross population size is currently estimated at 61,700 breeding pairs (Naughton et al. 2007), and is not considered to be in danger of collapse.

Takes of seabirds by pot gear is relatively uncommon both in the sablefish IFQ fishery and in all fisheries that occur in federal water off Alaska. In 2019, only 33 seabirds were taken in all federal fisheries off Alaska representing only 0.37 percent of the total seabird bycatch (Table 13 in Krieger and Eich 2020). As such, any increase in fishing effort with pot gear as a result of Alternative 2 is likely to have a negligible impact on the incidental take of seabirds.

Both short-tailed albatross and the Alaska-breeding population of Steller's eider are seabird species listed under the ESA and are known to occur in areas that overlap with the sablefish IFQ fishery. However, no takes of either of these species has ever been reported or observed in this fishery at the time this analysis was prepared.

Overall, actions that may result under Alternative 2 are not expected to result in a significant impact on the incidental take of seabirds.

Prey Availability

Under Alternative 2, while fishing effort may increase, the sablefish IFQ fishery is still constrained by existing regulations concerning the location and timing of the fishery, PSC and bycatch limits, and all other accountability measures currently in place. Under Alternative 2, no substantive changes are expected and impacts on seabird prey availability are expected to be negligible. Alternative 2 is not considered to have a significant impact on prey availability for seabirds.

Disturbance of Benthic Habitat

Under Alternative 2, while fishing effort may increase, the sablefish IFQ fishery is still constrained by existing regulations concerning the location and timing of the fishery, PSC and bycatch limits, and all other accountability measures currently in place. Furthermore, the EFH EIS states that very little information exists regarding the effects of longline gear on benthic habitat, and published literature is essentially nonexistent (NMFS 2005). As such, the potential increase in fishing effort as a result of changes under Alternative 2 are not likely to have impacts on the benthic habitat enough to decrease seabird prey base to the extent that it would impact survival rates or reproductive success. Alternative 2 is not considered to have a significant impact on benthic habitat for seabirds.

Reasonably Foreseeable Effects on Seabirds

Reasonably foreseeable future actions for seabirds include ecosystem-sensitive management; rationalization; traditional management tools; actions by other federal, state, and international agencies; and private actions, as described in Sections 8.4 and 9.3 of the Harvest Specifications EIS (NMFS 2007). Ecosystem-sensitive management, rationalization, and traditional management tools are likely to increase protection to seabirds by considering these species more in management decisions, and by improving the management of fisheries through the restructured Observer Program, catch accounting, seabird avoidance measures, and vessel monitoring systems. Changes in the status of species listed under the ESA, the addition of new listed species or critical habitat, and results of future Section 7 consultations may require modifications to groundfish fishing practices to reduce the impacts of these fisheries on listed species and critical habitat. Additionally, since future TACs will be set with existing or enhanced protection measures, we expect that the effects of the fishery on the harvest of prey species and disturbance will not increase in future years.

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 potential impacts of the proposed action under the alternatives evaluated in this analysis together with the effects of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of reasonably foreseeable future actions, the overall potential impacts of the proposed action are determined to be not significant.

of the reasonably foreseeable future actions listed above, the cumulative impacts of the proposed action are determined to be not significant.

3.7 Habitat

3.7.1 Status

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.

In 2005, NMFS and the Council completed the EIS for EFH Identification and Conservation in Alaska (NMFS 2005). The EFH EIS evaluates 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 describes 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 concludes that despite persistent disturbance to certain habitats, the effects on EFH are minimal because the analysis finds no indication 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 concludes 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 indicates 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 2012) and (Simpson et al. 2017). 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 (Simpson et al. 2017). Maps and descriptions of EFH for groundfish species are available at: https://www.fisheries.noaa.gov/alaska/habitat-conservation/essential-fish-habitat-efh-alaska

3.7.2 Effects of the Alternatives

Alternative 1

The 2005 EFH EIS (NMFS 2010), 2010 EFH Review (NMFS 2011) , and 2015 EFH Review (Simpson et al. 2017) 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. Similarly, the 2005 EFH EIS, 2010 EFH Review, and 2015 EFH Review (NMFS 2005) found no substantial adverse effects to habitat in the BSAI or GOA caused by fishing activities. The analysis in the EFH EIS concludes that current fishing practices in the sablefish IFQ fishery 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.

Alternative 2

Alternative 2 proposes an FMP amendment and regulatory change to allow vessels participating in the sablefish IFQ fishery to voluntarily discard sablefish in the BSAI and GOA. This could result in an increase in both the amount of gear deployed by vessels participating in the fishery and in the duration of the fishery, since vessels that choose to discard will need to increase effort to achieve the same amount of their quota.

Under Alternative 2, while fishing effort may increase, the sablefish IFQ fishery is still constrained by existing regulations concerning the location and timing of the fishery, PSC and bycatch limits, and all other accountability measures currently in place. Furthermore, the EFH EIS states that very little information exists regarding the effects of longline gear on benthic habitat, and published literature is essentially nonexistent (NMFS 2005). As such, the potential increase in fishing effort as a result 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.

Reasonably Foreseeable Effects on Habitat

Considering the potential impacts of the proposed action under the alternatives evaluated in this analysis together with the effects of past and present actions previously analyzed in other documents that are incorporated by reference and the impacts of reasonably foreseeable future actions, the overall potential impacts of the proposed action are determined to be not significant.

3.8 Ecosystem

3.8.1 Status

Ecosystems consist of communities of organisms interacting with their physical environment. Within marine ecosystems, competition, predation, and environmental disturbance cause natural variation in recruitment, survivorship, and growth of fish stocks. Human activities, including commercial fishing, can also influence the structure and function of marine ecosystems. Fishing may change predator-prey relationships and community structure, introduce foreign species, affect trophic diversity, alter genetic diversity, alter habitat, and damage benthic habitats.

The sablefish IFQ fishery potentially impacts the BSAI and GOA ecosystem by relieving predation pressure on shared prey species (i.e., species that are prey for both target groundfish and other species), reducing prey availability for predators of the target groundfish, altering habitat, imposing PSC and bycatch mortality, or by ghost fishing caused by lost fishing gear. Ecosystem considerations for the groundfish fisheries are summarized annually in the SAFE report (available from: https://www.fisheries.noaa.gov/alaska/population-assessments/north-pacific-groundfish-stock-assessments-and-fishery-evaluation). These considerations are summarized according to the ecosystem effects on the groundfish fisheries, as well as the potential fishery effects on the ecosystem.

3.8.2 Effects of the Alternatives

3.8.2.1 Alternative 1

As explained in Chapter 3, Section 3.3.1 of the Harvest Specifications EIS (NMFS 2007), NMFS and the Council continue to develop their ecosystem management measures for groundfish fisheries. The Council has created a committee to inform the Council of ecosystem developments and to assist in formulating positions with respect to ecosystem-based management. The Council's Scientific and Statistical Committee holds regular ecosystem scientific meetings, and the Council has recently reviewed and approved a Bering Sea Fishery Ecosystem Plan (available at: https://www.npfmc.org/bsfep/). In addition to these efforts to explore how to develop its ecosystem management efforts, the Council and NMFS continue to initiate efforts to take account of ecosystem impacts of fishing activity by designating EFH protection areas and habitat areas of particular concern. Ecosystem protection is supported by an extensive program of research into ecosystem components and the integrated functioning of ecosystems, carried out at the AFSC.

The effects of the sablefish IFQ fishery on the ecosystems of the BSAI and GOA have been comprehensively analyzed in the annually BSAI and GOA SAFE reports (NPFMC 2020), and was also evaluated in the Groundfish PSEIS (NOAA 2004), and Alaska Groundfish Fisheries Harvest Specifications EIS (NMFS 2007). These analyses concluded that current fishing practices in the sablefish IFQ fishery have minimal impact on the ecosystems of the BSAI and GOA and those impacts do occur are constantly monitored to prevent them from rising to a level which may jeopardize their continued sustainably. As a result, impacts on the ecosystems of the BSAI and GOA under Alternative 1 are determined not to be significant.

3.8.2.2 Alternative 2

Alternative 2 proposes an FMP amendment and regulatory change to allow vessels participating in the sablefish IFQ fishery to voluntarily discard sablefish in the BSAI and GOA. This could result in an increase in both the amount of gear deployed by vessels participating in the fishery and in the duration of the fishery, since vessels that choose to discard will need to increase effort to achieve the same amount of their quota.

As described above, fishery impacts on the ecosystems of the BSAI and GOA are continuously monitored by both NMFS and the Council in order to recognize and account for changes in fishery - ecosystem interactions. Under Alternative 2, while fishing effort may increase, the sablefish IFQ fishery is still constrained by existing regulations concerning the location and timing of the fishery, PSC and bycatch limits, and all other accountability measures currently in place. As such, the potential increase in fishing effort as a result of changes under Alternative 2 are not likely to have impacts on ecosystem components and considerations beyond those summarized in the Stock Assessment and Fishery Evaluation Reports for the BSAI and GOA groundfish fisheries. As a result, impacts on the ecosystems of the BSAI and GOA under Alternative 2 are determined not to be significant.

3.8.2.3 Cumulative Effects on the Ecosystem

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 future actions listed above, the cumulative impacts of the proposed action are determined to be not significant.

4 Regulatory Impact Review

This RIR examines some of the benefits and costs to harvesters, processors, and communities associated with a proposed action that would eliminate the prohibition on discarding in the sablefish IFQ fishery. Sablefish IFQ harvest operations would be directly impacted by a discarding allowance, and by possible reductions in available harvest to accommodate discarding. Processors are indirectly affected by potential changes in quantity and size of sablefish deliveries. Communities are indirectly affected by potential changes to the regulations through differential impacts on the amount of harvestable sablefish by FMP subarea. Vessel crew are directly affected because of changes in work operations.

The preparation of an RIR is required under Presidential Executive Order (E.O.) 12866 (58 FR 51735, October 4, 1993). 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 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 $100 million or more 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 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 novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in E.O. 12866.

4.1 Statutory Authority

Under the Magnuson-Stevens Act (16 U.S.C. 1801, *et seq.*), 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 and in the regional fishery management councils. In the Alaska Region, the Council has the responsibility for preparing 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 IFQ fishery in the EEZ off Alaska is managed under the GOA and BSAI FMPs. The action under consideration would amend this FMP 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.

4.2 Purpose and Need for Action

The Council adopted the following problem statement to originate analysis of this action in December 2019.

Large year classes of sablefish result in significant catches of small sablefish in the IFQ fixed gear fisheries. Small sablefish have low commercial value and current regulations require IFQ holders to retain all sablefish. Available data suggest that survival rates for carefully released sablefish are high. Operational flexibility to carefully release sablefish may increase the value of the commercial harvest and allow small fish to contribute to the overall biomass.

4.3 Alternatives

4.3.1 Alternative 1

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.

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.

4.3.2 Alternative 2: Allow voluntary careful release of sablefish in the IFQ fishery

Element 1: DMRs

Apply a DMR to discarded sablefish of:

e. 5%
f. 12%
g. 16%
h. 20%

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

Element 2: Catch Accounting

Option 1: Sablefish discards will be estimated using observer and EM data with a DMR applied annually as part of the specifications process.

Option 2: Sablefish discards will be estimated pre-season based on AFSC longline survey encounter rates of sub-three pound sablefish with the DMR applied annually as part of the specifications process.

Element 3: Discard Mortality Accounting

Sablefish discard 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 and specifications process.

Element 4: Monitoring and Enforcement

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

4.4 Methods Used for the Impact Analysis

The evaluation of impacts in this analysis is designed to meet the requirement of E.O. 12866, which dictates that an RIR evaluate the costs and benefits of the alternatives, to include both quantifiable and qualitative considerations. Additionally, the analysis should provide information for decision makers "to maximize net benefits (including potential economic, environment, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach." The costs and benefits of the alternatives with respect to these attributes are described in the sections that follow. Each action alternative is compared with Alternative 1: No Action, with "no action" not necessarily meaning a continuation of the present situation, but instead being the most likely scenario for the future, in the absence of other alternative actions. The analysis then provides a qualitative assessment of the net benefit to the nation of each alternative, with Alternative 1: No Action as a baseline.

This analysis was prepared using a combination of qualitative and quantitative sources. Quantitative data on harvest, harvesting vessels, and value were sourced through AKFIN using the Comprehensive Fish Ticket (Comprehensive FT) database and NMFS catch accounting system..

4.5 Description of the Sablefish Fisheries

U.S. fishermen began harvesting sablefish as a byproduct of halibut fishing at the end of the 19th century. Japanese longlining began 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, US fishermen took the majority of the sablefish harvested in the GOA and BSAI. Sablefish was increasingly harvested as a derby-style fishery in the late 1980s and early 1990s until individual fishing quotas (IFQs) were implemented.

The IFQ Program for managing the sablefish and halibut fixed gear fisheries off Alaska was developed over a lengthy period with discussion beginning in the 1970s and final implementation in 1995 (58 FR 215) through Amendments 15 (BSAI) and 20 (GOA). IFQ Program structure and much of the participation straddles both the sablefish and halibut fisheries. Given that the intent of the action being contemplated by the Council is limited to the sablefish fishery, the fishery descriptions provided here focus on the sablefish IFQ fishery.

Although many complicating factors are involved, the current state of the sablefish fishery off Alaska appears to be one of transition. Fishery participants, the Council and NMFS, and others have recently or are currently contending with a host of issues with potentially sweeping implications:

- depredation of sablefish catches by killer whales and sperm whales[6]
    - shifts in gear use from hook and line to pot gear by the IFQ fishery[7],
- dwindling availability of older, larger sablefish in the stock[8]
- sudden increases in recruitment from recent year classes[8] (and section 3.2)
    - massive increases in sablefish bycatch by BSAI trawl fisheries[9]
    - large decreases in sablefish market prices (section 4.5.2.5)
- reconsideration of area apportionment of ABC for the Alaska-wide sablefish stock[8]
- reconsideration or expansion of the single-stock approach[10]

These topics are likely to be addressed by the Council on a continuing basis according to priority and urgency, and in keeping with the Council's strategic goals.

4.5.1 Management

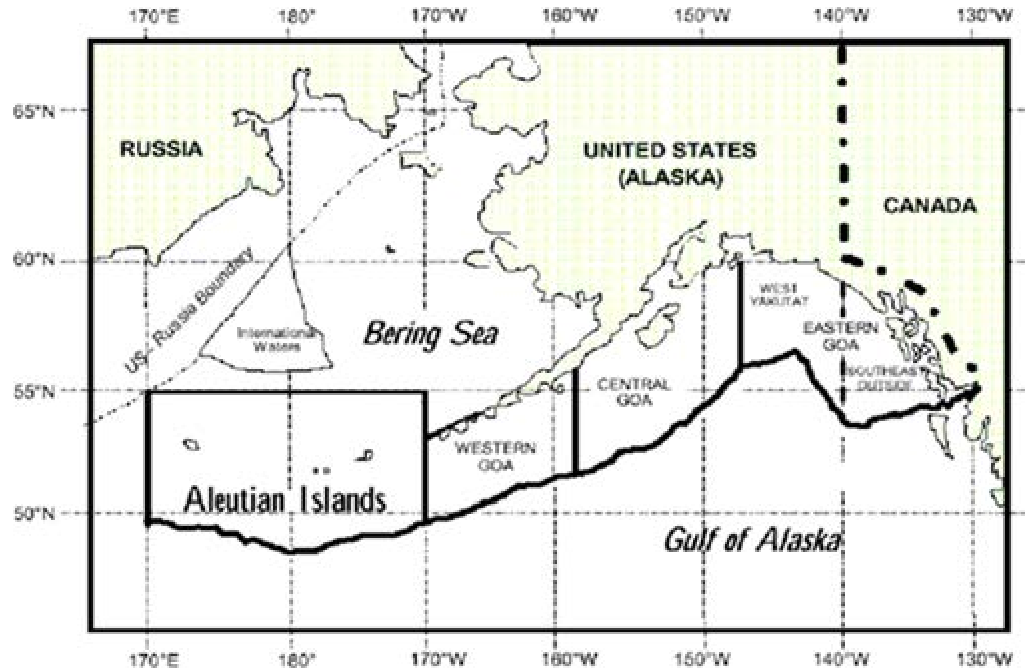
The Alaska sablefish fishery is managed through the Council's GOA and BSAI FMPs, in federal waters, subject to the MSA and corresponding federal regulations. The Council may amend measures and regulations at any time, including those implemented through the halibut and sablefish IFQ Program, through amendments to the Groundfish FMPs, and connected or independent federal regulations.

A fundamental component of federal fisheries management off Alaska that affects all fisheries that directly or incidentally catch sablefish is the annual specification of sablefish TAC, which, until recently has been set equivalent to ABC from the stock assessment. In 2020, total BSAI and GOA TACs were to 76% and 85% of the Area ABCs, respectively. For 2021, the BSAI TACs were set equal to the BSAI apportionment of ABC, but the GOA TACs sum to 83% of the GOA apportionment of ABC.

[6] April 2019 sablefish whale depredation workshop report
[7] NMFS AKRO FAQ webpage for GOA sablefish pots
[8] 2020 Sablefish SAFE (Goethel et al., 2020)
[9] NMFS Mgmt Report to Council Dec 2020
[10] Joint GF Plan Teams Report 2020

Allocative formulae from the Groundfish FMPs[11,12] are applied each year to distribute the GOA and BSAI sablefish TACs among subareas within the two FMP regions. In the GOA, the TAC is apportioned among four areas (Figure 4-1): Western Gulf (WG), Central Gulf (CG), West Yakutat (WY), and Southeast (SE). In the BSAI, the TAC is apportioned among the Bering Sea (BS) and Aleutian Islands (AI).

Figure 4-1. Sablefish Regulatory Areas and Districts in the GOA.



The sablefish area TACs are also distributed annually among the directed IFQ fixed gear and non-directed trawl fisheries in each of these areas, with the exception of Southeast GOA where trawl gear is prohibited. According to regulations, fixed gear is allocated 95 % of the TAC in the Eastern GOA and 80% of the TAC in the Central and Western GOA. In the BSAI FMP region, gear allocations are 25 % for trawl and 75 % fixed gear for the AI, and 50%:50% in the BS. Also within the BSAI, 20 % of the hook-and-line or pot gear allocation of sablefish is apportioned to the community development quota (CDQ) reserve for each subarea, and 7.5 % of the trawl gear allocation of sablefish to the non-specified reserves is assigned to the CDQ reserve. Table 4-1 shows the distribution of TAC among areas and sectors as published in the GOA and BSAI groundfish harvest specifications for 2020.

[11] Section 3.2.3.4.3.3.1 in the GOA Groundfish FMP
[12] Section 3.7.4.2 in the BSAI Groundfish FMP

Table 4-1. Final harvest specifications tables for sablefish in 2020, including division of TAC among IFQ fixed gear and trawl gear for the GOA (top) and BSAI (bottom).

Table 7—Final 2020 Sablefish TAC Amounts in the Gulf of Alaska and Allocations to Fixed and Trawl Gear [metric tons]

Area/district	TAC	Fixed gear allocation	Trawl gear allocation
Western	1,942	1,554	388
Central [1]	6,445	5,156	1,289
West Yakutat [2]	2,343	2,043	300
Southeast Outside	3,663	3,663	0
Total	14,393	12,415	1,978

[1] The trawl allocation of sablefish in the Central Regulatory Area is further apportioned to the Rockfish Program cooperatives (663 mt). See Table 12: Final 2020 Apportionments of Rockfish Secondary Species in the Central GOA. This results in 626 mt being available for the non-Rockfish Program trawl fisheries.

[2] The trawl allocation is based on allocating 5 percent of the combined Eastern Regulatory Area (West Yakutat and Southeast Outside Districts) sablefish TAC as incidental catch to trawl gear in the West Yakutat District.

Table 10—Final 2020 Gear Shares and CDQ Reserve of BSAI Sablefish TACS [metric tons]

Subarea and gear	Percent of TAC	2020 Share of TAC	2020 ITAC	2020 CDQ reserve
Bering Sea				
Trawl [1]	50	931	791	70
Hook-and-line/pot gear [2]	50	931	744	186
Total	100	1,861	1,535	256
Aleutian Islands				
Trawl [1]	25	510	433	38
Hook-and-line/pot gear [2]	75	1,529	1,223	306
Total	100	2,039	1,657	344

[1] For the sablefish trawl gear allocations, 15 percent of TAC is apportioned to the non-specific reserve (§ 679.20(b)(1)(i)). The ITAC is the remainder of the TAC after subtracting these reserves. In the BS and AI, 7.5 percent of the trawl non-specified reserve is assigned to the CDQ reserves (§ 679.20(b)(1)(ii)(D)(1)).

[2] For the portion of the sablefish TAC allocated to vessels using hook-and-line or pot gear, 20 percent of the allocated TAC is reserved for use by CDQ participants (§ 679.20(b)(1)(ii)(B)). The Council recommended that specifications for the hook-and-line gear sablefish IFQ fisheries be limited to one year.

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

4.5.1.1 Harvest relative to Management Thresholds

From a management standpoint, sablefish catches (landings + dead discards) have been unremarkable for the past 25 years, tracking specified TAC levels, more or less, but never exceeding them (Figure 4-2). Realized catches have averaged only 85% of the total Alaska combined TACs, annually, since 1995.

In the last four years (2017-2020), however, catches have risen steeply from just below 23 M lb in 2016 to almost 37 M lb in 2019, before dropping to around 34 M lb in 2020 (Figure 4-2). These recent increases are driven by the surge in sablefish bycatch from trawl gear in the Bering Sea, while directed fixed gear catch has remained relatively stable for the same period (Figure 4-3).

Between the two FMP areas, TACs in the GOA have been fully achieved prior to 2020, while in the AI harvest has been around 40% of TAC historically. In the BS, prior to 2017, catches contributed to about 38% of TAC, on average, but from 2017-2020 was well above the summed area TACs (91% in 2017, 109% in 2018, 214% in 2019, and 211% in 2020). Combined catches in both FMP areas contributed to a TAC/ABC overage in 2019, however, the OFL has never been exceeded (Figure 4-4).

According the groundfish FMPs, harvest that exceeds the TAC is included in the total catch estimate used in the next stock assessment. A higher catch during a year will result in a lower biomass in the subsequent year. For stocks where biomass is estimated (assessment tiers 1-5), this corresponds to a lower ABC in the subsequent year, because ABC tends to vary with biomass. For a stock (such as sablefish) where spawning biomass is below the reference level, it is managed under sub-tier "b" and the decrease is compounded because on the sloping portion of the control rule, F_{ABC} also decreases as biomass decreases.

While portions of the TAC are allocated to trawl fisheries, AKRO Inseason Management also determines the subset of the TAC necessary as incidental catch in target fisheries. Sablefish bycatch in the trawl fisheries is limited by the maximum retainable amount (MRA) expressed as a percentage of an alternate target fishery catch.

All retention is prohibited if the total TAC is caught before the end of the year. Prohibiting retention removes any incentive to increase incidental catch as a portion of other fisheries. If the ABC is taken and the trajectory of catch indicates the OFL may be approached, additional closures are imposed. To prevent overfishing, specific fisheries that incur the greatest incidental catch can be closed. Closures expand to other fisheries if the rate of take is not sufficiently slowed.

Figure 4-2. Total sablefish catch (Mlb) from 1980-2020. Source 2020 Sablefish SAFE.

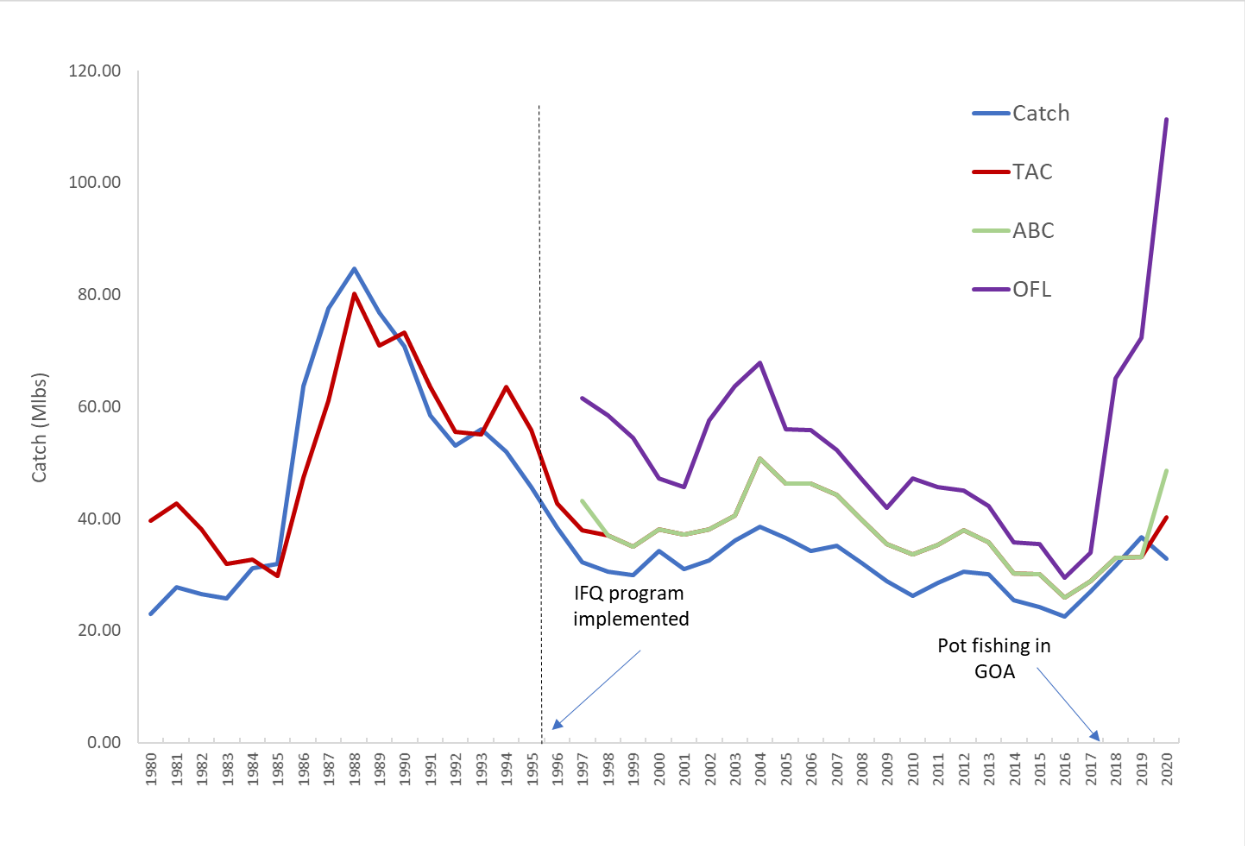


Figure 4-3. Changes in sablefish catch by gear type between 2015 and 2020. CAS catch by gear reports 2010-2020.

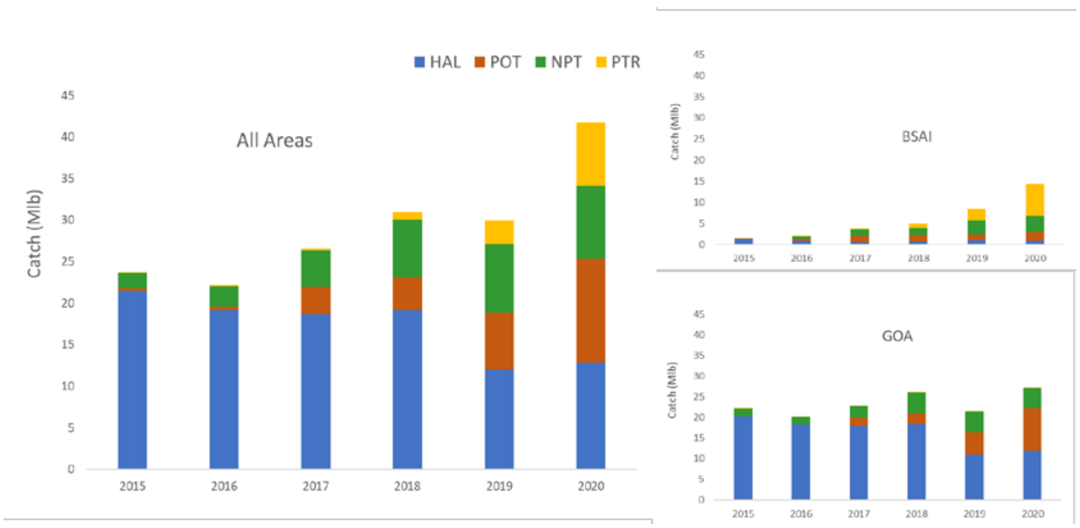


Figure 4-4. Area-specific catches of sablefish (Mlb) from 2000-2020. The dashed line in the area figures is provided to highlight IFQ-only catch during the recent divergence in bycatch. Source 2020 Sablefish SAFE.

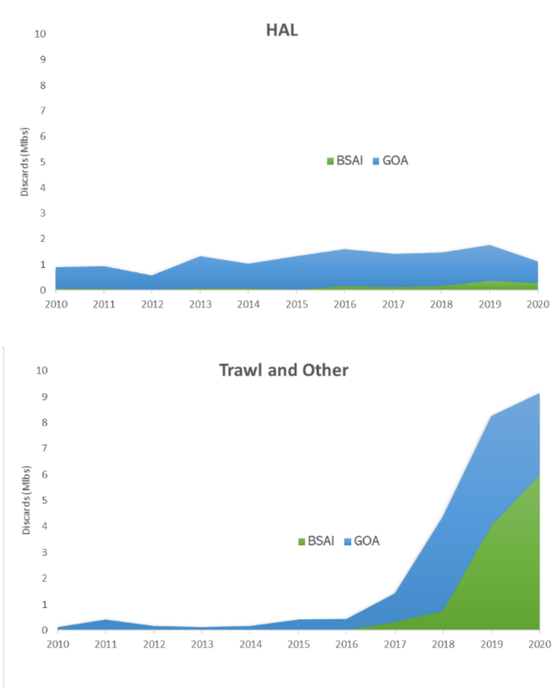
4.5.1.2 Sablefish Non-target Fisheries

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. For most of the last twenty years, sablefish has been a regular component of BS non-pelagic trawl bycatch, with the retained and discarded trawl catch comprising 10% of the overall sablefish catch, but that changed beginning in 2017 (Figure 4-5), and by 2019 trawl sablefish catches were 31% of the total sablefish catch and 43% in 2020 (Figure 4-3).

These increases in trawl bycatch of sablefish were driven by the sudden appearance of sablefish from recent strong year classes on the Eastern Bering Sea (EBS) 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 EBS pelagic trawl fishery that targets walleye pollock and that has been a historic non-factor in sablefish bycatch, saw catches of sablefish increase by a factor of seven between 2018 and 2020 (Figure 4-3). Non-pelagic trawl fisheries targeting pollock, arrowtooth flounder, and Greenland turbot.

Figure 4-5. Recent trends in sablefish *discards* by gear type. CAS catch by gear reports 2010-2020.



Although the large increases in trawl catches of sablefish in 2019 and 2020 are not expected to continue indefinitely, catches in excess of the trawl TAC by the trawl fleet makes it increasingly unlikely that it can function as a reserve for discards by fixed gear vessels, as had been done previously.

Rapid increases in BS sablefish bycatch began to trigger PSC status changes for trawl gear (Table 4-2) starting in 2017. Changes to "bycatch" or "PSC" 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 GOA, accumulation of catches triggered PSC status changes in the Central Gulf every year since 2016, in the Western Gulf in 2019, and in West Yakutat in 2017 and 2018 (Table 4-2). When this occurred, the NMFS AKRO initiated information bulletins, "IB" in the table, notifying permit holders that sablefish may not be retained.

Table 4-2. Sablefish PSC status changes from 2016 to 2020. Source: NMFS AKRO Catch Accounting.

Effective Date	Gear	Sub Area	Program	Status	Reason	IB
2017-07-07	Trawl Gear	BS		PSC	TAC	36
2018-04-05	Trawl Gear	BS	All	PSC	TAC	
2019-06-29	Trawl Gear	BS	All	PSC	TAC	
2020-07-01	Trawl Gear	BS	All	PSC	TAC	46
2016-10-14	Trawl Gear	CG	All	PSC	TAC	80
2017-10-12	Trawl Gear	CG	Open Access	PSC	TAC	62
2018-04-09	Trawl Gear	CG	Open Access	PSC	TAC	
2019-08-28	Trawl Gear	CG	All	PSC	TAC	
2020-08-18	Trawl Gear	CG	CP	PSC	TAC	57
2020-08-18	Trawl Gear	CG	CV	PSC	TAC	57
2019-09-13	Trawl Gear	WG	All	PSC	TAC	
2017-08-08	Trawl Gear	WY	All	PSC	TAC	44
2018-08-14	Trawl Gear	WY	All	PSC	TAC	49

At the December 2020 Council meeting, the Council initiated a discussion paper to identify management tools that would prevent or minimize overages in sablefish area- and sector-specific TACs and ABCs. Specifically, the Council is interested in management solutions to limit *trawl* sablefish mortality to area sector allocations (TACs and ABCs). Likely, that effort will accommodate any changes to IFQ accounting that may arise through this action. This analysis does not address the mitigation of trawl bycatch or its effects on the IFQ fisheries.

Retaining trawl caught sablefish is also permissible through the maximum retainable amount (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% 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%. The MRA for arrowtooth flounder changed effective in 2009 in the GOA, to 1%.

4.5.2 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. 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. In both fisheries, growth in fishing effort under open access had necessitated large reductions in length of the fishing seasons and caused a host of undesirable biological, economic, and social effects.

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). Importantly for this analysis, no changes to the structural provisions of the sablefish IFQ Program are being contemplated by the Council. Thorough descriptions of each of these components is 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

An individual's IFQ is determined annually as the ratio of their QS to the area QSP and the area-specific TAC:

(QS/QSP) x TAC = IFQ

Area	Quota Share Pool
BS	18,765,280
AI	31,932,492
WG	36,029,579
CG	111,686,622
WY	53,266,430
SE	66,120,619
TOTAL	317,801,022

Annually, the Restricted Access Management (RAM) Division of NMFS AKRO updates the conversion ratio (QS:IFQ) for translating QS into fishable pounds for each regulatory area. The QS pool (QSP) for each IFQ regulatory area was determined at initial allocation, that is, when the IFQ Program was initially established, and has been changed since then only through administrative adjustments. Therefore, the pounds (or kg) of sablefish that correspond to a single QS change as a function of Area TAC, which is , in turn, determined by overall TAC and the apportionment scheme.

Table 4-3. Annual apportionment of TAC among areas in GOA and BSAI and corresponding value of QS in lbs. of TAC.

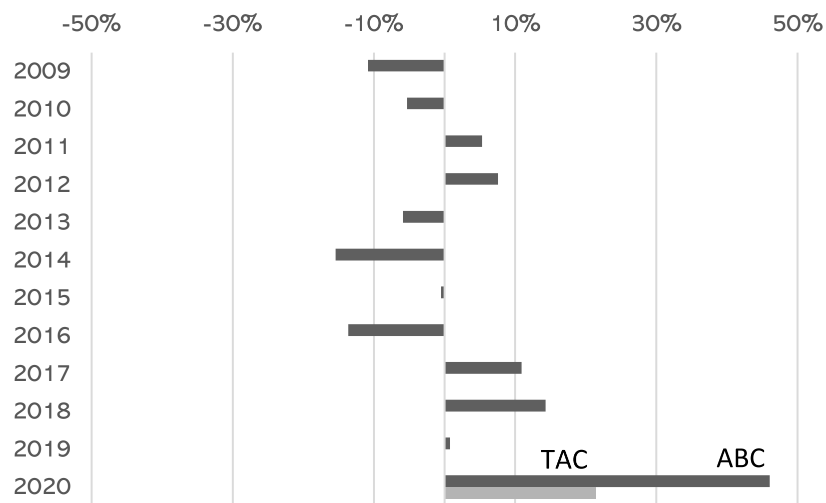
Sablefish IFQ TAC (lbs)								
	2013	2014	2015	2016	2017	2018	2019	2020
BS	1,393,307	1,181,666	1,177,256	1,014,116	1,124,346	1,291,896	1,313,942	1,640,222
AI	2,830,706	2,394,196	2,383,173	2,059,096	2,294,989	2,630,088	2,656,543	2,696,226
WG	3,086,440	2,610,246	2,599,223	2,244,283	2,378,763	2,722,681	2,788,819	3,425,948
CG	9,770,787	8,256,227	8,214,340	7,094,403	7,960,811	9,096,180	9,131,453	11,366,918
WY	3,899,937	3,295,877	3,282,649	2,832,911	3,073,212	3,503,109	3,498,700	4,503,998
SE	7,032,674	5,941,397	5,912,737	5,108,058	5,745,188	6,556,480	6,578,526	8,075,450
	28,013,851	23,679,609	23,569,378	20,352,867	22,577,309	25,800,434	25,967,983	31,708,762
Sablefish lbs/QS								
	2013	2014	2015	2016	2017	2018	2019	2020
BS	0.074	0.063	0.063	0.054	0.060	0.069	0.070	0.087
AI	0.089	0.075	0.075	0.064	0.072	0.082	0.083	0.084
WG	0.086	0.072	0.072	0.062	0.066	0.076	0.077	0.095
CG	0.087	0.074	0.074	0.064	0.071	0.081	0.082	0.102
WY	0.073	0.062	0.062	0.053	0.058	0.066	0.066	0.085
SE	0.106	0.090	0.089	0.077	0.087	0.099	0.099	0.122

If the incorporation of discretionary discarding by the IFQ fishery into the sablefish stock assessment were to effectively reduce stockwide ABC, it might be helpful to consider the magnitude of that reduction in the context of interannual variation in ABC without a discarding provision. The reductions in ABC considered in Section 2.2 that are linked to a discarding allowance suggest that ABC could be reduced by approximately 10-40%. Figure 4-6 provides the relative annual change in ABC, which underlies TAC and therefore the available harvest stock-wide for the IFQ fishery. Note that stockwide TAC has been set equal to ABC historically, however, in 2020, stockwide TAC was 83% of ABC.

Annual fluctuations in ABC vary in absolute magnitude from 0% to 46%, the largest deviation being the increase from 2019 (33.22 M lb) to 2020 (40.33 M lb). From 2014-2016, ABCs decreased in 2014 and 2016 by about 15% at about -15% and the largest increases were in 2020 (28.7% increase).

These adjustments to TAC are distributed proportionately across area TACs and finally to QS holders. Any subsequent variation among QS holders would reflect participants' exercise of the adjustment tools available to them such as leasing and transfers, as well as participant-specific adjustments due to overages and underages.

Figure 4-6. Pct annual change in ABC/TAC from 2009-2020



4.5.2.1 IFQ Prohibition on Discarding

Release of sablefish by the IFQ target fisheries is currently prohibited by regulation. The regulations that would need to be amended include 50 CFR 679.7(d)(4)(ii) and 50 CFR 679.7(f)(11). Additionally, in both the BSAI and GOA Groundfish FMPs, the fourth provision under General Provisions section 3.7.1.7, prohibiting discarding of sablefish, would need to change.

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.

A 2018 Council discussion paper provides clues to the sablefish no-discard origin story, referring the reader to the 1991 proposed rule (57 FR 57130) for the IFQ Program. There, the requirement is characterized as a means to prohibit fishermen from discarding bycatch of IFQ halibut or sablefish on catcher vessels *in favor of other more valuable species*.

“Initial allocations of QS probably would not yield an IFQ large enough for many fishermen to conduct a full-time directed fishery for either halibut or sablefish throughout the IFQ fishing season. Therefore, many IFQ fishermen are expected to use their IFQ to retain their bycatch of halibut or sablefish in fisheries for other species. If the other species have more market value than the bycatch of IFQ species, fishermen would have an incentive to discard the bycatch of IFQ species. To prevent this practice, the proposed rule would prohibit the discard of IFQ halibut or sablefish from any catcher vessel when any IFQ holder on board has unused halibut or sablefish IFQ for that vessel and the area in which IFQ Gear Types

To clarify, discarding sablefish in the context of overwhelming catches of small, unmarketable fish would be a form of economic discards, i.e., *highgrading*. During the development of the IFQ program, economic discards of sablefish by the IFQ fishery, in other words highgrading was not expected to be a problem. This is because the cost associated with ‘replacing’ discarded (small) fish was expected to exceed the additional value associated with larger, presumably more valuable fish (NPFMC 1992).

In the Final Rule for the IFQ Program, NOAA Fisheries stated that it recognized that

“… underreporting will not be completely prevented, but a planned increased enforcement and monitoring effort coupled with severe penalties for gross underreporting is likely to minimize this potential source of biological damage to the stocks. Highgrading, the substitution of large high-valued fish for harvested small low-valued fish, is not expected to be a major threat because of increased enforcement and because a relatively small market price difference between small and large fish will reduce the profitability of highgrading and, therefore, the incentive to discard harvested fish. Generally, NOAA expects substantially less unreported fishing mortality under the IFQ program than under open access management.”

Nevertheless, the following “Key Findings” are provided in the Twenty Year Review (NPFMC 2017):

- The IFQ Program could have provided participants with an incentive to highgrade their catch of IFQ species, because of the inherent limit on the quantity of fish that may be harvested given a certain QS allocation. The incentive to highgrade is determined by the price premium for larger fish (for which there is often a dockside premium in both IFQ fisheries) and the cost per unit of landing. The data reveal that, as expected, the IFQ Program has led to increased discarding of IFQ species in the IFQ fisheries.
- Since IFQ implementation, discards in metric tons of sablefish in the sablefish IFQ fleet have generally been above the pre-IFQ baseline level (average of 1991 through 1994) of just under 400 metric tons. The discard rate of sablefish in the sablefish IFQ fleet (estimated as the sum of all discarded weight to the sum of all retained weight in the sablefish IFQ fleet) has also increased since IFQ implementation.

4.5.2.2 Accounting for IFQ discards

The IFQ Program includes measures to contend with the inability of any management system to precisely quantify landings against account limits. These mitigating measures include provisions (overage and underage) that allow shareholders to have a margin of error in how they harvest their annual QS allocations. If a person does not harvest their full annual IFQ allocation, an underage of up to 10% of that person's total IFQ account for a current fishing year will be added to that person's annual IFQ account in the year following determination of the underage. If a person lands IFQ species in excess of their annual IFQ allocation, their account will be debited in the following year by the amount of the overage, by up to 10% of the amount remaining in the person's IFQ account at the time of landing. Any overage greater than 10% is subject to confiscation and potentially an enforcement action, depending on the degree of the overage. Overages in the fixed gear allocation of the TAC were intended to be absorbed by the trawl gear allocation of the TAC. However, if the trawl sector catches their full allocation, there is no buffer to account for the discards in the fixed gear allocation. Catches described below clearly show that directed and nondirected sectors are increasingly using ABC.

Fixed gear sablefish TACs are fully allocated to the IFQ Program, and none of the TAC is set aside for sablefish caught incidentally in other fixed gear fisheries (i.e., in the Pacific cod and halibut IFQ fisheries). Because there is no incidental catch allowance for sablefish caught in the other fixed gear fisheries, any incidental catch of sablefish must be discarded and accrues toward the TAC. Sources of discards of sablefish in the fixed gear fisheries include sablefish caught in excess of a vessel's available sablefish IFQ, sablefish caught by vessels that do not have sablefish IFQ, and sablefish that are caught out of season (e.g., during the early season Pacific cod fishery). As the Twenty-Year Review notes, overages in the fixed gear allocation of the TAC were intended to be absorbed by the trawl gear allocation of the TAC. However, if the trawl sector catches their full allocation, there is no buffer to account for the discards in the fixed gear allocation.

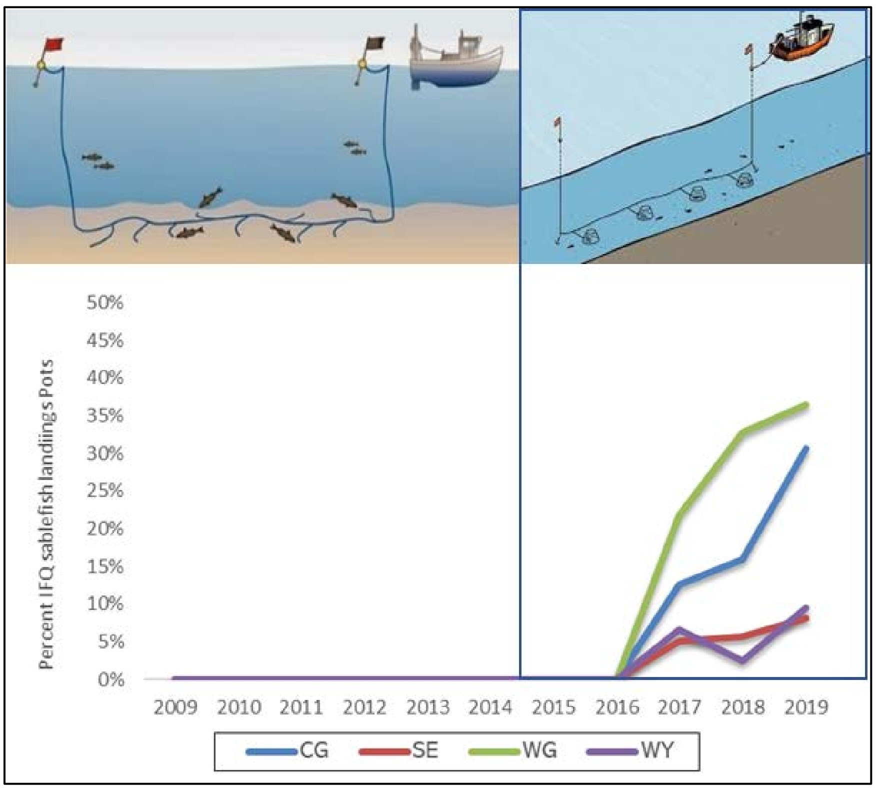
4.5.2.3 Sablefish IFQ Gear Types

The primary gear used for directed sablefish harvest offshore Alaska has been longline hook-and-line gear (HAL), which is fished on-bottom. 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 have historically 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 sperm whale depredation, and pots were effectively legal in early 2017. This allowance in the GOA was followed by a substantial movement of fishery effort in that area to pot gear. Pot catches comprised approximately 10% of GOA landings in 2017, but grew to near parity with HAL gear by 2020 (Figure 4-7).

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 internal incentive to incur small additional costs in order 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.

Figure 4-7. Subarea pot gear use since 2017.



4.5.2.3.1 Operational costs

Gear. The analysis for the 2017 allowance for pot gear in the GOA (NPFMC 2016) provided estimated investment costs associated with sablefish fixed gear. The estimates are useful in establishing gross differences in investment expenditure between the gear types, suggesting that pot gear may represent a much greater initial investment. The negative impacts of whale depredation on HAL sablefish fishing make pot gear a compelling alternative. The widespread movement of the fixed gear fishery to using pot gear in the GOA (Figure 4-7) bears this out.

A string of HAL longline gear (150 skates of auto-line gear with swivels, plus anchors, buoys, and flag poles) would cost around $100,000 new. While gear configuration varies, one estimate of length per HAL longline set at 3 miles, and 30 skates per set. Again noting the rough estimate, a HAL longline set-up would reflect an investment of around *$7,000 per mile*. HAL set-ups for hand baited gear are likely to be shorter in length, which would affect the per-mile cost estimate.

The total cost of a two-mile longline (buoyant groundline) pot string of 30 to 50 pots to be around $25,000 if purchased new. Other necessary gear includes an overhead hoist for lifting pots, large buoys and flagpoles, line anchors, line reels if line is not coiled on deck, and a hydraulic block or line hauler. A comparable estimate broke down the $100,000 cost of a 150 pot string as follows: $35,000 for pots and shackles, $40,000 for the hauler and hydraulics, and $25,000 for groundline. A 150 pot string would be between six and 10 miles long, depending on configuration. Acknowledging that this provides only a rough estimate, a pot longline set-up could represent an investment of around *$12,000 to $16,000 per mile in gear*, not including vessel modifications.

Day-to-day operating costs will include either trip-specific or ongoing expenditures for labor, fuel, bait, fishing gear, vessel maintenance, insurance and cost recovery fees, among others. The magnitude of these costs will vary among IFQ vessel operations depending on vessel size, type and distances traveled for trips. Additionally, cost variables will vary among regions, for example fuel expenses would reflect both fuel price and fuel consumption. Whale depredation for the HAL fishery is likely considered to be an operating cost, but which varies regionally and between gear types.

Cost recovery. Section 304(d)(2)(A) 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 fish landed under the IFQ Program. The MSA limits the fee to 3% of the annual ex-vessel value of the IFQ fisheries.

NMFS assesses cost recovery fees only for fish that are landed and deducted from the total allowable catch in the IFQ fisheries. NMFS publishes the individual fishing quota (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 2020 is 3%.

4.5.2.4 Sablefish IFQ vessel class categories

Table 4-4 shows that the sablefish IFQ fleet is dominated by Class C vessels, which are the smaller grouping within three vessel classes in the sablefish IFQ fishery. 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

There is substantial geographic variability in QS distributions by vessel class for the sablefish IFQ fishery, with the Southeast being dominated by the smaller vessel class, suggesting conditions there allow favorable accessibility to sablefish fishing grounds compared to the other areas.

Table 4-4. Count of distinct QS Holders in 2019 for each vessel class and sablefish management area in Alaska .

	Vessel Class		
Area	A	B	C
BS	30	52	39
AI	33	50	31
WG	47	95	74
CG	51	205	291
WY	33	129	174
SE	44	102	432

Table 4-5. Count of sablefish vessel classes associated with gear type and sablefish management area in Alaska in from 2011-2019.

Year	Vess Class	BSAI			GOA			All Areas
		All gear	HAL	Pot	All gear	HAL	Pot	All Gears
2011	A	11	9	2	34	34		41
	B	17	10	7	52	52		61
	C	36	36		239	239		255
	Total	64	55	9	325	325	0	357
2012	A	12	11	1	37	37		44
	B	15	11	4	48	48		54
	C	27	27		243	243		254
	Total	54	49	5	328	328	0	352
2013	A	8	8		32	32		36
	B	14	10	4	46	46		51
	C	25	25		227	227		237
	Total	47	43	4	305	305	0	324
2014	A	8	8		30	30		34
	B	13	9	4	44	44		49
	C	26	26		220	220		228
	Total	47	43	4	294	294	0	311
2015	A	7	7		32	32		36
	B	13	11	2	43	43		47
	C	27	26	1	216	216		222
	Total	47	44	3	291	291	0	305
2016	A	8	8		33	33		37
	B	13	9	4	40	39	1	43
	C	25	25		216	216		222
	Total	46	42	4	289	288	1	302
2017	A	6	5	1	32	31	1	34
	B	10	5	5	38	32	6	42
	C	20	20		211	196	15	215
	Total	36	30	6	281	259	22	291
2018	A	9	8	1	34	33	1	38
	B	7	4	3	35	28	7	37
	C	27	23	4	211	196	15	219
	Total	43	35	8	280	257	23	294
2019	A	6	5	1	39	37	2	42
	B	12	8	4	36	28	8	39
	C	21	18	3	187	165	22	195
	Total	39	31	8	262	230	32	276

4.5.2.5 Sablefish IFQ Landings and Revenue

Sablefish IFQ landings and revenue from 2009-2019 are provided in Figure 4-8 and Figure 4-9 below for IFQ vessel classes and regulatory areas, respectively. Because fish ticket data are used, vessel classes are represented by vessel size category (<60, >=60, >90 ft LOA) rather than letter code.

Trip-level landings and revenue in Figure 4-9 may provide context for discussions about trip-level decision-making by IFQ participants in the atmosphere of a discard allowance.

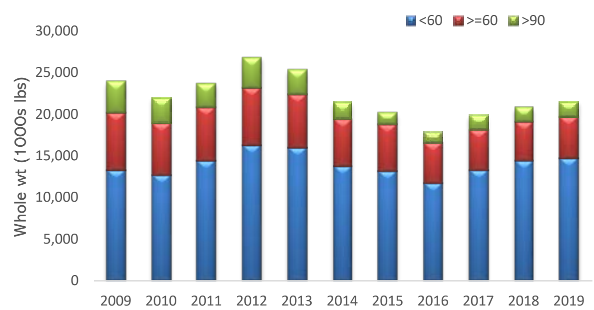
While total IFQ sablefish landings reached a low of less than 18 M lb in 2016, ex-vessel revenue was at the lowest point in the analyzed time series more recently, at less than $60 million in 2019. This low point is reflected across all vessel classes and areas (Figure 4-8).

The relative contribution to landings and total revenue varies among the different vessel classes (Figure 4-8) making smallest boats the largest part of the fishery. On a per trip basis, vessel size is a not-surprising predictor of the variation in trip level revenues by the vessel classes (Figure 4-10). The much more numerous Class C vessels typify the southeastern GOA (Table 4-4) and contribute to that area's near dominance, along with the Central GOA in total Alaska sablefish harvest.

Diverging landings and revenue trend (Figure 4-8) suggest that participants' are likely familiar with limited control over ex-vessel revenues as dynamic market forces perturb price/lb.

Figure 4-8. GOA Sablefish IFQ landings and revenue by year and vessel class. Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive FT

LANDINGS				
	Vessel Class			
	<60	>=60	>90	Total
2009	13,386	6,840	3,699	23,926
2010	12,791	6,164	3,026	21,981
2011	14,422	6,429	2,865	23,716
2012	16,248	6,953	3,680	26,880
2013	16,047	6,410	2,917	25,374
2014	13,790	5,676	1,960	21,425
2015	13,219	5,532	1,438	20,189
2016	11,771	4,813	1,308	17,892
2017	13,398	4,833	1,655	19,887
2018	14,464	4,650	1,708	20,823
2019	14,691	5,025	1,809	21,524
REVENUE				
	Vessel Class			
	<60	>=60	>90	Total
2009	$ 49,079	$ 24,936	$ 13,362	$ 87,377
2010	$ 54,778	$ 26,493	$ 12,826	$ 94,098
2011	$ 80,956	$ 36,147	$ 16,016	$ 133,119
2012	$ 71,867	$ 31,113	$ 14,990	$ 117,970
2013	$ 48,894	$ 19,805	$ 8,929	$ 77,629
2014	$ 51,416	$ 21,264	$ 7,302	$ 79,983
2015	$ 52,453	$ 22,042	$ 5,691	$ 80,186
2016	$ 51,639	$ 20,835	$ 5,305	$ 77,780
2017	$ 67,386	$ 24,245	$ 7,025	$ 98,656
2018	$ 52,201	$ 16,616	$ 5,219	$ 74,037
2019	$ 40,698	$ 13,002	$ 5,097	$ 58,797
EFFORT				



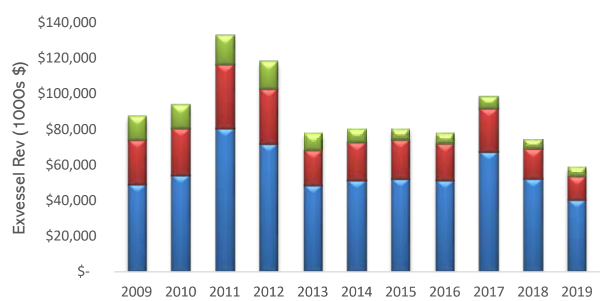
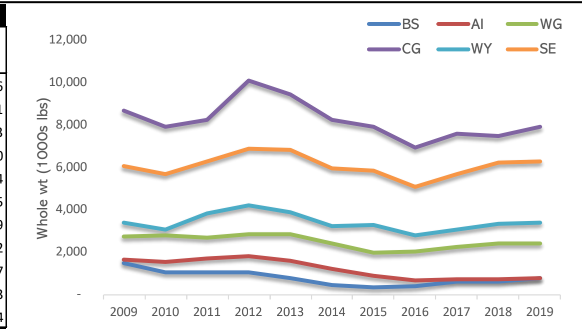


Figure 4-9. GOA Sablefish IFQ landings and revenue by year and area Source: ADFG/CFEC Fish Tickets, datacompiled by AKFIN in Comprehensive FT

LANDINGS							
	Management Area						
	BS	AI	WG	CG	WY	SE	Total
2009	1,458	1,643	2,713	8,651	3,398	6,061	23,926
2010	1,046	1,516	2,774	7,914	3,080	5,651	21,981
2011	1,050	1,683	2,660	8,210	3,810	6,299	23,713
2012	1,054	1,807	2,847	10,070	4,232	6,869	26,880
2013	797	1,605	2,848	9,410	3,890	6,826	25,374
2014	427	1,183	2,416	8,243	3,232	5,924	21,425
2015	315	892	1,982	7,917	3,268	5,816	20,189
2016	388	659	2,023	6,930	2,808	5,085	17,892
2017	605	694	2,248	7,579	3,065	5,696	19,887
2018	637	734	2,386	7,472	3,359	6,235	20,823
2019	783	754	2,400	7,915	3,390	6,282	21,524



REVENUE							
	Management Area						
	BS	AI	WG	CG	WY	SE	Total
2009	$ 4,984	$ 5,919	$ 9,852	$ 32,360	$ 12,473	$ 21,791	$ 87,377
2010	$ 4,252	$ 6,526	$ 12,003	$ 34,253	$ 13,212	$ 23,851	$ 94,097
2011	$ 5,775	$ 9,481	$ 15,337	$ 46,331	$ 21,192	$ 34,986	$ 133,100
2012	$ 3,605	$ 7,648	$ 12,144	$ 44,964	$ 19,204	$ 30,404	$ 117,970
2013	$ 2,294	$ 4,929	$ 8,933	$ 29,267	$ 11,925	$ 20,281	$ 77,629
2014	$ 1,538	$ 4,391	$ 9,273	$ 31,145	$ 12,004	$ 21,633	$ 79,983
2015	$ 1,153	$ 3,563	$ 8,024	$ 31,624	$ 13,013	$ 22,809	$ 80,186
2016	$ 1,268	$ 2,769	$ 8,901	$ 30,455	$ 12,081	$ 22,307	$ 77,780
2017	$ 2,106	$ 2,931	$ 10,774	$ 38,186	$ 15,816	$ 28,843	$ 98,656
2018	$ 1,455	$ 2,078	$ 7,423	$ 26,246	$ 12,885	$ 23,950	$ 74,037
2019	$ 1,415	$ 1,478	$ 5,742	$ 19,324	$ 9,931	$ 20,907	$ 58,797

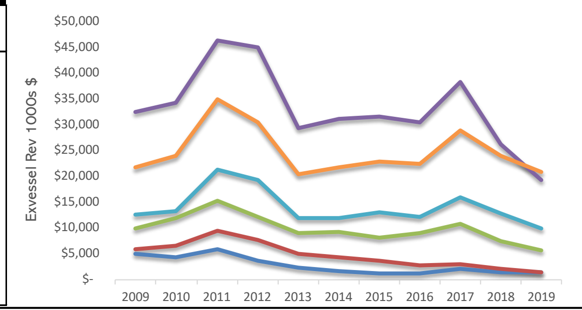
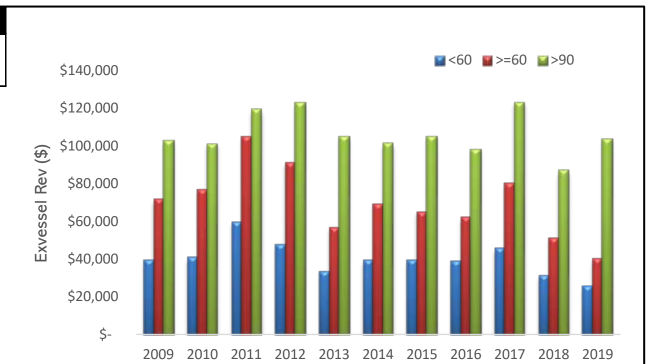
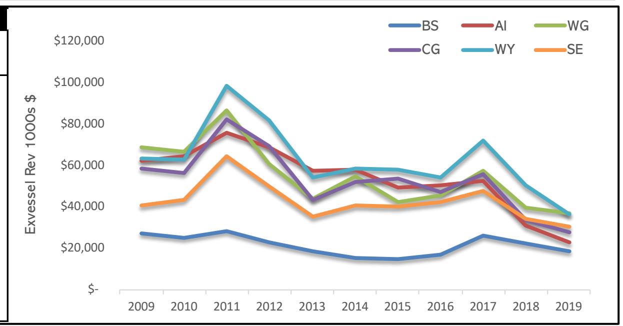


Figure 4-10. GOA Sablefish average IFQ revenue per trip by year, vessel class, and area Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive FT

REVENUE / TRIP				
	Vessel Class			
	<60	>=60	>90	Total
2009	$ 39,870	$ 71,861	$ 102,788	$ 51,158
2010	$ 40,637	$ 76,570	$ 100,992	$ 51,674
2011	$ 59,835	$ 105,385	$ 119,523	$ 72,743
2012	$ 47,879	$ 91,509	$ 122,869	$ 60,097
2013	$ 33,697	$ 56,911	$ 105,048	$ 41,204
2014	$ 39,369	$ 69,264	$ 101,417	$ 47,467
2015	$ 39,498	$ 65,212	$ 105,388	$ 46,620
2016	$ 38,652	$ 62,010	$ 98,245	$ 45,064
2017	$ 45,623	$ 80,550	$ 123,252	$ 53,764
2018	$ 31,371	$ 51,443	$ 86,988	$ 36,168
2019	$ 25,645	$ 40,129	$ 104,025	$ 29,999



REVENUE / TRIP							
	Management Area						
	BS	AI	WG	CG	WY	SE	Total
2009	$ 27,384	$ 62,302	$ 68,892	$ 58,411	$ 63,313	$ 40,654	$ 51,188
2010	$ 25,011	$ 64,615	$ 66,681	$ 56,061	$ 62,916	$ 43,524	$ 51,702
2011	$ 28,306	$ 75,847	$ 86,648	$ 82,001	$ 98,566	$ 64,549	$ 72,812
2012	$ 22,816	$ 68,905	$ 60,721	$ 69,389	$ 81,718	$ 50,007	$ 60,189
2013	$ 18,652	$ 57,318	$ 44,004	$ 43,166	$ 53,958	$ 35,394	$ 41,204
2014	$ 15,377	$ 57,770	$ 54,871	$ 51,821	$ 58,556	$ 40,510	$ 47,467
2015	$ 14,597	$ 49,483	$ 42,455	$ 53,691	$ 57,835	$ 40,370	$ 46,647
2016	$ 16,902	$ 50,340	$ 45,411	$ 47,071	$ 54,419	$ 42,088	$ 45,090
2017	$ 26,322	$ 52,346	$ 57,616	$ 55,504	$ 71,890	$ 47,753	$ 53,764
2018	$ 22,378	$ 31,022	$ 39,697	$ 33,822	$ 50,529	$ 34,361	$ 36,168
2019	$ 18,616	$ 23,093	$ 36,809	$ 27,685	$ 36,246	$ 30,212	$ 29,999



4.5.2.6 Sablefish IFQ Market Grades and Price/lb

Historically and currently, sablefish harvest has been sold as frozen H&G fish to high-volume distributors in Japan and other Asian countries. Fish for the U.S. domestic market are more typically filleted by primary processors in Alaska or by secondary processors/distributors. Regardless of whether sablefish is exported or sold domestically, it generally passes through one or two distributors before being sold to consumers at the retail level.

Sablefish prices and markets have always been sensitive to the size of the fish, with larger sablefish consistently worth much more than smaller fish. Wholesale price per pound for the largest fish can be more than double those for smaller fish. Additionally small sablefish are difficult to sell into higher-end export markets, like Japan, but there is a market in China as well as a growing domestic market. In other words, biological events and management decisions that occur in Alaska can directly affect the economic performance of the fishery.

Outside of unpredictable market influences, the relative value of the market grades is fairly typical for seafood products that can generate a wide range of poundage at a similar processing cost on a per fish basis Fish Ticket data on IFQ sablefish landings show a clear delineation in ex-vessel value between market categories as defined by fish size in weight (Table 4-7).

The distribution of landed weight across the six market categories for the GOA and the BSAI, are provided in Table 4-6. The increase in small sablefish landings in the BSAI likely reflects distributional differences in sablefish, at least as they are selected to the fishery.

Table 4-6. Landed sablefish lbs by market category, 2014-2020 for BSAI and GOA. Source: ADFG Fish Ticket data provided by AKFIN.

BSAI							
	2014	2015	2016	2017	2018	2019	2020
1 to 2 Lbs	41,849	9,470	145,733	417,060	164,467	248,280	108,067
2 to 3 Lbs	215,386	76,403	107,955	244,321	312,758	481,765	371,264
3 to 4 Lbs	128,448	79,601	36,818	73,976	89,140	198,322	285,316
4 to 5 Lbs	266,515	158,279	102,727	60,377	47,220	79,875	110,411
5 to 7 Lbs	288,422	190,850	140,264	84,197	61,599	50,650	51,525
7 UP	250,262	108,913	58,651	65,395	88,508	37,662	11,937
Total	1,190,882	623,516	592,148	945,326	763,691	1,096,555	938,519

GOA							
	2014	2015	2016	2017	2018	2019	2020
1 to 2 Lbs	65,293	69,476	182,532	362,701	403,305	652,659	497,309
2 to 3 Lbs	747,602	606,191	643,697	1,039,881	1,652,616	1,888,267	2,251,439
3 to 4 Lbs	3,222,748	2,823,297	2,391,503	2,404,874	3,115,044	3,130,341	3,611,479
4 to 5 Lbs	3,002,277	2,826,089	2,276,366	2,234,511	2,545,187	2,581,875	3,104,438
5 to 7 Lbs	3,397,428	3,165,844	2,736,494	2,824,136	3,023,953	2,526,869	2,508,143
7 UP	2,902,126	2,638,494	2,434,326	2,926,010	3,013,562	2,164,216	1,513,841
Total	13,337,473	12,129,393	10,664,919	11,792,112	13,753,667	12,944,229	13,486,650

Fish in the 4lb+ market grades contribute an increasing percentage of the catch in the eastern portion of the fishery (Figure 4-11, while in the BSAI these large fish comprise a little over half the catch by weight.

The largest landings and revenue category for the EGOA is the 5-7 lbs. grouping. Due to the increasing value of sablefish at larger market sizes, the “7 up” market size comprises 21% of the landings but 25% of the revenue.

Figure 4-11. Market-grade catches of sablefish in the IFQ fixed gear fishery for the different management areas from 2015-2020. Source: AKFIN.

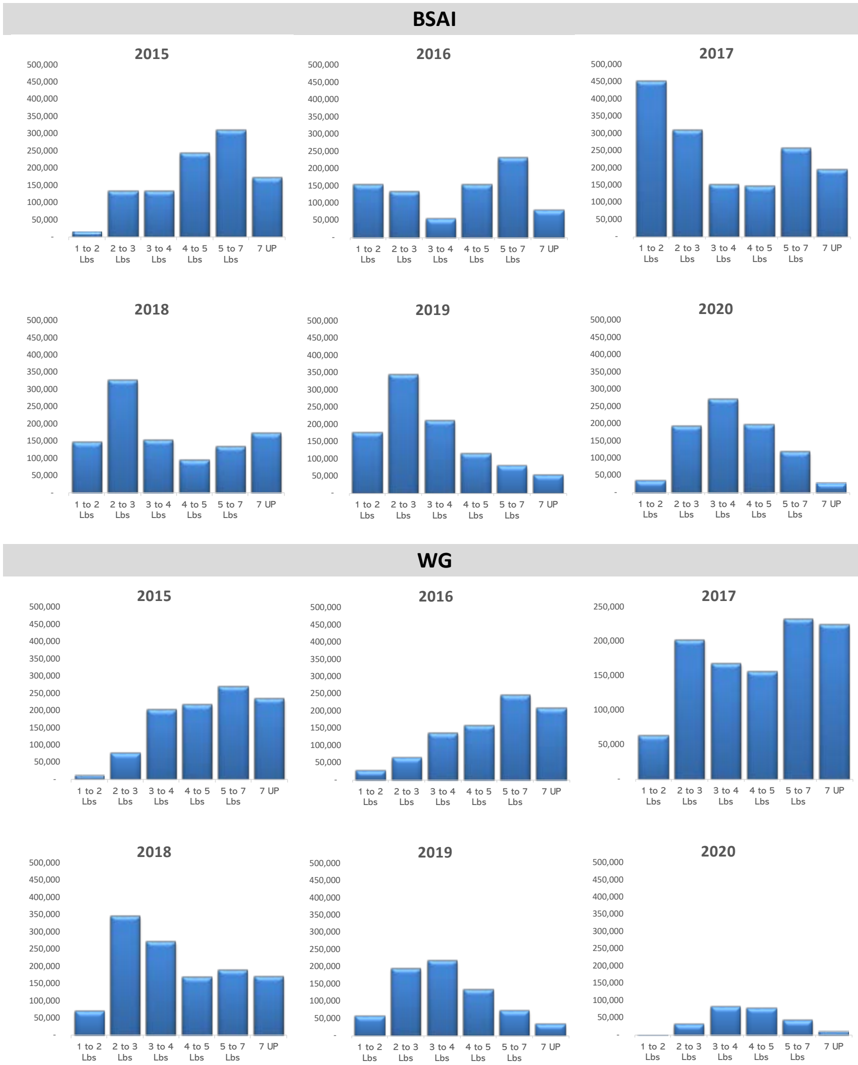
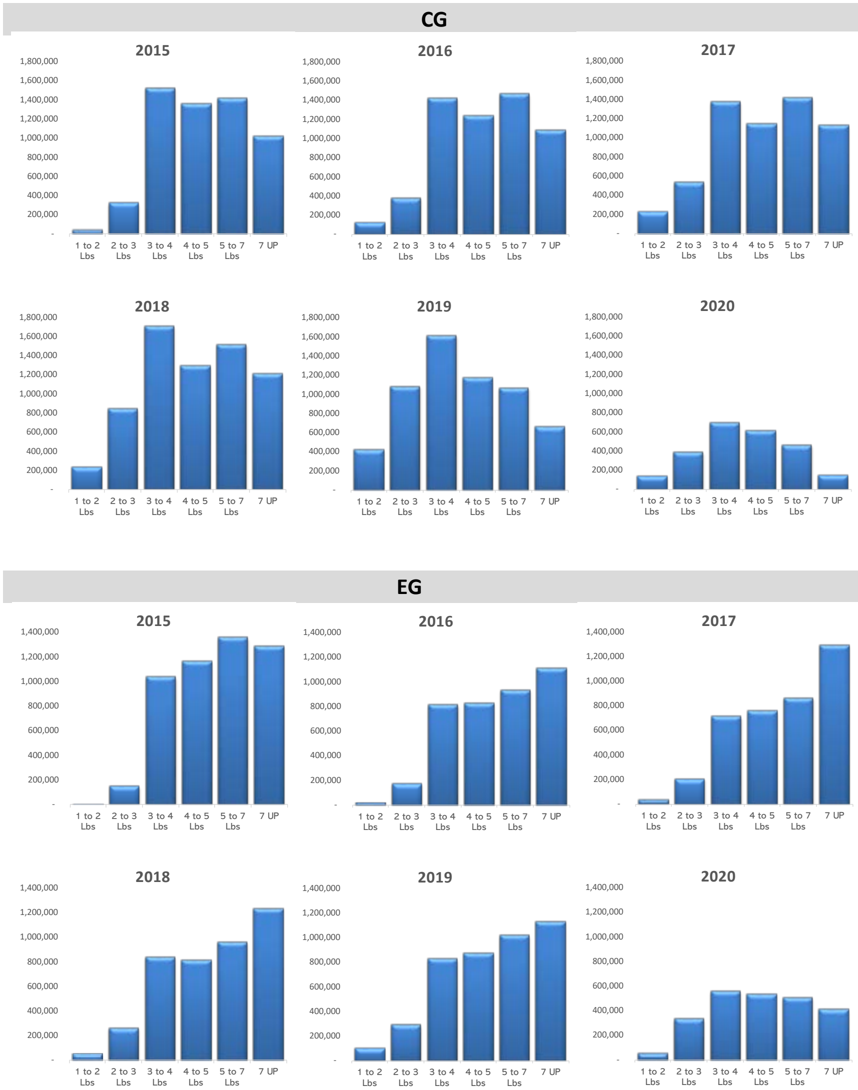


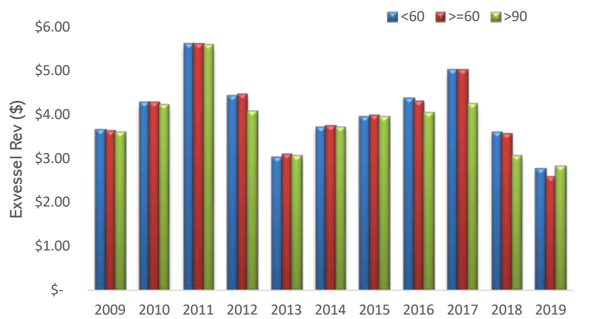
Figure 4-11. (continued) Market-grade catches of sablefish in the IFQ fixed gear fishery for the different management areas from 2015-2020. Source: AKFIN.



Sablefish prices are more stable across vessel types than among management areas (Figure 4-12). This is consistent with the previous information presented to the Council showing both a predominance of larger and smaller year classes in different geographic regions and .

Figure 4-12. GOA Sablefish average IFQ price/lb by year, area, vessel class Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT

PRICE/LB				
	Vessel Class			
	<60	>=60	>90	Total
2009	$ 3.67	$ 3.65	$ 3.61	$ 3.65
2010	$ 4.28	$ 4.30	$ 4.24	$ 4.28
2011	$ 5.61	$ 5.62	$ 5.59	$ 5.61
2012	$ 4.42	$ 4.48	$ 4.07	$ 4.39
2013	$ 3.05	$ 3.09	$ 3.06	$ 3.06
2014	$ 3.73	$ 3.75	$ 3.73	$ 3.73
2015	$ 3.97	$ 3.98	$ 3.96	$ 3.97
2016	$ 4.39	$ 4.33	$ 4.06	$ 4.35
2017	$ 5.03	$ 5.02	$ 4.24	$ 4.96
2018	$ 3.61	$ 3.57	$ 3.06	$ 3.56
2019	$ 2.77	$ 2.59	$ 2.82	$ 2.73



PRICE/LB							
	Management Area						
	BS	AI	WG	CG	WY	SE	Total
2009	$ 3.42	$ 3.60	$ 3.63	$ 3.74	$ 3.67	$ 3.60	$ 3.65
2010	$ 4.06	$ 4.30	$ 4.33	$ 4.33	$ 4.29	$ 4.22	$ 4.28
2011	$ 5.50	$ 5.63	$ 5.76	$ 5.64	$ 5.56	$ 5.55	$ 5.61
2012	$ 3.42	$ 4.23	$ 4.27	$ 4.47	$ 4.54	$ 4.43	$ 4.39
2013	$ 2.88	$ 3.07	$ 3.14	$ 3.11	$ 3.07	$ 2.97	$ 3.06
2014	$ 3.60	$ 3.71	$ 3.84	$ 3.78	$ 3.71	$ 3.65	$ 3.73
2015	$ 3.66	$ 3.99	$ 4.05	$ 3.99	$ 3.98	$ 3.92	$ 3.97
2016	$ 3.26	$ 4.20	$ 4.40	$ 4.39	$ 4.30	$ 4.39	$ 4.35
2017	$ 3.48	$ 4.22	$ 4.79	$ 5.04	$ 5.16	$ 5.06	$ 4.96
2018	$ 2.28	$ 2.83	$ 3.11	$ 3.51	$ 3.84	$ 3.84	$ 3.56
2019	$ 1.81	$ 1.96	$ 2.39	$ 2.44	$ 2.93	$ 3.33	$ 2.73

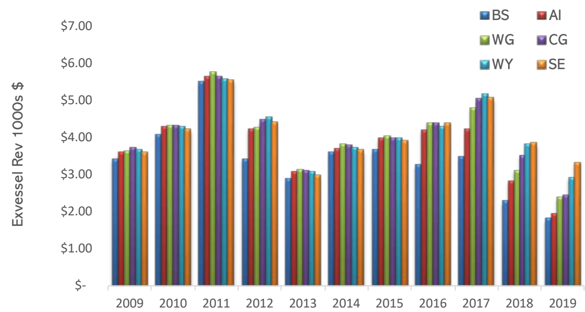


Table 4-7. Fixed-gear sablefish ex-vessel value/lb. by market category. ADFG Fish Ticket data.

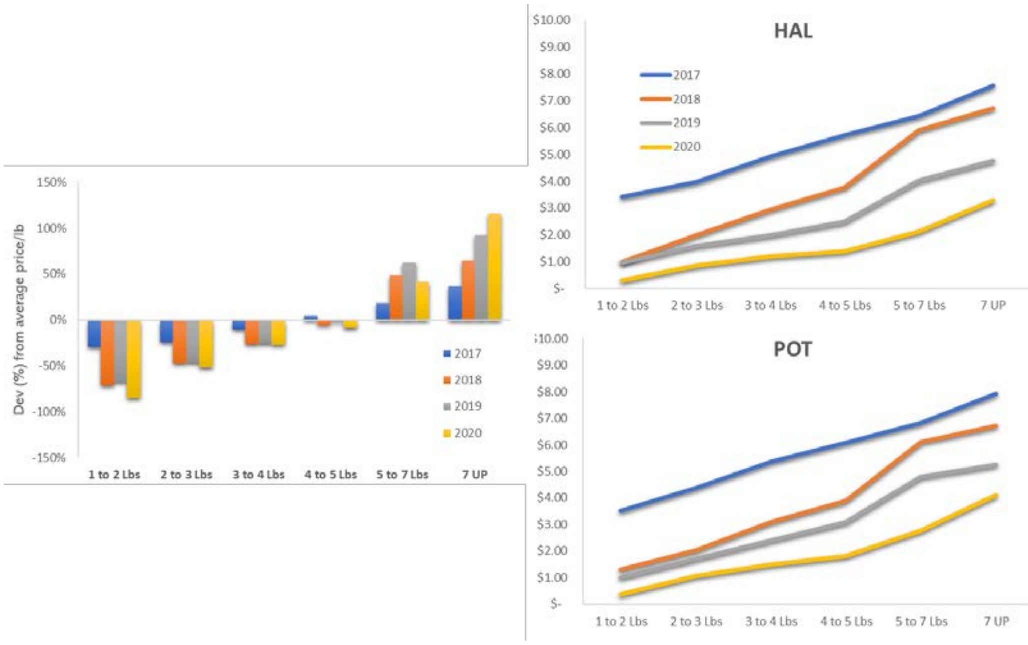
Price Per Pound	2014	2015	2016	2017	2018	2019	2020
HAL	**$ 4.34**	**$ 4.61**	**$ 5.08**	**$ 6.06**	**$ 4.56**	**$ 2.96**	**$ 1.74**
1 to 2 Lbs	$ 2.93	$ 2.50	$ 2.78	$ 3.43	$ 0.98	$ 0.97	$ 0.30
2 to 3 Lbs	$ 3.07	$ 2.67	$ 3.18	$ 3.97	$ 1.99	$ 1.60	$ 0.85
3 to 4 Lbs	$ 3.69	$ 3.56	$ 3.91	$ 4.93	$ 2.94	$ 2.00	$ 1.20
4 to 5 Lbs	$ 4.05	$ 4.17	$ 4.48	$ 5.73	$ 3.75	$ 2.49	$ 1.38
5 to 7 Lbs	$ 4.56	$ 5.15	$ 5.49	$ 6.44	$ 5.89	$ 4.04	$ 2.11
7 UP	$ 5.39	$ 6.04	$ 7.00	$ 7.57	$ 6.71	$ 4.77	$ 3.28
POT	**$ 3.28**	**$ 4.26**	**$ 3.60**	**$ 4.97**	**$ 3.01**	**$ 2.44**	**$ 1.63**
1 to 2 Lbs	**$ 2.66**	**$ 2.73**	**$ 2.78**	**$ 3.52**	**$ 1.29**	**$ 1.02**	**$ 0.36**
2 to 3 Lbs	$ 2.78	$ 3.12	$ 3.35	$ 4.37	$ 2.02	$ 1.71	$ 1.07
3 to 4 Lbs	$ 3.60	$ 4.09	$ 5.26	$ 5.36	$ 3.10	$ 2.39	$ 1.48
4 to 5 Lbs	$ 3.44	$ 4.51	$ 4.69	$ 6.08	$ 3.89	$ 3.09	$ 1.82
5 to 7 Lbs	$ 3.88	$ 5.60	$ 5.69	$ 6.84	$ 6.10	$ 4.81	$ 2.77
7 UP	$ 4.46	$ 5.85	$ 9.19	$ 7.92	$ 6.72	$ 5.26	$ 4.10

Figure 4-13 plots annual average price per pound for HAL and pot gear types as well as the relative price per pound (as a percent of average price) for both gear types over the same period. Given that the prices fell precipitously between 2017 and 2020, the important distinctions illustrated in the figure are price effects based on market category and year. The year-effect is apparent across all market categories, as apparent in the fact that 2017 was a high-water mark across all size categories and 2020 is a low value year across all categories. In other words, in 2017, H&G sablefish in the 1-2 lb market category were getting a remarkable $4.70/lb or so, while in 2020, sablefish in the 5-7 lb market category were only getting $3.75 per pound.

Despite these impressive annual fluctuations for all market categories over the past four years, it is important to also consider relative value of market categories within years. Maintaining the comparison between 2017 and 2020 as in the above, in 2017 at $4.70, the lowest market category was worth about

30% less than the average price per pound that year ($6.70), and the largest category (7 lbs. ups) was worth 37% more per pound than that average. In 2020, at $0.41, the lowest market category was worth 85% less that the average that year ($2.65) and 7 lbs. ups were worth 116% more than average.

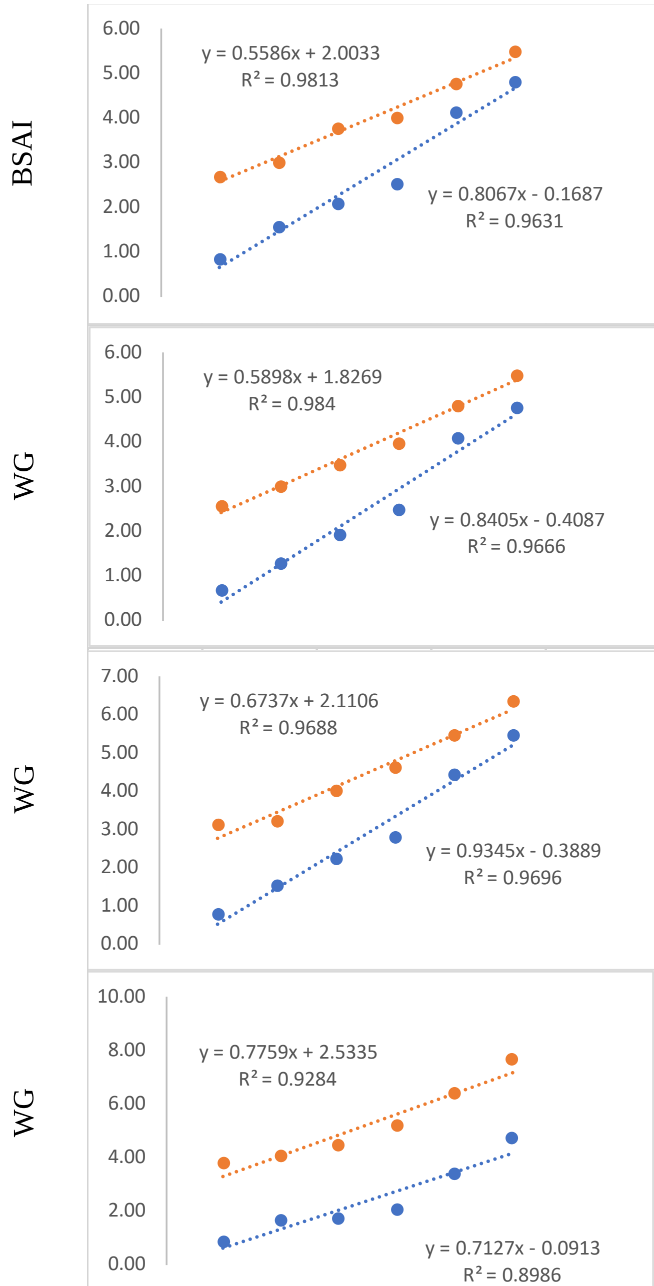
Figure 4-13. 2017 through 2020 deviations in IFQ sablefish ex-vessel value/lb.by market category relative to average price (left panel) and Fish Ticket price/lb by gear. Source: ADFG Fish Ticket data provided by AKFIN.



These differences could be helpful in considering possible fishery responses to the management action under consideration since they imply that the response may vary among years depending on market conditions. A recurring concern within IFQ management in general has been the possibility of creating circumstances that introduce incentives to discard catch. The following statement is from the Twenty Year Review: "There is lots of literature [sic] about catch shares creating incentives to highgrading, particularly in situations where at-sea discards are difficult to monitor. These conditions could exist in the IFQ fisheries given limited observations of at-sea discards, and price differentials for ex-vessel payments on larger fish. Currently, NMFS does not have the fleet-wide data to characterize the extent to which highgrading is or is not occurring."

The price gradient also appears to vary across areas. In the figures below, FT data are used to compare price/lb across market grades and management areas. The upper (orange) points in each panel represent the average price/lb during the period prior to the arrival of the large year classes (2015-2017), while the lower (blue) points represent the years 2018-2020 when fishery catches were affected by these year classes. Incorporating both the moderate change in relative price in 2018 and the aberrant differences in 2020, the price gradient (represented here by the slope of the trendline) in the recent period is consistently greater than in the previous period for all areas except the eastern GOA. Note that the division of EGOA into WY and SE isn't done here due to the constraints of the FT data.

Figure 4-14. Sablefish price gradients before (orange; 2015-2017) and after (blue; 2018-2020) the emergence of recent year classes in the catch. Source: AKFIN



In the figures below, the top row of market grade distributions for each area reflects fishery catches that occurred when the fishery was operating under conditions before the emergence of recent year classes, Furthermore, the two years in which the gradient appears to be steepest are the most recent. So in years when the fishery as a whole appears to be tanking, driven by dramatic changes in the size of fish encountered on the fishing grounds, the market-drive for differentiating catch in order to maximize value at the dock may have actually increased.

4.5.2.7 Sablefish IFQ Communities

IFQ sablefish quota shares are distributed among 52 communities in Alaska. Participants in an additional 142 communities in 21 states outside Alaska complete the universe of QS ownership. Vessels that land

IFQ sablefish are homeported in 49 different communities, 30 of which are located in Alaska (homeport is self-reported to CFEC). Catcher vessels deliver sablefish shoreside in 26 Alaska communities, five of which are in the BSAI area. Alaska communities involved in the sablefish IFQ fishery are primarily in the Central GOA and Eastern GOA (map Figure 4-15), consistent with more than 85% of the sablefish value being delivered to processors in the CG and SE.

Figure 4-15. The distribution of communities involved in the IFQ sablefish fishery in Alaska. Source:

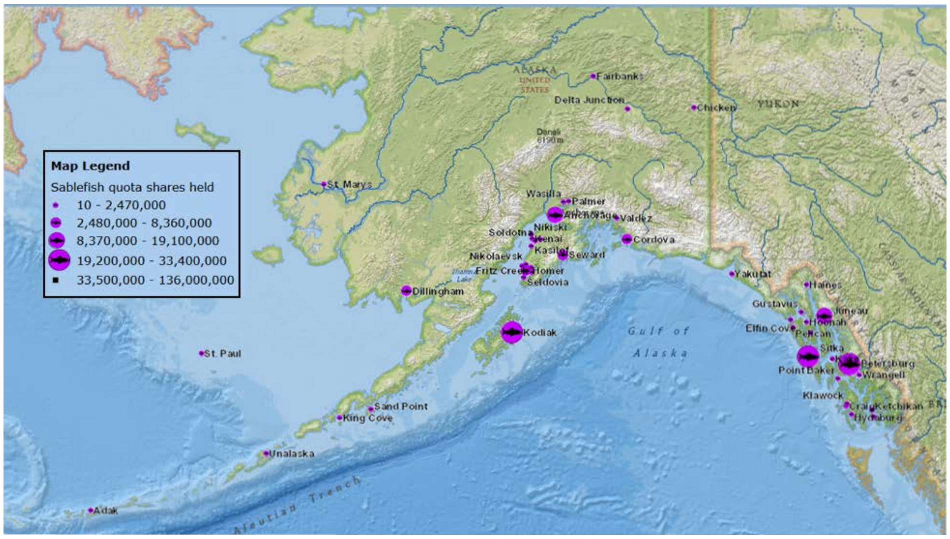
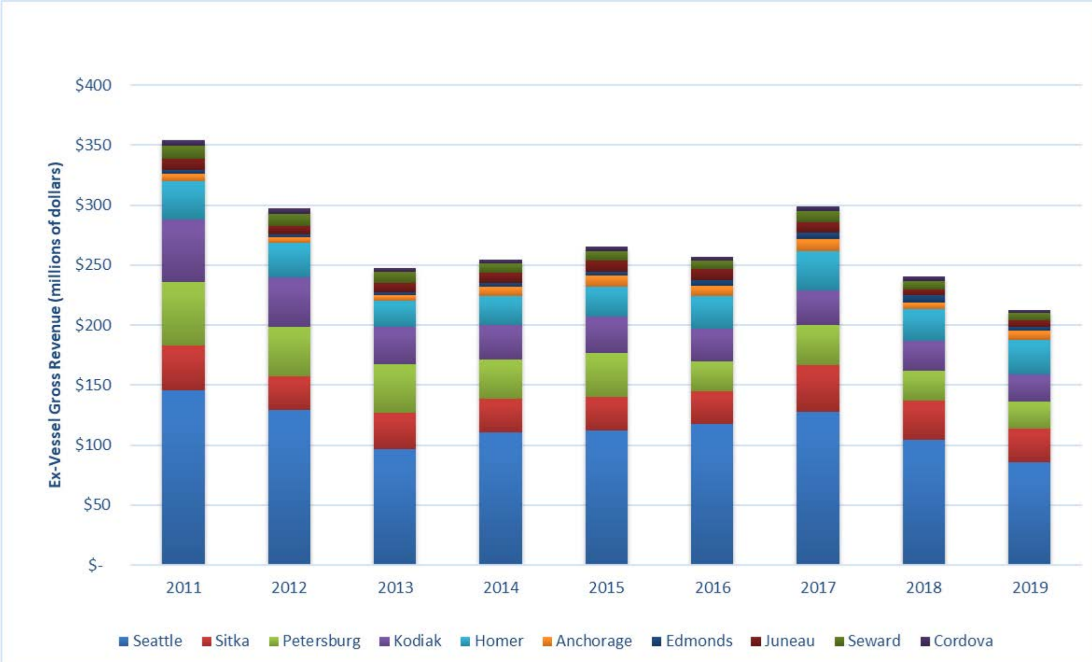


Table 4-8 below updates data from Kasperski and Himes-Cornell (2014) for Top Ten Alaska communities involved in the sablefish IFQ Program in 2000 and 2010 by adding a panel with 2019 distributions in the right panel. These communities are ranked in descending order by total community QS shares. IFQ sablefish ex-vessel revenues from 2011-2019 are illustrated in Figure 4-16 for these communities. Eight of the top ten earning communities are located within Alaska, with two other communities from Washington (Seattle and Edmonds) rounding out the top ten.

Table 4-8. Top Ten sablefish IFQ communities for 2000, 2010, and 2019 based on the distribution of QS.

Year 2000			Year 2010			Year 2019		
Community	Sablefish IFQ Allotment (pounds)	Sablefish Quota Shares Held	Community	Sablefish IFQ Allotment (pounds)	Sablefish Quota Shares Held	Community	Sablefish IFQ Allotment (pounds)	Sablefish Quota Shares Held
Sitka	3,468,534	33,407,542	Sitka	2,331,889	29,734,443	Sitka	2,836,263	31,161,502
Petersburg	2,713,036	27,963,913	Petersburg	2,059,608	27,422,822	Petersburg	2,277,112	26,154,650
Kodiak	1,573,109	17,988,783	Kodiak	1,447,274	19,086,362	Kodiak	1,212,829	15,491,339
Homer	1,303,948	14,348,725	Juneau	836,744	9,679,945	Homer	954,537	12,133,829
Juneau	1,110,894	10,691,521	Homer	917,114	9,611,888	Anchorage	815,089	10,420,961
Seward	481,446	5,348,346	Anchorage	752,348	7,656,130	Seward	536,945	6,853,407
Dillingham	286,564	3,176,112	Seward	480,714	6,659,312	Juneau	540,957	6,390,532
Pelican	259,299	2,362,394	Cordova	249,802	3,386,595	Cordova	426,270	5,707,315
Ketchikan	255,102	2,471,368	Dillingham	263,166	3,181,804	Dutch Harbor	287,557	3,458,419
Halibut Cove	251,087	2,766,565	Wrangell	131,150	1,501,025	Dillingham	254,963	3,176,112

Figure 4-16. Ex-vessel revenues from 2011-2019 for the Top Ten communities associated with the IFQ sablefish fishery.



Roughly 95% of the vessels in the smaller length groups (less than or equal to 50’ LOA) report their homeport in an Alaska community. Eighty-five percent of vessels in the 51’ to 60’ LOA group homeported in Alaska. By comparison, over half of the sablefish IFQ vessels that are greater than 60’ LOA (54%) homeport outside of Alaska.

There are 67 sablefish processing entities among 26 Alaska communities with most in the CG and SE areas with Kodiak and Seward topping the communities in terms of number of processing entities. While comparable processing capacity exists between Central and Southeast GOA, processors in SE are spread among 13 communities, compared to just 5 in the CG.

Table 4-9. Ex-Vessel Values of Sablefish IFQ Deliveries to Shore-Based Processors in Alaska by Community of Operation, 2011-2019 (millions of 2019 dollars)

Port Area	2011	2012	2013	2014	2015	2016	2017	2018	2019	Annual Average 2011-2019 ($ millions)	Annual Average 2011-2019 (percent)
Aleutian	*	*	*	*	*	*	*	*	*	$.80	0.98%
Bering Sea	$9.76	$5.46	$5.33	$5.34	$4.68	$4.26	$6.15	$3.35	$3.03	$5.26	6.44%
Central Gulf	$54.27	$48.07	$32.57	$35.53	$35.99	$36.99	$44.64	$31.03	$21.43	$37.84	46.31%
Southeast	$46.75	$41.79	$26.78	$27.41	$29.23	$27.88	$35.70	$30.16	$25.86	$32.40	39.65%
Western Gulf	*	*	*	*	*	*	*	*	*	$5.40	6.61%
Grand Total	$121.39	$105.27	$70.96	$74.47	$74.93	$72.82	$92.29	$69.32	$53.82	$81.70	100.00%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive_FT
*Includes Floating Processors

4.6 Analysis of Impacts: Alternative 1, No Action

Selecting the No Action Alternative 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. Additionally, any of the costs or benefits attributable to that prohibition would continue for this fishery.

Although many complicating factors are involved, the current state of the sablefish IFQ fishery off Alaska appears to be that one that has been in a downturn since 2018, which also coincides with the period when large numbers of small sablefish started showing up on the fishing grounds. The interplay of market conditions and these unusual population events for the sablefish stock appear to have reduced the value of Alaska sablefish to an all-time low in 2020, and on top of that, the global pandemic has had a disrupting effect on all involved.

While the price gradient for sablefish market grades is never flat, in a more favorable market, demand for the premium product (largest market grades) appears to have a buoying up effect on less sought after components of the overall catch. The opposite appears also to be true. When the value of sablefish is depressed across all product categories, the difference in value per pound between the smallest fish and the largest fish becomes magnified (Figure 4-10).

On a given trip, therefore, with the prospect of their IFQ being worth half of what it was two years ago, small boat operators who see nothing but 1-2 pound fish in a string of pots or a section of groundline are keenly aware that bringing these fish in is not improving things for them. Since retaining these fish means being penalized heavily at the dock, compliance is only ensured by the presence of significant offsetting penalties. However, even with penalties as stiff as the total loss of permitting, there are doubtless circumstances when there is simply no chance that the decision to discard will be observed and enforced. The total effect of this is reflected in the catch compositions, e.g., (Figure 4-11). Another contributing factor to that decision, is that, according to abundant public testimony, small sablefish are often quite lively, and fishermen are confident that they will survive the release.

Shoreside wholesale operations are also investing in a loss if they accept these fish, by increasing their processing time per pound to generate a product with no immediate market or anticipated future market subsequent to long term frozen storage. The discouraging effects of these experiences will be most keenly felt by businesses that are operating near the margins of solvency, whether in the harvest or processing sector.

Given these scenarios, especially when the perceived harm to discarded sablefish is low, maintaining the status quo may seem unnecessarily punitive. This is the perspective that many testifiers have spoken to before the Council since 2018. With hundreds of primarily small-boat operations involved, the probability arises that for at least one operation, the value of their sablefish IFQ and other opportunities will not be sufficient to offset overall costs further investments in gear, bait, vessel maintenance and crew. On the whole, however, this robust and diverse fishery operates within a program designed to deliver benefits by ensuring flexibility to its participants, and that flexibility means being able to pick when and where to fish.

Additional flexibility was introduced in 2020 during the extraordinary circumstances of the COVID pandemic that allowed temporary transfer of IFQ for all quota shareholders. The current sablefish IFQ fleet includes many participates who have endured vacillating markets amid the unpredictability inherent in running a commercial fishing business. Furthermore, fishermen that diversify their catch across multiple species should experience reduced variability in total revenue, at least to the extent that they own fishing permits that allow access to multiple target fisheries.

There is a great deal of overlap in participation in the IFQ fisheries and vessels that fish sablefish IFQ typically also fish halibut IFQ. From 2009-2013, more than 300 vessels participated in both IFQ fisheries (NPFMC 2015). 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 come from salmon, herring, or crab.

The impacts of Alternative 1 to communities is expected to vary with the extent to which they are dependent on sablefish fishing and sablefish revenues. The "top ten" list of sablefish IFQ communities identified in section 4.5.2.7 , provides an example of communities likely to reap benefits and costs derived from current sablefish market conditions. The effects of the existing regulations on these communities would be an appropriate focus for those considering this action.

The benefits of Alternative 1 to harvesters, processors, and communities are probably best appreciated along an extended timeframe, given the current performance of the fishery. As provided in section 4.5.2, the prohibition was established to constrain flexibility for operations, thus preventing, or at least reducing, the tendency to make short-term choices that would cumulatively contribute to long term costs to resource and participants. Thus, a benefit of maintaining the status quo prohibition would be the current availability of larger more valuable fish to the fishery. If the prohibition were not been in place, the size structure and productivity of the sablefish resource would likely be reduced from what it is currently and would correspond to a smaller total volume of fishery participation.

4.7 Analysis of Impacts: Alternative 2

An allowance for releasing sablefish in the IFQ fishery would be brought about by amendments to the BSAI and GOA Groundfish FMPs and associated regulatory changes. The allowance itself would generate such a major change in the operational atmosphere for IFQ participants that the variances in the management of the fishery, reflected in the elements and options, would be of secondary importance.

Under an allowance for optional discarding, and in the absence of controls on the portion of the stock that could be discarded, highgrading or differentiating the catch any other way, would not be in violation, as long as the discards occur in a manner that is consistent with safe release provisions of the regulations for fisheries off Alaska. Therefore the impacts of Alternative 2, on individuals, operations, and communities would be in the synergistic relationship that arises between the fishery response to Alternative 2 and attempts by managers to set harvest limits to appropriately account for that response.

The information that is provided in section 2.2.3 suggests that a bottom line impact of Alternative 2 on the stock assessment (Element 3) would be a reduction in ABC and therefore TAC that would be experienced by all fishery sectors that interact with the sablefish resource. This would not only include the IFQ fishery but also the non-target fisheries that have become increasingly important contributors to the overall mortality of sablefish off Alaska. A reduction in ABC for these fisheries would increase the likelihood that sablefish would be listed as PSC and would move the timing of that change in status to earlier in the year. If reductions in ABC as a result of Alternative 2 also reduce OFL, the possibility of a sector closure begins to arise, and this becomes more likely as the magnitude of the reduction increases. A 51% reduction in ABC, the most extreme scenario described in section 2.2.3 may interrupt trawl landings before they have completed a full year's worth of harvest efforts, extending the impacts of the Alternative to persons, operations, and communities far beyond the intended scope of this action.

4.7.1 Harvester Responses to Release Allowance

Fish Ticket data show a clear delineation in ex-vessel value between market categories as defined by fish weight (section 4.5.2.6). Wholesale price per pound for the largest fish is typically greater by a factor of two than the price for smaller fish, which was evident prior to 2018. But after the arrival of the recent year classes, the difference was a factor of 6 in 2018 and 2019, and a factor of 14 in 2020. This creates particularly challenging circumstances for the IFQ sablefish fishery because in years when the fishery as a whole is struggling, such as in 2020, the market-drive for differentiating catch in order to maximize value at the dock may be reaching its peak. In other words, the time when operations would most want to discard is also the time when removing the prohibition on discarding is most likely to result in an exaggerated response beyond the intent of the allowance.

Under Alternative 2, allowing the release of unwanted sablefish caught in the IFQ fishery would expand the toolbox for vessel operators and enhance their flexibility on the water. In the absence of a minimum size for retention or a maximum size for discarding, fishermen would be able to fully explore the potential to maximize the value of their catch by selectively retaining fish. There would likely be a range of responses associated with the allowance, but most vessel operators would be expected to release fish they are sure cannot be sold. This is currently allowed for fish that are observed to be damaged when brought to the surface. Selective discarding would tend to reduce retention of the smallest fish in the catch, such as the 1-2lb market category. This market grade was an increasingly insignificant contributor to gross revenue in all areas and operations in recent years. In 2020, these fish yielded about $0.30 /lb at the dock, probably not enough to justify bringing them in under most circumstances, and even in the BS, these fish provided barely 2% of gross revenues.

Harvest of fish in the 2-3lb market grade could also be minimized under Alternative 2 and is explored in section 2.2. The Council is explicitly considering the use of survey catches of fish *less than three pounds* for providing estimated discards under Element 2, Option 2 in Alternative 2. Importantly, and helpful for providing a rough estimate of the revenues involved, a sablefish that is 3lbs in round weight (i.e., whole) are in the market grade for sub-3lb fish, according to the conversion table in Appendix A (section 8). These fish comprised a larger portion of the total catch. By area, this market category contributed to about 20% of BSAI gross revenues in the most recent three years, and thus, it is less likely that these fish would be discarded by IFQ vessels in the Bering Sea. On the other hand, gross revenues in the CG and EG from the 2-3lb grade, were 8% and 5% on average in the past three years, and given the opportunity, fishermen in those areas may be more likely to discard this component of the catch. Since the probability of discarding is likely to vary according to the size composition of the catch across management areas, the creation of discards from longline survey data, as an accounting measure for the fishery is problematic. This is addressed more comprehensively in section 2.2.2.

The moment at which discarding will or will not occur will likely vary at the operational level according to the conditions on specific trips, essentially gambling the cost of extra effort against the prospect that it will pay off in the form of profitable catches. The sense of whether to take that risk would likely fluctuate from set to set within a trip, or even pot to pot, and hook to hook. Responses could include immediate release of fish in unwanted market grades, which is consistent with regulations on releasing fish. Alternatively, vessels could also dump fish later that have been brought on board depending on trends in the catch. This would be in violation of careful release regulations, but is likely to occur occasionally.

This also elicits classic objections to the allocated management approach that have been directly and indirectly brought up throughout this document. Specifically, during development of the IFQ Program, detractors predicted it would enhance conditions for highgrading. That perspective did not necessarily argue in support of the derby fishery atmosphere of the time, but observed that within that atmosphere, vessels were under a great deal of pressure to land their catches as quickly as possible. Conversely, if vessel operators were allowed to make decisions about how to maximize the value of their IFQ in a more relaxed atmosphere, given the price gradient for sablefish products, it would often be hard to justify holding onto less valuable components of the catch.

The variable that contributed most compellingly to the establishment of the discarding prohibition is the steepness of the price differential between the various market grades at the dock. In section 4.5.2.6, the variability in price gradients across years is demonstrated. Furthermore, in that document section, variation is suggested in differential market grade prices across the geographic range of the fishery. This has important implications for fishery behavior and differential impacts to harvesters and communities. In other words, the benefits of discarding may be experienced more by participants that fish in areas where the likelihood of encountering more valuable fish is greater, which diminishes as one follows the market grade catches from south to north. Operations in the BS are less likely to dramatically eliminate 1-2 and 2-3 lb market grades from their deliveries.

4.7.2 Impacts of ABC Reductions

4.7.2.1 Element 1 DMRs

The elements and options associated with Alternative 2 and described in section 2, address operational concerns involved in managing the IFQ sablefish fishery in the absence of a prohibition on discarding. As described in section 2 of this document, further Council consideration of some elements and options, under the advice of its SSC, may be needed to resolve the adequacy each in achieving compliance with National Standards 1 and 2. The number of DMR options under consideration under Element 1, in particular, would likely be reduced after the SSC provides advice for the Council on the DMR values that are likely to be consistent with best available science. At that point, Council recommendation of DMR options would be appropriately oriented to those DMRs that reflect a policy consistent with the Council's intent, perhaps in exercising precaution by specifying a DMR or DMRs larger than the likely true values in order to that would allow, but not encourage discarding. By exceeding the likely true DMRs, the Council would not impose risk to the sablefish stock (National Standard 1).

4.7.2.2 Element 2 Catch Accounting

The Catch Accounting Element would be expected to have impacts that are similarly contingent on the magnitude of the ABC adjustment. No expansion of the existing observer program is proposed under this action. If expansion of the observer program were developed, increased costs to the IFQ fleet would be incurred that would be processed through existing cost recovery measures. Section 304(d)(2)(A) 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 fish landed under the IFQ Program. The MSA limits the fee to 3% of the annual ex-vessel value of the IFQ fisheries. NMFS assesses cost recovery fees only for fish that are landed and deducted from the total allowable catch in the IFQ fisheries. NMFS publishes the individual fishing quota (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 2020 is 3%.

4.7.2.3 Element 3 Discard Mortality Accounting

The impacts of Element 3 include impacts from Element 1 and Element 2 which are nested within their effects on sablefish ABC (section 142.2.1), and considered further in a range of scenarios explored in section 2.2.3.4 that correspond to either insignificant adjustments to stockwide sablefish ABC (e.g., 0.8% reduction) at one end, to potentially cutting Alaska wide sablefish ABC by one half at the other end.. Resolution of the relative likelihood of these scenarios would greatly serve an evaluation of the overall impacts of Alternative 2.

In order to understand how any ABC reduction would impact the diverse fishery operations and communities that participate in the sablefish IFQ fishery, it is important to first establish whether the reduction would be a simplistic overall reduction, or would explicitly accommodate variation in the landscape of participants. Nothing in Alternative 2 suggests spatially or operationally different accommodations for incorporating the discard allowance would be established. As such, the simplistic scenario is assumed.

Under the existing approach for apportioning a reduced ABC among management areas, spatial variation in the size composition of the stock is not an explicit input variable. This means that whatever the percent reduction in hypothetical ABC would be, area TACs would be reduced equally by that percentage, and this raises a distinction between equality and equitability that is beyond mere semantics. Under a voluntary discarding allowance, discarding on a given vessel would tend to be driven by the operator's sense of net value to be gained. On an aggregate level, therefore, participation in the discarding allowance would be expected to vary spatially. Using the landings of 2-3lb fish in BSAI and EG in 2019 as an example (Figure 4-11), it is unlikely that all catches of this market grade and the 1-2lb market grade would have been converted to discards in either area, especially when this was the largest part of the catch for the Bering Sea. In other words, the simplistic approach to a discard allowance in the current state of the action, would likely result in losses to fisheries through reductions in IFQs that are geographically biased.

Scenarios are provided in Appendix C Trip-level discard scenarios that indicate the variability in effort involved in sacrificing a portion of catch to augment harvest of more valuable market grades. The scenarios consider prices during the three years prior to the arrival of large year classes (2015-2017) and after (2018-2020). Effort indicated in the tables reflects the proportion of total additional catch involved in returning the value of the retained catch to what it was if no discarding occurred. This is break-even point would have to be exceeded in order to not defray costs associated with the discarded catch. These scenarios could be further explored, but it is fairly clear that there is a substantial difference in the effort needed to harvest larger fish in the BSAI as compared to, for example, the EG.

Impacts to vessel operations outside of the IFQ fishery would be primarily driven by the reductions in ABC since the allocation of TAC to trawl gear (e.g.,Table 4-1) is not under consideration. Unless this action is developed to ensure that TAC available to trawl fisheries is maintained near existing levels (~5 M lbs in 2020; Table 4-1) reductions in available discards for those fisheries (primarily nonpelagic trawl and possibly pelagic trawl fisheries) would be reduced as a function the percent reduction in ABC. Under the current circumstances, the trawl fisheries are exceeding their TAC, and thus the modest decreases in ABC under the section 2.2.3.4 scenarios would have an exaggerated impact on trawl fisheries. Reductions in trawl TAC would invoke earlier status change of sablefish to PSC for those gear types, perhaps to the beginning of the fishing year. Under the more extreme ABC reduction scenarios, OFL may also be reduced, which, in a worst case scenario where trawl discards exceed ABC, widespread trawl fishery closures may occur.

Catch accounting options affect the magnitude of estimated discards which would not affect catches inseason, but instead be incorporated into the stock assessment along with measures of uncertainty with a resulting ABC reduction. Reductions in ABC are discussed above and in section 2.2.3.4.

4.8 Management and Enforcement Considerations

4.8.1 Alternative 1, No Action

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.

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. The vessels participating in this fishery now fall into the trip-selection pool, but in 2013 and 2014 they were in the partial coverage category (either trip or vessel selection), and prior to 2013 they were not observed. In 2015, NMFS proposes two trip-section strata that will affect the sablefish IFQ fishery:

- Small vessel trip-selection: This pool is comprised of catcher vessels that are fishing HAL or pot gear and are greater than or equal to 40’ but less than 57.5’ LOA. The vessels in this stratum were in the “vessel-selection” pool in the 2013 and 2014 Annual Deployment Plans (ADP).

- Large vessel trip-selection: This pool comprises three classes of vessels: (1) all catcher vessels fishing trawl gear, (2) catcher vessels fishing hook-and-line or pot gear that are also greater than or equal to 57.5’ LOA, and (3) catcher-processor vessels exempted from full coverage requirements. The vessels in this stratum were termed the “trip-selection” pool in the 2013 and 2014 ADPs.

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, 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 appropriate to do so.

The Office of Law Enforcement monitors the sablefish IFQ fishery on a regular basis, conducts random dock side inspections in ports throughout the GOA, and enforces NMFS regulations. OLE does not have the vessel or fiscal resources to provide personnel to conduct 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 specification. OLE also conducts limited monitoring and enforcement activities through at-sea boarding in coordination with the U.S. Coast Guard and Alaska Wildlife Troopers.

4.8.2 Alternative 2 Allow voluntary careful release of sablefish in the IFQ fishery

4.8.2.1 Management Considerations

As outlined in Section 2 of this document, the chief concerns of this action from a management perspective involve the inability to accurately estimate annual variability in number, size, and composition of discarded sablefish and the resulting impact on the sablefish stock.

Section 2.2.2 details current observer data collection methods and describes the difficulties associated with implementing a voluntary release allowance for sablefish in the IFQ fishery, as proposed under Alternative 2. These difficulties ultimately result in biased estimates of at-sea sablefish discards.

Section 2.2.2.1 describes how discard estimates from observer and EM data are used by the AKRO CAS to provide estimates of total catch (and discards) for inseason management and for estimating total fishing mortality for the stock assessment. 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 discard will incorporate the weight of larger retained fish. While some potential solutions are presented, the analysts emphasize that any re-programing to how the CAS currently estimates discards would require significant testing and review.

Finally, Section 2.2.3 discusses how estimated fishing mortality (retained and discarded fish) provided by the CAS is used as an input in the sablefish stock assessment. That 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. The analysts provide several modeled scenarios which describe the possible implications to the sablefish stock as a result of variable discarding scenarios, and again emphasize the need for accurate information regarding the discarded portion of the catch.

NMFS is concerned about any resulting action that would allow vessels to discard sablefish if appropriate estimates of the size, number, and composition of the discarded catch cannot be obtained. This analysis describes in detail that the agency is not currently equipped to collect the necessary information to accurately estimate sablefish discards in the sablefish IFQ fishery. Furthermore, this analysis also explicitly describes possible negative consequences that poorly informed discard estimates could have on the sablefish stock and the resulting fishery.

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

4.8.2.2 Enforcement Considerations

Release of sablefish by the IFQ target fisheries is currently prohibited by regulation. The regulations that would need to be amended include 50 CFR 679.7(f)(11) and 50 CFR 679.7(d)(4)(H)(ii) regarding the discard of sablefish caught with fixed gear, and 50 CFR 679.21(a)(2)(ii) that requires all prohibited species be returned to the sea immediately, with a minimum of injury. Additionally, in both the BSAI and GOA Groundfish FMPs, the fourth provision under General Provisions section 3.7.1.7, prohibiting discarding of sablefish, would need to change. For at-sea enforcement operations, this would involve observing fishery operations and ensuring that sablefish not retained by IFQ vessels are returned to the sea immediately, with a minimum of injury.

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

Risk will need to be addressed in a future analysis and review to ensure regulations or other management structures do not create unintended mismatch between sablefish discard accounting and discard reporting and monitoring mechanisms. Potential issues to be addressed could include: (1) accuracy of trip-level discard reporting, (2) observer involvement in compliance.

4.9 Affected Small Entities (Regulatory Flexibility Act Considerations)

The Regulatory Flexibility Act (RFA), first enacted in 1980 and amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (5 U.S.C. 601-612), is designed to place the burden on the government to review all regulations to ensure that, while accomplishing their intended purposes, they do not unduly inhibit the ability of small entities to compete. The RFA recognizes that the size of a business, unit of government, or nonprofit organization frequently has a bearing on its ability to comply with a Federal regulation. Major goals of the RFA are 1) to increase agency awareness and understanding of the impact of their regulations on small business, 2) to require that agencies communicate and explain their findings to the public, and 3) to encourage agencies to use flexibility and to provide regulatory relief to small entities.

The RFA emphasizes predicting significant adverse economic impacts on small entities as a group distinct from other entities, and on the consideration of alternatives that may minimize adverse economic impacts, while still achieving the stated objective of the action. When an agency publishes a proposed rule, it must either ‘certify’ that the action will not have a significant adverse economic impact on a substantial number of small entities, and support that certification with the ‘factual basis’ upon which the decision is based; or it must prepare and make available for public review an Initial Regulatory Flexibility Analysis (IRFA). Under section 603 of the RFA, an IRFA “shall describe the impact of the proposed rule on small entities.”

Under 5 U.S.C., section 603(b) of the RFA, each IRFA is required to contain:

- A description of the reasons why action by the agency is being considered;
- A succinct statement of the objectives of, and the legal basis for, the proposed rule;
- A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply (including a profile of the industry divided into industry segments, if appropriate);
- A description of the projected reporting, record keeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record;
- An identification, to the extent practicable, of all relevant Federal rules that may duplicate, overlap, or conflict with the proposed rule;
- A description of any significant alternatives to the proposed rule that accomplish the stated objectives of the proposed action, consistent with applicable statutes, and that would minimize any significant economic impact of the proposed rule on small entities. Consistent with the stated objectives of applicable statutes, the analysis shall discuss significant alternatives, such as:
    1. The establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities;
    2. The clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities;
    3. The use of performance rather than design standards;
    4. An exemption from coverage of the rule, or any part thereof, for such small entities.

When an agency publishes a final rule, it must prepare a Final Regulatory Flexibility Analysis, unless, based on public comment, it chooses to certify the action.

As of January 2017, NMFS Alaska Region prepares the IRFA for a proposed action in the Classification section of the proposed rule. Therefore, the preparation of a complete IRFA is not necessary for Council final action on this issue. This section of the RIR provides information about the small entities that may be directly regulatory by the alternatives and the general nature of those effects. This information is useful for the Council to consider in selecting among the alternatives analyzed in this EA/RIR and for NMFS to use to prepare the IRFA for the proposed rule, should the Council recommend implementation of one of the action alternatives. Specifically, this section provides a description and estimate of the number of small entities that may be directly regulated by the action alternatives, noting if the categories or numbers of directly regulated small entities differs among the action alternatives. 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 of the alternatives 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.

The RFA recognizes and defines three kinds of small entities: 1) small businesses, 2) small non-profit organizations, and 3) small government jurisdictions.

<u>Small businesses</u>. Section 601(3) of the RFA defines a ‘small business’ as having the same meaning as ‘small business concern’, which is defined under section 3 of the Small Business Act (SBA). ‘Small

business' or 'small business concern' includes any firm that is independently owned and operated and not dominant in its field of operation. The SBA has further defined a "small business concern" as one "organized for profit, with a place of business located in the United States, and which operates primarily within the United States or which makes a significant contribution to the U.S. economy through payment of taxes or use of American products, materials or labor…A small business concern may be in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that where the firm is a joint venture there can be no more than 49 percent participation by foreign business entities in the joint venture."

The thresholds applied to determine if an entity or group of entities is a small business under the RFA depend on the industry classification for the entity or entities. Businesses 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 (81 FR 4469; January 26, 2016). Businesses classified as primarily engaged in fish processing are considered small entities if they employ 750 or fewer persons on a full-time, part-time, temporary, or other basis, at all affiliated operations worldwide. Since at least 1993, NMFS has considered CPs to be predominantly engaged in fish harvesting rather than fish processing. Under this classification, the threshold of $11.0 million in annual gross receipts is appropriate.

The SBA has established "principles of affiliation" to determine whether a business concern is "independently owned and operated." In general, business concerns are affiliates of each other when one concern controls or has the power to control the other, or a third party controls or has the power to control both. The SBA considers factors such as ownership, management, previous relationships with or ties to another concern, and contractual relationships, in determining whether affiliation exists. Individuals or firms that have identical or substantially identical business or economic interests, such as family members, persons with common investments, or firms that are economically dependent through contractual or other relationships, are treated as one party with such interests aggregated when measuring the size of the concern in question.

The SBA counts the receipts or employees of the concern whose size is at issue and those of all its domestic and foreign affiliates, regardless of whether the affiliates are organized for profit, in determining the concern's size. However, business concerns owned and controlled by Indian Tribes, Alaska Regional or Village Corporations organized pursuant to the Alaska Native Claims Settlement Act (43 U.S.C. 1601), Native Hawaiian Organizations, or Community Development Corporations authorized by 42 U.S.C. 9805 are not considered affiliates of such entities, or with other concerns owned by these entities solely because of their common ownership.

Affiliation may be based on stock ownership when 1) a person is an affiliate of a concern if the person owns or controls, or has the power to control 50 percent or more of its voting stock, or a block of stock which affords control because it is large compared to other outstanding blocks of stock; or 2) if two or more persons each owns, controls or has the power to control less than 50 percent of the voting stock of a concern, with minority holdings that are equal or approximately equal in size, but the aggregate of these minority holdings is large as compared with any other stock holding, each such person is presumed to be an affiliate of the concern.

Affiliation may be based on common management or joint venture arrangements. Affiliation arises where one or more officers, directors, or general partners, controls the board of directors and/or the management of another concern. Parties to a joint venture also may be affiliates. A contractor and subcontractor are treated as joint venturers if the ostensible subcontractor will perform primary and vital requirements of a contract or if the prime contractor is unusually reliant upon the ostensible subcontractor. All requirements of the contract are considered in reviewing such relationship, including contract management, technical responsibilities, and the percentage of subcontracted work.

NMFS considers members of fishing cooperatives affiliated for purposes of applying thresholds for identifying small entities. In making this determination, NMFS considered SBA's "principles of affiliation" at 13 CFR 121.103. Specifically, in § 121.103(f), SBA refers to "[A]ffiliation based on identity of interest," which states "[A]ffiliation may arise among two or more persons with an identity of interest. Individuals or firms that have identical or substantially identical business or economic interests (such as family members, individuals or firms with common investments, or firms that are economically dependent through contractual or other relationships) may be treated as one party with such interests aggregated." If business entities are affiliated, then the threshold for identifying small entities is applied to the group of affiliated entities rather than on an individual entity basis.

Small organizations. The RFA defines "small organizations" as any not-for-profit enterprise that is independently owned and operated, and is not dominant in its field.

Small governmental jurisdictions. The RFA defines "small governmental jurisdictions" as governments of cities, counties, towns, townships, villages, school districts, or special districts with populations of fewer than 50,000.

4.10 Summation of the Alternatives with Respect to Net Benefit to the Nation

[To be completed after Council selects its PPA: number of entities directly regulated and the impacts]

5 Magnuson-Stevens Act and FMP Considerations

[This section will be addressed when the Preliminary Preferred Alternative is selected.]

5.1 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), and a brief discussion of how each alternative is consistent with the National Standards, where applicable. In recommending a preferred alternative, the Council must consider how to balance the national standards.

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.

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

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 EA/RIR prepared for this plan amendment constitutes the fishery impact statement. The likely effects of the proposed action are analyzed and described throughout the EA/RIR. The effects on participants in the fisheries and fishing communities are analyzed in the RIR chapter of the analysis (Chapter 4). The effects of the proposed action on safety of human life at sea are evaluated in Section 4, and above under National Standard 10, in Section 0. Based on the information reported in this section, there is no need to update the Fishery Impact Statement included in the FMP.

The proposed action affects the groundfish 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.

5.3 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.

[This section will be further developed when the Preliminary Preferred Alternative is selected.]

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8 Appendix A Conversion Table

Conversion table between sablefish sex, age, fork length (cm), round weight (kg), dressed weight (lb, Eastern cut, assumed product recovery rate = 0.63), and processor grade.

Sex	Age	Fork length (cm)	Round weight (kg)	Dressed weight (lb)	Grade
M	2	48.1	1	1	Grade 1/2
M	3	53.1	1.5	2	Grade 2/3
M	4	56.8	1.9	3	Grade 3/4
M	5	59.6	2.2	3	Grade 3/4
M	6	61.6	2.5	3	Grade 3/4
M	7	63.2	2.7	4	Grade 4/5
M	8	64.3	2.8	4	Grade 4/5
M	9	65.2	2.9	4	Grade 4/5
M	10	65.8	3	4	Grade 4/5
M	11	66.3	3	4	Grade 4/5
M	12	66.7	3.1	4	Grade 4/5
M	13	67	3.1	4	Grade 4/5
M	14	67.2	3.1	4	Grade 4/5
M	15	67.3	3.1	4	Grade 4/5
M	16	67.4	3.1	4	Grade 4/5
M	17	67.5	3.1	4	Grade 4/5
M	18	67.6	3.2	4	Grade 4/5
M	19	67.6	3.2	4	Grade 4/5
M	20	67.7	3.2	4	Grade 4/5
M	21	67.7	3.2	4	Grade 4/5
M	22	67.7	3.2	4	Grade 4/5
M	23	67.7	3.2	4	Grade 4/5
M	24	67.7	3.2	4	Grade 4/5
M	25	67.7	3.2	4	Grade 4/5
M	26	67.8	3.2	4	Grade 4/5
M	27	67.8	3.2	4	Grade 4/5
M	28	67.8	3.2	4	Grade 4/5
M	29	67.8	3.2	4	Grade 4/5
M	30	67.8	3.2	4	Grade 4/5
M	31	67.8	3.2	4	Grade 4/5
F	2	46.8	0.9	1	Grade 1/2

Sex	Age	Fork length (cm)	Round weight (kg)	Dressed weight (lb)	Grade
F	3	53.5	1.5	2	Grade 2/3
F	4	58.8	2.1	3	Grade 3/4
F	5	63.1	2.6	4	Grade 4/5
F	6	66.5	3.1	4	Grade 4/5
F	7	69.2	3.5	5	Grade 5/7
F	8	71.4	3.9	5	Grade 5/7
F	9	73.2	4.2	6	Grade 5/7
F	10	74.6	4.4	6	Grade 5/7
F	11	75.7	4.6	6	Grade 5/7
F	12	76.6	4.8	7	Grade 7+
F	13	77.3	4.9	7	Grade 7+
F	14	77.9	5.1	7	Grade 7+
F	15	78.4	5.1	7	Grade 7+
F	16	78.7	5.2	7	Grade 7+
F	17	79	5.3	7	Grade 7+
F	18	79.3	5.3	7	Grade 7+
F	19	79.5	5.3	7	Grade 7+
F	20	79.6	5.4	7	Grade 7+
F	21	79.7	5.4	7	Grade 7+
F	22	79.8	5.4	8	Grade 7+
F	23	79.9	5.4	8	Grade 7+
F	24	80	5.4	8	Grade 7+
F	25	80	5.4	8	Grade 7+
F	26	80.1	5.4	8	Grade 7+
F	27	80.1	5.4	8	Grade 7+
F	28	80.1	5.4	8	Grade 7+
F	29	80.1	5.5	8	Grade 7+
F	30	80.2	5.5	8	Grade 7+
F	31	80.2	5.5	8	Grade 7+

9 Appendix B Approximate and relative value of sablefish harvests in management areas

Approximate Ex-vessel Revenues - BSAI							
	2014	2015	2016	2017	2018	2019	2020
1 to 2 Lbs	$ 124,666	46,014	412,619	1,221,137	120,472	143,319	26,853
2 to 3 Lbs	$ 815,882	401,041	401,080	929,543	502,366	529,152	296,563
3 to 4 Lbs	$ 684,582	498,081	202,003	566,415	318,455	440,016	564,612
4 to 5 Lbs	$ 1,302,595	976,213	617,121	586,255	241,051	289,873	498,678
5 to 7 Lbs	$ 1,724,557	1,483,170	1,102,005	1,223,927	545,261	321,428	480,422
7 UP	$ 1,439,248	880,779	408,002	996,746	827,910	255,664	126,383
Total	$ 6,091,532	$ 4,285,298	$ 3,142,830	$ 5,524,023	$ 2,555,515	$ 1,979,452	$ 1,993,511

Pct Revenue - BSAI							
	2014	2015	2016	2017	2018	2019	2020
1 to 2 Lbs	2.0%	1.1%	13.1%	22.1%	4.7%	7.2%	1.3%
2 to 3 Lbs	13.4%	9.4%	12.8%	16.8%	19.7%	26.7%	14.9%
3 to 4 Lbs	11.2%	11.6%	6.4%	10.3%	12.5%	22.2%	28.3%
4 to 5 Lbs	21.4%	22.8%	19.6%	10.6%	9.4%	14.6%	25.0%
5 to 7 Lbs	28.3%	34.6%	35.1%	22.2%	21.3%	16.2%	24.1%
7 UP	23.6%	20.6%	13.0%	18.0%	32.4%	12.9%	6.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Approximate Ex-vessel Revenues - Western Gulf of Alaska							
	2014	2015	2016	2017	2018	2019	2020
1 to 2 Lbs	$ 475,493	228,075	190,270	604,418	445,449	251,336	40,619
2 to 3 Lbs	$ 1,092,419	710,789	473,864	584,586	515,214	413,482	155,191
3 to 4 Lbs	$ 1,072,807	863,392	627,871	619,610	420,424	329,404	191,972
4 to 5 Lbs	$ 1,673,772	1,300,947	1,182,407	1,118,570	771,365	297,294	171,844
5 to 7 Lbs	$ 1,681,535	1,293,563	1,144,195	1,230,458	810,126	156,639	47,028
7 UP	$ -	-	-	-	-	-	-
Total	$ 5,996,026	$ 4,396,767	$ 3,618,606	$ 4,157,642	$ 2,962,578	$ 1,448,157	$ 606,654

Pct Revenue - Western Gulf of Alaska							
	2014	2015	2016	2017	2018	2019	2020
1 to 2 Lbs	7.9%	5.2%	5.3%	14.5%	15.0%	17.4%	6.7%
2 to 3 Lbs	18.2%	16.2%	13.1%	14.1%	17.4%	28.6%	25.6%
3 to 4 Lbs	17.9%	19.6%	17.4%	14.9%	14.2%	22.7%	31.6%
4 to 5 Lbs	27.9%	29.6%	32.7%	26.9%	26.0%	20.5%	28.3%
5 to 7 Lbs	28.0%	29.4%	31.6%	29.6%	27.3%	10.8%	7.8%
7 UP	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Approximate Ex-vessel Revenues - Central Gulf of Alaska							
	2014	2015	2016	2017	2018	2019	2020
1 to 2 Lbs	$ 79,685	127,108	384,412	707,429	189,726	338,891	111,687
2 to 3 Lbs	$ 856,637	1,039,289	1,227,188	1,733,563	1,295,388	1,663,262	594,939
3 to 4 Lbs	$ 4,829,556	6,131,469	5,710,149	5,521,717	3,780,162	3,570,310	1,537,658
4 to 5 Lbs	$ 4,785,691	6,297,765	5,723,560	5,307,658	3,645,281	3,303,207	1,728,885
5 to 7 Lbs	$ 6,320,405	7,736,860	8,013,262	7,737,715	6,774,172	4,756,481	2,073,042
7 UP	$ 5,680,455	6,501,591	6,960,638	7,190,708	6,600,735	3,595,399	798,699
Total	$ 22,552,429	$ 27,834,082	$ 28,019,208	$ 28,198,791	$ 22,285,464	$ 17,227,550	$ 6,844,910

Pct Revenue - Central Gulf of Alaska							
	2014	2015	2016	2017	2018	2019	2020
1 to 2 Lbs	0.4%	0.5%	1.4%	2.5%	0.9%	2.0%	1.6%
2 to 3 Lbs	3.8%	3.7%	4.4%	6.1%	5.8%	9.7%	8.7%
3 to 4 Lbs	21.4%	22.0%	20.4%	19.6%	17.0%	20.7%	22.5%
4 to 5 Lbs	21.2%	22.6%	20.4%	18.8%	16.4%	19.2%	25.3%
5 to 7 Lbs	28.0%	27.8%	28.6%	27.4%	30.4%	27.6%	30.3%
7 UP	25.2%	23.4%	24.8%	25.5%	29.6%	20.9%	11.7%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Approximate Ex-vessel Revenues - Eastern Gulf of Alaska (WY and SE)							
	2014	2015	2016	2017	2018	2019	2020
1 to 2 Lbs	$ 30,187	37,792	93,264	139,427	46,792	87,444	46,086
2 to 3 Lbs	$ 656,389	613,938	709,664	847,765	445,510	502,760	569,101
3 to 4 Lbs	$ 5,096,172	4,752,040	3,733,035	3,255,099	1,677,737	1,651,147	1,110,163
4 to 5 Lbs	$ 6,568,604	6,165,406	4,403,996	4,002,183	1,953,735	2,108,109	1,289,658
5 to 7 Lbs	$ 9,531,843	8,691,586	5,968,160	5,522,296	3,648,294	3,865,738	1,919,746
7 UP	$ 11,514,867	9,872,576	8,517,156	9,897,757	5,801,984	5,330,387	1,930,482
Total	$ 33,398,062	$ 30,133,337	$ 23,425,275	$ 23,664,528	$ 13,574,052	$ 13,545,586	$ 6,865,236

Pct Revenue - Eastern Gulf of Alaska (WY and SE)							
	2014	2015	2016	2017	2018	2019	2020
1 to 2 Lbs	0.1%	0.1%	0.4%	0.6%	0.3%	0.6%	0.7%
2 to 3 Lbs	2.0%	2.0%	3.0%	3.6%	3.3%	3.7%	8.3%
3 to 4 Lbs	15.3%	15.8%	15.9%	13.8%	12.4%	12.2%	16.2%
4 to 5 Lbs	19.7%	20.5%	18.8%	16.9%	14.4%	15.6%	18.8%
5 to 7 Lbs	28.5%	28.8%	25.5%	23.3%	26.9%	28.5%	28.0%
7 UP	34.5%	32.8%	36.4%	41.8%	42.7%	39.4%	28.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

10 Appendix C Trip-level discard scenarios

The tables below incorporate prices and landings by market grade among management areas for the periods before (2015-2017, second page) and after the arrival of recent year classes (2018-2020, first page). For any scenario, encounters with sablefish market grades are assumed to remain constant, thus effort increases are a function of expanding total catch until the value of the retained market grades achieve a constant catch value.

BSAI	2018-2020				Discard 1-2Lbs		Discard 1-3Lbs		Discard 1-4Lbs	
	Pct Mkt Grade	Price/lb	Landings (lb)	Value	Catch (lb)	Value	Catch (lb)	Value	Catch (lb)	Value
1 to 2 Lbs	12%	$ 0.82	1,075	$ 879	1,123	$ 918	1,419	$ 1,160	1,952	$ 1,596
2 to 3 Lbs	30%	$ 1.54	2,671	$ 4,110	2,790	$ 4,293	3,526	$ 5,425	4,852	$ 7,464
3 to 4 Lbs	23%	$ 2.08	2,043	$ 4,258	2,134	$ 4,448	2,697	$ 5,621	3,711	$ 7,733
4 to 5 Lbs	15%	$ 2.54	1,319	$ 3,344	1,378	$ 3,493	1,741	$ 4,415	2,395	$ 6,074
5 to 7 Lbs	12%	$ 4.14	1,053	$ 4,358	1,100	$ 4,552	1,390	$ 5,752	1,913	$ 7,915
7 UP	8%	$ 4.81	753	$ 3,625	787	$ 3,787	994	$ 4,785	1,368	$ 6,584
Total			8,914	$ 20,573	**9,312**	$ 20,573	**11,768**	$ 20,573	**16,191**	$ 20,573
	Adjusted landings and effort(%)				**8,189**	4.5%	**6,822**	32.0%	**5,676**	81.6%
	Discards				1,123		4,945		10,515	

WG	2018-2020				Discard 1-2Lbs		Discard 1-3Lbs		Discard 1-4Lbs	
	Pct Mkt Grade	Price/lb	Landings (lb)	Value	Catch (lb)	Value	Catch (lb)	Value	Catch (lb)	Value
1 to 2 Lbs	5%	$ 0.68	540	$ 364	547	$ 370	627	$ 424	860	$ 581
2 to 3 Lbs	23%	$ 1.29	2,514	$ 3,238	2,550	$ 3,284	2,922	$ 3,764	4,005	$ 5,158
3 to 4 Lbs	29%	$ 1.90	3,154	$ 5,990	3,199	$ 6,076	3,667	$ 6,963	5,025	$ 9,543
4 to 5 Lbs	21%	$ 2.49	2,341	$ 5,820	2,375	$ 5,903	2,722	$ 6,766	3,730	$ 9,272
5 to 7 Lbs	14%	$ 4.09	1,567	$ 6,408	1,590	$ 6,500	1,822	$ 7,450	2,497	$ 10,209
7 UP	8%	$ 4.76	828	$ 3,940	839	$ 3,996	962	$ 4,580	1,318	$ 6,277
Total			10,943	$ 25,759	**11,100**	$ 25,759	**12,722**	$ 25,759	**17,435**	$ 25,759
	Adjusted landings and effort(%)				**10,552**	1.4%	**9,172**	16.3%	**12,570**	59.3%
	Discards				547		3,549		4,864	

CG	2018-2020				Discard 1-2Lbs		Discard 1-3Lbs		Discard 1-4Lbs	
	Pct Mkt Grade	Price/lb	Landings (lb)	Value	Catch (lb)	Value	Catch (lb)	Value	Catch (lb)	Value
1 to 2 Lbs	5%	$ 0.80	634	$ 507	644	$ 515	700	$ 560	897	$ 718
2 to 3 Lbs	15%	$ 1.53	1,809	$ 2,774	1,835	$ 2,815	1,996	$ 3,062	2,558	$ 3,923
3 to 4 Lbs	27%	$ 2.21	3,136	$ 6,944	3,183	$ 7,046	3,462	$ 7,664	4,435	$ 9,820
4 to 5 Lbs	21%	$ 2.82	2,481	$ 6,999	2,518	$ 7,102	2,739	$ 7,725	3,509	$ 9,898
5 to 7 Lbs	20%	$ 4.46	2,308	$ 10,288	2,342	$ 10,439	2,547	$ 11,355	3,264	$ 14,549
7 UP	12%	$ 5.47	1,354	$ 7,399	1,374	$ 7,508	1,494	$ 8,166	1,914	$ 10,463
Total			11,722	$ 34,910	**11,895**	$ 34,910	**12,938**	$ 34,910	**16,578**	$ 34,910
	Adjusted landings and effort(%)				**11,251**	0.0%	**10,242**	0.0%	**13,123**	41.4%
	Discards				644		2,697		3,455	

EG	2018-2020				Discard 1-2Lbs		Discard 1-3Lbs		Discard 1-4Lbs	
	Pct Mkt Grade	Price/lb	Landings (lb)	Value	Catch (lb)	Value	Catch (lb)	Value	Catch (lb)	Value
1 to 2 Lbs	2%	$ 0.86	237	$ 204	238	$ 205	251	$ 216	289	$ 249
2 to 3 Lbs	9%	$ 1.64	1,059	$ 1,733	1,065	$ 1,744	1,123	$ 1,839	1,293	$ 2,118
3 to 4 Lbs	21%	$ 1.71	2,457	$ 4,211	2,472	$ 4,236	2,606	$ 4,466	3,002	$ 5,145
4 to 5 Lbs	21%	$ 2.07	2,442	$ 5,063	2,456	$ 5,094	2,590	$ 5,370	2,983	$ 6,185
5 to 7 Lbs	23%	$ 3.43	2,670	$ 9,154	2,686	$ 9,210	2,832	$ 9,710	3,262	$ 11,184
7 UP	24%	$ 4.70	2,872	$ 13,514	2,890	$ 13,596	3,047	$ 14,334	3,509	$ 16,510
Total			11,737	$ 33,880	**11,808**	$ 33,880	**12,449**	$ 33,880	**14,339**	$ 33,880
	Adjusted landings and effort(%)				**11,570**	0.6%	**11,075**	6.1%	**12,756**	22.2%
	Discards				238		1,374		1,583	

BSAI	2015-2017				Discard 1-2Lbs		Discard 1-3Lbs		Discard 1-4Lbs	
	Pct Mkt Grade	Price/lb	Landings (lb)	Value	Catch (lb)	Value	Catch (lb)	Value	Catch (lb)	Value
1 to 2 Lbs	12%	$ 2.70	1,262	$ 3,406	1,383	$ 3,733	1,888	$ 5,094	2,885	$ 7,787
2 to 3 Lbs	30%	$ 3.02	3,136	$ 9,463	3,438	$ 10,373	4,691	$ 14,153	7,170	$ 21,635
3 to 4 Lbs	23%	$ 3.74	2,399	$ 8,980	2,630	$ 9,843	3,588	$ 13,430	5,485	$ 20,530
4 to 5 Lbs	15%	$ 4.01	1,548	$ 6,214	1,697	$ 6,811	2,316	$ 9,294	3,540	$ 14,207
5 to 7 Lbs	12%	$ 4.78	1,236	$ 5,914	1,355	$ 6,482	1,849	$ 8,844	2,827	$ 13,520
7 UP	8%	$ 5.50	884	$ 4,859	969	$ 5,326	1,322	$ 7,267	2,021	$ 11,109
Total			10,467	$ 38,836	**11,473**	$ 38,836	**15,654**	$ 38,836	**23,929**	$ 38,836
	Adjusted landings and effort(%)				**10,089**	9.6%	**9,076**	49.6%	**8,389**	128.6%
	Discards				1,383		6,578		15,541	

WG	2015-2017				Discard 1-2Lbs		Discard 1-3Lbs		Discard 1-4Lbs	
WG	Pct Mkt Grade	Price/lb	Landings (lb)	Value	Catch (lb)	Value	Catch (lb)	Value	Catch (lb)	Value
1 to 2 Lbs	5%	$ 2.57	694	$ 1,784	718	$ 1,846	884	$ 2,274	1,338	$ 3,442
2 to 3 Lbs	23%	$ 2.99	3,233	$ 9,656	3,345	$ 9,991	4,120	$ 12,305	6,234	$ 18,622
3 to 4 Lbs	29%	$ 3.49	4,056	$ 14,143	4,197	$ 14,634	5,169	$ 18,023	7,822	$ 27,276
4 to 5 Lbs	21%	$ 3.98	3,010	$ 11,988	3,115	$ 12,405	3,837	$ 15,278	5,806	$ 23,120
5 to 7 Lbs	14%	$ 4.81	2,015	$ 9,702	2,086	$ 10,039	2,569	$ 12,364	3,887	$ 18,712
7 UP	8%	$ 5.51	1,064	$ 5,859	1,101	$ 6,062	1,356	$ 7,466	2,052	$ 11,299
Total			14,072	$ 53,131	**14,562**	$ 53,131	**17,934**	$ 53,131	**27,141**	$ 53,131
	Adjusted landings and effort(%)				**13,844**	3.5%	**12,930**	27.4%	**19,568**	92.9%
	Discards				718		5,004		7,572	

CG	2015-2017				Discard 1-2Lbs		Discard 1-3Lbs		Discard 1-4Lbs	
CG	Pct Mkt Grade	Price/lb	Landings (lb)	Value	Catch (lb)	Value	Catch (lb)	Value	Catch (lb)	Value
1 to 2 Lbs	5%	$ 3.12	567	$ 1,768	589	$ 1,837	665	$ 2,073	921	$ 2,871
2 to 3 Lbs	15%	$ 3.23	1,618	$ 5,218	1,680	$ 5,419	1,897	$ 6,117	2,626	$ 8,471
3 to 4 Lbs	27%	$ 4.01	2,805	$ 11,253	2,913	$ 11,688	3,289	$ 13,194	4,554	$ 18,270
4 to 5 Lbs	21%	$ 4.63	2,219	$ 10,276	2,305	$ 10,673	2,602	$ 12,048	3,603	$ 16,683
5 to 7 Lbs	20%	$ 5.46	2,064	$ 11,265	2,144	$ 11,700	2,420	$ 13,208	3,351	$ 18,289
7 UP	12%	$ 6.37	1,211	$ 7,710	1,258	$ 8,009	1,420	$ 9,040	1,966	$ 12,518
Total			10,484	$ 47,490	**10,889**	$ 47,490	**12,292**	$ 47,490	**17,021**	$ 47,490
	Adjusted landings and effort(%)				**10,300**	0.0%	**9,730**	0.0%	**13,473**	62.4%
	Discards				589		2,562		3,547	

EG	2015-2017				Discard 1-2Lbs		Discard 1-3Lbs		Discard 1-4Lbs	
EG	Pct Mkt Grade	Price/lb	Landings (lb)	Value	Catch (lb)	Value	Catch (lb)	Value	Catch (lb)	Value
1 to 2 Lbs	2%	$ 3.78	220	$ 830	223	$ 841	238	$ 898	288	$ 1,089
2 to 3 Lbs	9%	$ 4.04	982	$ 3,969	996	$ 4,022	1,064	$ 4,297	1,289	$ 5,207
3 to 4 Lbs	21%	$ 4.46	2,280	$ 10,167	2,311	$ 10,302	2,468	$ 11,006	2,992	$ 13,339
4 to 5 Lbs	21%	$ 5.17	2,266	$ 11,715	2,296	$ 11,872	2,453	$ 12,682	2,973	$ 15,371
5 to 7 Lbs	23%	$ 6.40	2,478	$ 15,857	2,511	$ 16,069	2,683	$ 17,166	3,251	$ 20,804
7 UP	24%	$ 7.65	2,666	$ 20,392	2,701	$ 20,664	2,886	$ 22,075	3,497	$ 26,754
Total			10,892	$ 62,929	11,037	$ 62,929	**11,791**	$ 62,929	**14,290**	$ 62,929
	Adjusted landings and effort(%)				**10,815**	1.3%	**10,489**	8.3%	**12,713**	31.2%
	Discards				223		1,301		1,577	