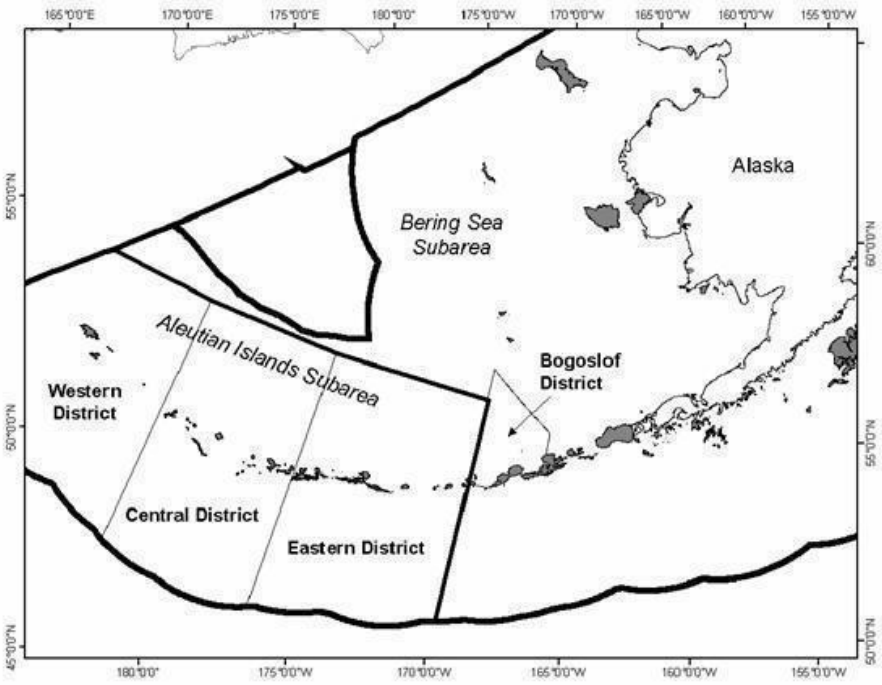
STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

FOR THE GROUNDFISH RESOURCES

OF THE BERING SEA/ALEUTIAN ISLANDS REGIONS

Compiled by:

The Plan Team for the Groundfish Fisheries
of the Bering Sea and Aleutian Islands



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Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea/Aleutian Islands Region

BSAI Introduction Contents

NOTE: full chapters are available through links within each summary and via website HERE

Summary

By

The Plan Team for the Groundfish Fisheries
of the Bering Sea and Aleutian Islands

Introduction

The Stock Assessment and Fishery Evaluation (SAFE) report summarizes the best available scientific information concerning the past, present, and possible future condition of the stocks, marine ecosystems, and fisheries that are managed under Federal regulation. It provides information to the Councils for determining annual harvest levels from each stock, documenting significant trends or changes in the resource, marine ecosystems, and fishery over time, and assessing the relative success of existing state and Federal fishery management programs. For the FMP for the Groundfish Fishery of the Bering Sea and Aleutian Islands (BSAI) Area, the SAFE report is published in three reports: a "Stock Assessment" report, the "Economic Status of Groundfish Fisheries off Alaska" (i.e., the "Economic SAFE report") and the "Ecosystem Status Report" (by Area between the Eastern Bering Sea (EBS) and Aleutian Islands (AI)).

The BSAI Groundfish FMP requires that a draft of the SAFE report be produced each year in time for the December meeting of the North Pacific Fishery Management Council. Each stock or stock complex is represented in the SAFE report by a chapter containing the latest stock assessment. New or revised stock assessment models are usually previewed at the September Plan Team meeting and considered again by the Team at its November meeting for recommending final specifications for the following two fishing years. This process is repeated annually.

This Stock Assessment section of the SAFE report for the BSAI groundfish fisheries is compiled by the BSAI Groundfish Plan Team from chapters contributed by scientists at NMFS Alaska Fisheries Science Center (AFSC). These chapters include a recommendation by the author(s) for the overfishing level (OFL) and acceptable biological catch (ABC) for each stock and stock complex managed under the FMP for the next two fishing years. This introductory section includes the recommendations of the Team (Table 1), along with a summary of each chapter, including the Ecosystem Status Report and the Economic SAFE report.

The OFL and ABC recommendations by the Plan Team are reviewed by the Scientific and Statistical Committee (SSC), which may confirm the Team recommendations or develop its own. The Team and SSC recommendations, together with social and economic factors, are considered by the Council in determining total allowable catches (TACs) and other measures used to manage the fisheries. Neither the author(s), Team, nor SSC typically recommends TACs.

The BSAI Groundfish Plan Team met in Seattle on November 14-18, 2022 to review the status of stocks of twenty-three species or species groups that are managed under the FMP. The Plan Team review was based on presentations by ADF&G and NMFS AFSC scientists with opportunity for public comment and input. Members of the BSAI Groundfish Plan Team who compiled this SAFE report were: Steve Barbeaux (Co-chair), Kalei Shotwell (Co-Chair), Cindy Tribuzio (Vice Chair), Diana Stram (BSAI Groundfish PT coordinator), Mary Furuness, Michael Smith, Allan Hicks, Lisa Hillier, Kirstin Holsman, Andy Kingham, Phillip Joy, Andrew Seitz, Beth Matta, and Caitlin Allen Akselrud.

Background Information

The BSAI management area lies within the 200-mile U.S. Exclusive Economic Zone (EEZ) of the US (Figure 1). International North Pacific Fisheries Commission (INPFC) statistical areas 1 and 2 comprise the EBS. The Aleutian Islands (AI) region is INPFC Area 5.

Amendment 95 to the BSAI Groundfish FMP, which was implemented in 2010 for the start of the 2011 fishing year, defined three categories of species or species groups that are likely to be taken in the

groundfish fishery. Species may be split or combined within the "target species" category according to procedures set forth in the FMP. The three categories of finfishes and invertebrates that have been designated for management purposes under two management classifications are listed below.

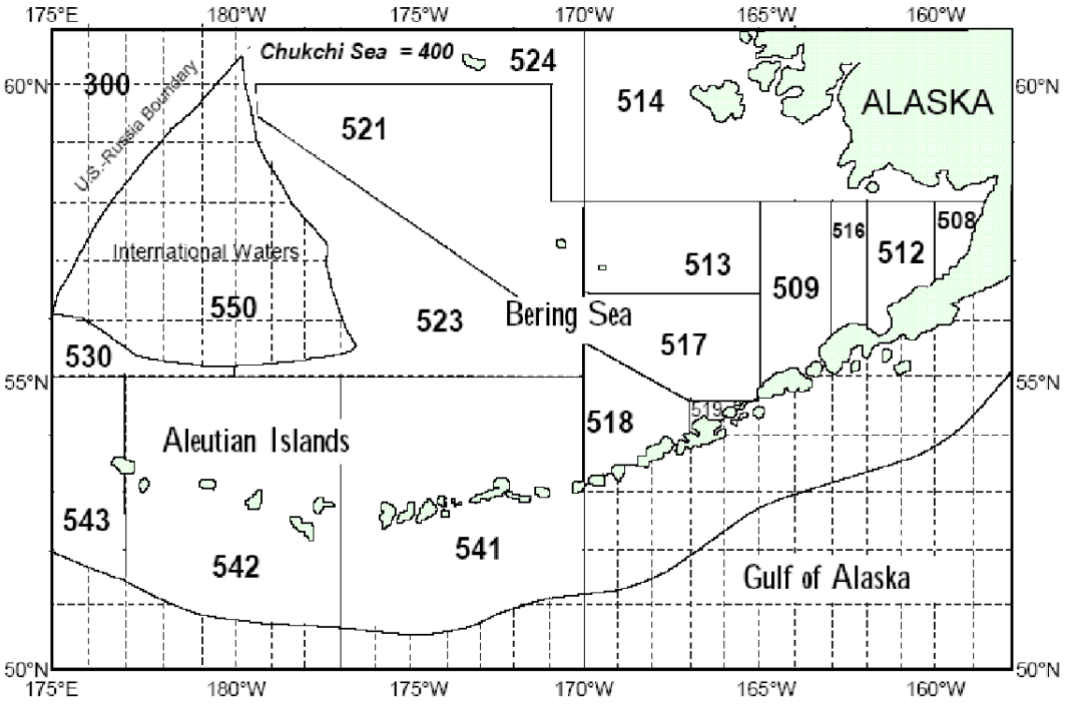

Figure 1. Bering Sea/Aleutian Islands statistical and reporting areas.

In the Fishery:

Target species–are those species that support either a single species or mixed species target fishery, are commercially important, and for which a sufficient database exists that allows each to be managed on its own biological merits. Accordingly, a specific TAC is established annually for each target species or species assemblage. Catch of each species must be recorded and reported. Stocks/assemblages in the target category are listed below.

Ecosystem Component:

Prohibited Species–are those species and species groups the catch of which must be avoided while fishing for groundfish, and which must be immediately returned to sea with a minimum of injury except when their retention is authorized by other applicable law. Groundfish species and species groups under the FMP for which the ABCs have been achieved shall be treated in the same manner as prohibited species.

Forage fish species–are those species listed below, which are a critical food source for many marine mammal, seabird and fish species. The forage fish species category is established to allow for the management of these species in a manner that prevents the development of a commercial directed fishery for forage fish. Management measures for this species category will be specified in regulations and may include such measures as prohibitions on directed fishing, limitations on allowable bycatch retention amounts, or limitations on the sale, barter, trade or any other commercial exchange, as well as the processing of forage fish in a commercial processing facility.

In the fishery	Ecosystem component	
Target species[1]	**Prohibited species**[2]	**Forage fish species**[3]
Walleye Pollock	Pacific halibut	Osmeridae family (eulachon, capelin,and other smelts)
Pacific cod	Pacific herring	Myctophidae family (laternfishes)
Sablefish	Pacific salmon	Bathylagidae (deep-sea smelts)
Yellowfin sole	Steelhead trout	Ammodytidae family (Pacific sandlance)
Greenland turbot	King crab	Trichodontidae family (Pacific sand fish)
Arrowtooth flounder	Tanner crab	Pholidae family (gunnels)
Kamchatka flounder		Stichaeidae family (pricklebacks warbonnets, eelblennys, cockscombs, shannys)
Northern rock sole		Gonostomatidae family (bristlemouths, lightfishes and anglemouths)
Flathead sole		Other euphausiacea (krill)
Alaska plaice		Squid
Other flatfish		Sculpins
Pacific Ocean perch		
Northern rockfish		
Blackspotted/Rougheye		
Shortraker rockfish		
Other rockfish		
Atka mackerel		
Skates		
Sharks		
Octopus		

[1] TAC for each listing. Species and species groups may or may not be targets of directed fisheries.
[2] Must be immediately returned to the sea, except when retention is required or authorized.
[3] Management measures for forage fish are established in regulations implementing the FMP.

In 2019, the NPFMC took final action to amend the FMPs for the BSAI (Amendment 121) and GOA (Amendment 110) and moved the sculpin stock complex into the ecosystem component category and establish an MRA of 20% for sculpins for all basis species in both the BSAI and GOA. Amendments 121/110 and their implementing regulations were approved by the Secretary of Commerce in August 2020 (85 FR 133,41427). Sculpins are, therefore, categorized as an ecosystem component species and information on sculpins will be contained in a report produced every four years.

Historical Catch Statistics

Catch statistics since 1954 are shown for the Eastern Bering Sea (EBS) subarea in Table 3. The initial target species in the BSAI commercial fisheries was yellowfin sole. During this period, total catches of groundfish peaked at 674,000 t in 1961. Following a decline in abundance of yellowfin sole, other species (principally walleye pollock) were targeted, and total catches peaked at 2.2 million t in 1972. Pollock is now the principal fishery, with catches peaking at approximately 1.4-1.5 million t due to years of high recruitment. After the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) was adopted in 1976, catch restrictions and other management measures were placed on the fishery and total groundfish catches have since varied from one to two million t. In 2005, Congress implemented a statutory cap on TACs for BSAI groundfish of 2 million t, which had previously been a policy adopted by the Council. Total groundfish catches in the EBS in 2020 totaled 1,770,739t. Catches in 2021 totaled 1,696,581 with catches in 2022 through November 5th at 1,492,897t. Pollock catches in the EBS totaled 1,367,232t in 2020; catches in 2021 were 1,376, 265 t and through November 5, 2022, totaled 1,104,252 t.

Catches in the Aleutian Islands (AI) subarea always are much less than in the EBS (Table 4). Total AI catches peaked at 190,750 t in 1996. Total AI catches were 144,446 t in 2010 and dropped to 103,804 t in 2012. Total catch decreased again in 2015 to 99,916 t but rose to 101,375 t in 2016 and 110,824 t in 2017, 123,896 t in 2018, 114,926 t in 2019 and 124,081 t in 2020 decreasing again to 117,685 t in 2021. Total catch as of November 5, 2022, was 108,231 t.

The predominance of target species in the AI has changed over the years. Pacific ocean perch (POP) was the initial target species. As POP abundance declined, the fishery diversified to target different species. Atka mackerel was the largest fishery in the AI at 50,600 t in 2011 and 46,859 t in 2012 (down from 68,496 t in 2010); catch was 30,815 t in 2014 and increased to 53,003 in 2015, to 54,125 t in 2016, 63,401 t in 2017, 69,248 t in 2018, and 56,081 t in 2019, 57,820 in 2020 and increasing to 60,111 t in 2021. Through November 5, 20221 Atka mackerel catch in the AI was 51,704 t. Catches since 2015 have been higher due to modifications in the Steller sea lion protection measures. POP was the second largest fishery at 26,311 t in 2013, 26,944 t in 2014, 23,507 in 2015, 23,097 t in 2016, 23,240 t in 2017, 29,097 in 2019, 28,473 t in 2020 and 24,786 t in 2021. Through November 5, 2022, POP catch in the AI was 22,629 t. Pacific ocean perch displaced Pacific cod as the second largest fishery beginning in 2011, as Pacific cod catch dropped from 29,001 t in 2010 to 9,064 in 2015 as a result of Steller sea lion protection measures; catch has increased since to 12,359 t in 2016, 12,286 in 2017, 14,719 t in 2018, 12,941 t in 2019, 14,250 t in 2020 and 13,966 t in 2021. Through November 5, 2022, Pacific cod catch was 11,580 t.

Total catches since 1954 for the BSAI, combined, are shown in Table 5. Total BSAI catches were 1,354,662 t in 2010 (81 percent of the total TAC and 67 percent of the OY) and rose to 1,817,774 t in 2011 (92 percent of total TACs (which equaled the OY)), 1,914,585 t (96 percent of OY) in 2013 and 1,928,379 t in 2014 (96 percent of OY), 1,914,061 in 2015 (96 percent of OY), 1,952,492 t in 2016 (98 percent of OY), 1,909,033 t in 2017 (95% of OY) 1,947,840 t in 2018 (97% of OY), 1,936,278 t in 2019 (97% of OY) 1,895,427 t in 2020 (95% of OY) and 1,814,266 t in 2021 (91% of OY). BSAI catches through November 5, 2022, were 1,601,128 t, which is 80% of OY.

Recent Total Allowable Catches

Amendment 1 to the BSAI Groundfish FMP provided the framework to manage the groundfish resources as a complex. Maximum sustainable yield (MSY) for the BSAI groundfish complex was estimated at 1.8 to 2.4 million t. The OY range was set at 85% of the MSY range, or 1.4 to 2.0 million t. The sum of the TACs equals OY for the groundfish complex, which is constrained by the 2.0 million t cap on OY. Recent total TACs have been set equal to the OY cap.

Establishment of the Western Alaska Community Development Quota (CDQ) Program annual groundfish reserves is concurrent with the annual BSAI groundfish harvest specifications. Once annual BSAI groundfish TACs are established, the CDQ Program is allocated set portions of the TACs for certain species and species assemblages. This includes 10% of the BS and AI pollock TACs, 20% of the fixed gear sablefish TAC, and 7.5% of the sablefish trawl gear allocation. It also receives 10.7% of the TACs for Pacific cod, yellowfin sole, rock sole, flathead sole, Atka mackerel, AI Pacific ocean perch, arrowtooth flounder, and BS Greenland turbot. The program also receives allocations of PSC limits.

The TAC specifications for the primary allocated species, and PSC limit specifications, are recommended by the Council at its December meetings. The State of Alaska (State) manages separate Pacific cod guideline harvest level (GHL) fisheries in the Bering Sea subarea (starting in 2006) and Aleutian Islands subarea (starting in 2014). The State's Pacific cod GHL fisheries are conducted independently of the Federal groundfish fisheries under direct regulation of the State. The GHL amounts for 2023 for each subarea are derived as 9% of the Bering Sea ABC (and an additional 45 t to the State jig fishery) and 39% of the Aleutian Islands subarea ABC to a maximum of 15 million pounds (6804 t). The Council is expected to set the TAC for each subarea to account for the two State GHL fisheries. This is necessary to prevent harvest levels, GHL plus TAC, from exceeding the ABCs.

For the BSAI reserves, 15% of the TAC for each target species, except for pollock, the hook-and-line and pot gear allocation of sablefish, and the Amendment 80 species (Pacific cod, Atka mackerel, flathead sole, rock sole, yellowfin sole, and Aleutian Islands Pacific ocean perch), are automatically apportioned to a non-specified reserve. Apportionments to the non-specified reserve range from 4.3% to 15% of the TAC for each species or species group. The non-specified reserve is used to (1) correct operational problems in the fishing fleets, (2) promote full and efficient use of groundfish resources, (3) adjust species TACs according to changing conditions of stocks during the fishing year, and (4) make apportionments and

Community Development Quota allocations. The initial TAC (ITAC) for each species is the remainder of the TAC after the subtraction of the reserve.

Definition of Acceptable Biological Catch and the Overfishing Level

Amendment 56 to the BSAI Groundfish FMP, which was implemented in 1999, defines ABC and OFL for the BSAI groundfish fisheries. The definitions are shown below, where the fishing mortality rate is denoted *F*, stock biomass (or spawning stock biomass, as appropriate) is denoted *B*, and the *F* and *B* levels corresponding to MSY are denoted F_{MSY} and B_{MSY} respectively.

Acceptable Biological Catch is a preliminary description of the acceptable harvest (or range of harvests) for a given stock or complex. Its derivation focuses on the status and dynamics of the stock, environmental conditions, other ecological factors, and prevailing technological characteristics of the fishery. The fishing mortality rate used to calculate ABC is capped as described as shown in the text box below.

Overfishing is defined as any amount of fishing in excess of a prescribed maximum allowable rate. This maximum allowable rate is prescribed through a set of six tiers which are listed below in descending order of preference, corresponding to descending order of information availability. The SSC will have final authority for determining whether a given item of information is reliable for the purpose of this definition and may use either objective or subjective criteria in making such determinations. For determination, a pdf refers to a probability density function. For Tiers (1-2), if a reliable pdf of B_{MSY} is available, the preferred point estimate of B_{MSY} is the geometric mean of its pdf. For Tiers (1-5), if a reliable pdf of *B* is available, the preferred point estimate is the geometric mean of its pdf. For Tiers (1-3), the coefficient 'α' is set at a default value of 0.05, with the understanding that the SSC may establish a different value for a specific stock or stock complex as merited by the best available scientific information. For Tiers (2-4), a designation of the form "$F_{X\%}$" refers to the *F* associated with an equilibrium level of spawning per recruit (SPR) equal to X percent of the equilibrium level of spawning per recruit in the absence of any fishing. If reliable information sufficient to characterize the entire maturity schedule of a species is not available, the SSC may choose to view SPR calculations based on a knife-edge maturity assumption as reliable. For Tier (3), the term $B_{40\%}$ refers to the long-term average biomass that would be expected under average recruitment and $F=F_{40\%}$.

Tier

1) Information available: *Reliable point estimates of B and B_{MSY} and reliable pdf of F_{MSY}.*

1a) Stock status: $B/B_{MSY} > 1$

$F_{OFL} = \mu_A$, *the arithmetic mean of the pdf*

$F_{ABC} \leq \mu_H$, *the harmonic mean of the pdf*

1b) Stock status: $\alpha < B/B_{MSY} \leq 1$

$F_{OFL} = \mu_A \times (B/B_{MSY} - \alpha)/(1 - \alpha)$

$F_{ABC} \leq \mu_H \times (B/B_{MSY} - \alpha)/(1 - \alpha)$

1c) Stock status: $B/B_{MSY} \leq \alpha$

$F_{OFL} = 0$

$F_{ABC} = 0$

2) Information available: *Reliable point estimates of B, B_{MSY}, F_{MSY}, $F_{35\%}$, and $F_{40\%}$.*

2a) Stock status: $B/B_{MSY} > 1$

$F_{OFL} = F_{MSY}$

$F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%})$

2b) Stock status: $\alpha < B/B_{MSY} \leq 1$

$F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)$

$F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)$

2c) Stock status: $B/B_{MSY} < \alpha$

$F_{OFL} = 0$

$F_{ABC} = 0$

3) Information available: *Reliable point estimates of B, $B_{40\%}$, $F_{35\%}$, and $F_{40\%}$.*

3a) Stock status: $B/B_{40\%} > 1$

$F_{OFL} = F_{35\%}$

$F_{ABC} \leq F_{40\%}$

3b) Stock status: $\alpha < B/B_{40\%} < 1$

$F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$

$F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$

3c) Stock status: $B/B_{40\%} < \alpha$

$F_{OFL} = 0$

$F_{ABC} = 0$

4) Information available: *Reliable point estimates of B, $F_{35\%}$, and $F_{40\%}$.*

$F_{OFL} = F_{35\%}$

$F_{ABC} \leq F_{40\%}$

5) Information available: *Reliable point estimates of B and natural mortality rate M.*

$F_{OFL} = M$

$F_{ABC} < 0.75 \times M$

6) Information available: *Reliable catch history from 1978 through 1995.*

OFL = the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information

$ABC \leq 0.75 \times OFL$

Overfished or approaching an overfished condition is determined for all age-structured stock assessments by comparison of the stock level in relation to its MSY level according to harvest scenarios 6 and 7 described in the next section (for Tier 3 stocks, the MSY level is defined as $B_{35\%}$). For stocks in Tiers 4-6, no determination can be made of overfished status or approaching an overfished condition as information is insufficient to estimate the MSY stock level.

Standard Harvest and Recruitment Scenarios and Projection Methodology

A standard set of projections is required for each stock managed under Tiers 1, 2, or 3 of Amendment 56. This set of projections encompasses seven harvest scenarios designed to satisfy the requirements of Amendment 56, the National Environmental Policy Act, and the MSFCMA.

For each scenario, authors have the option of making projections using either Stock Synthesis or the standard AFSC projection model. For the AFSC projection model the projections begin with an estimated vector of 2019 numbers at age. In each subsequent year, the fishing mortality rate is prescribed on the basis of the spawning biomass in that year and the respective harvest scenario.

For assessments using the standard AFSC projection model, recruitment in each year is drawn from an inverse Gaussian distribution whose parameters consist of maximum likelihood estimates determined from recruitments estimated in the assessment. Spawning biomass is computed in each year based on the time of peak spawning and the maturity and weight schedules described in the assessment. Total catch is

assumed to equal the catch associated with the respective harvest scenario in all years, except that in the first two years of the projection, a lower catch may be specified for stocks where catch is typically below ABC. This projection scheme is run 1000 times to obtain distributions of possible future stock sizes, fishing mortality rates, and catches.

Five of the seven standard scenarios are designed to provide a range of harvest alternatives that are likely to bracket the final TACs for 2021 and 2022, are as follow ("*max* F_{ABC}" refers to the maximum permissible value of F_{ABC} under Amendment 56):

Scenario 1: In all future years, *F* is set equal to *max* F_{ABC}. (Rationale: Historically, TAC has been constrained by ABC, so this scenario provides a likely upper limit on future TACs.)

Scenario 2: In all future years, *F* is set equal to a constant fraction of *max* F_{ABC}, where this fraction is equal to the ratio of the F_{ABC} value for 2022 recommended in the assessment to the *max* F_{ABC} for 2022, and where catches for 2022 and 2023 are estimated at their most likely values given the 2022 and 2023 maximum permissible ABCs under this scenario. (Rationale: When F_{ABC} is set at a value below *max* F_{ABC}, it is often set at the value recommended in the stock assessment.)

Scenario 3: In all future years, *F* is set equal to the average of the five most recent years. (Rationale: For some stocks, TAC can be well below ABC, and recent average *F* may provide a better indicator of F_{TAC} than F_{ABC}.)

Scenario 4: In all future years, the upper bound on F_{ABC} is set at $F_{60\%}$. (Rationale: This scenario provides a likely lower bound on F_{ABC} that still allows future harvest rates to be adjusted downward when stocks fall below reference levels.)

Scenario 5: In all future years, *F* is set equal to zero. (Rationale: In extreme cases, TAC may be set at a level close to zero.)

Two other scenarios are needed to satisfy the MSFCMA's requirement to determine whether a stock is currently in an overfished condition or is approaching an overfished condition. These two scenarios are as follow (for Tier 3 stocks, the MSY level is defined as $B_{35\%}$):

Scenario 6: In all future years, *F* is set equal to F_{OFL}. (Rationale: This scenario determines whether a stock is overfished. If the stock is 1) above its MSY level in 2023 or 2) above 1/2 of its MSY level in 2023 and expected to be above its MSY level in 2033 under this scenario, then the stock is not overfished.)

Scenario 7: In 2022, *F* is set equal to *max* F_{ABC}, and in all subsequent years, *F* is set equal to F_{OFL}. (Rationale: This scenario determines whether a stock is approaching an overfished condition. If the stock is 1) above its MSY level in 2023 or 2) above 1/2 of its MSY level in 2023 and expected to be above its MSY level in 2033 under this scenario, then the stock is not approaching an overfished condition.)

Overview of "Stock Assessment" Section

The current status of individual groundfish stocks managed under the FMP is summarized in this section. Plan Team recommendations for 2023 and 2024 ABCs and OFLs are summarized in Tables 1, and 2.

The sum of the Plan Team's recommended ABCs for target species for 2023 and 2024 (including Alaska wide Sablefish ABC) are 2,933,080 t and 3,130,210 t, respectively. These compare with the 2,383,653 t in 2022 and 2,747,727 in 2021. The primary increase from previous years is due to increases in EBS pollock. The Team recommended maximum permissible ABCs for all stocks, except for EBS pollock, Northern rock sole, Greenland turbot, Blackspotted rougheye rockfish (in the AI) and sharks (Table 2).

Overall, the status of the stocks continues to appear favorable. All stocks are above B_{MSY} or the B_{MSY} proxy of $B_{35\%}$ (Figure 2).

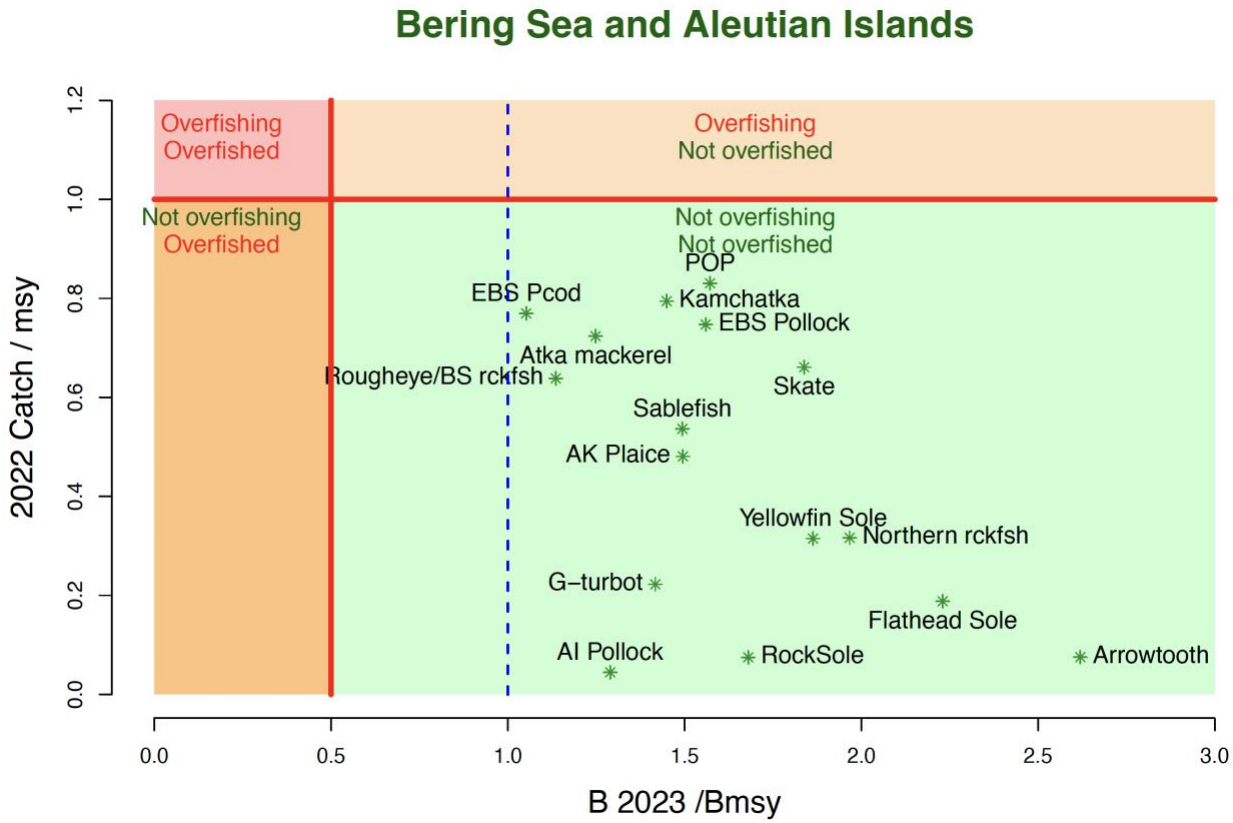

Figure 2. Summary of Bering Sea stock status next year (spawning biomass relative to B_{msy}; horizontal axis) and current year catch relative to fishing at F_{msy} (vertical axis) where F_{OFL} is taken to equal F_{msy}.

Summary and Use of Terms

Stock status is summarized and OFL and ABC recommendations are presented on a stock-by-stock basis in the remainder of this section, with the following conventions observed:

"Fishing mortality rate" refers to the full-selection F (i.e., the rate that applies to fish of fully selected sizes or ages), except in the cases of stocks managed under Tier 1 (EBS pollock, yellowfin sole, and northern rock sole). For these stocks, the fishing mortality rate consists of the ratio between catch (in biomass) and biomass at the start of the year. EBS pollock uses "fishable biomass," whereas yellowfin sole and northern rock sole use age 6+ biomass for this calculation.

"Projected age+ biomass" refers to the total biomass of all cohorts of ages greater than or equal to some minimum age, as projected for January 1 of the coming year. The minimum age varies from species to species. When possible, the minimum age corresponds to the age of recruitment listed in the respective stock assessment. Otherwise, the minimum age corresponds to the minimum age included in the assessment model, or to some other early age traditionally used for a particular species. When a biomass estimate from the trawl survey is used as a proxy for projected age+ biomass, the minimum age is assumed to correspond with the age of recruitment, even though the survey may not select that age fully and undoubtedly selects fish of younger ages to some extent.

The reported ABCs and OFLs for past years correspond to the values approved by the Council. Projected ABCs and OFLs listed for the next two years are the Team's recommendations.

Reported catches are as of November 5, 2022.

Two-Year OFL and ABC Projections

Proposed and final harvest specifications are adopted annually for a two-year period. This requires the Team to provide OFLs and ABCs for the next two years in this cycle (Table 1). The 2023 harvest specifications (from Council recommendations in December 2021) are in place to start the fishery on January 1, 2023, but these will be replaced by final harvest specifications that will be recommended by the Council in December 2022. The final 2023 and 2024 harvest specifications will become effective when final rulemaking occurs in February or March 2023. This process allows the Council to use the most current survey and fishery data in stock assessment models for setting quotas for the next two years, while having no gap in harvest specifications.

The 2024 ABC and OFL values recommended in next year's SAFE report are likely to differ from this year's projections for 2024 because of new information (e.g., survey) that is incorporated into the assessments. In the case of stocks managed under Tier 3, ABC and OFL projections for the second year in the cycle are typically based on the output for Scenario 2 from the standard projection model using assumed (best estimates) of actual catch levels. For stocks managed under Tiers 4-6, projections for the second year in the cycle are set equal to the Plan Team's recommended values for the first year in the cycle. Revised Stock Assessment Schedule

Based on consideration of stock prioritization including assessment methods and data availability, some stocks are assessed on an annual basis while others are assessed less frequently. The following table provides an overview of the level of assessment presented in this year's SAFE report, the Tier level and schedule as well as the year of the next full assessment by stock.

Stock Assessment schedule for Bering Sea-Aleutian Islands

Stock	2022 SAFE Assessment status	Tier	Schedule (years)	Year of next full assessment
Eastern Bering Sea pollock	Full	1	1	2023
Bogoslof Island Pollock	Full	5	2	2024
Aleutian Islands pollock	Full	3	2	2024
Eastern Bering Sea Pacific Cod	Full	3	1	2023
Aleutian Islands Pacific cod	Full	5	1	2023
Sablefish	Full	3	1	2023
Yellowfin sole	Full	1	1	2023
Greenland Turbot	Full	3	2	2024
Arrowtooth flounder	Full	3	2	2024
Kamchatka flounder	Full	3	2	2024
Northern Rock sole	Full	1	2	2024
Flathead sole	Partial	3	2	2023
Alaska plaice	Partial	3	2	2023
Other flatfish	None	5	4	2024
Pacific ocean perch	Full	3	2	2024
Northern rockfish	Partial	3	2	2023
Rougheye & blackspotted rockfish	Full	3	2	2024
Shortraker rockfish	Full	5	2	2024
Other rockfish	Full	5	2	2024
Atka mackerel	Full	3	1	2023
Skates	Partial	3/5	2	2023
Sharks	Full	5	2	2024
Octopus	Partial	6	2	2023
Sculpins	None	Eco	4	2024
Forage Species (including Squids)	None	Eco	2	2023
Grenadiers (BSAI/GOA)	None	Eco	4	2024

The products anticipated under each year and by Tier are shown below depending upon the 1-,2-, or 4-year assessment cycle for different stocks.

	1-year cycle		2-year cycle		4-year cycle	
Year	Tiers 1-3	Tiers 4-6	Tiers 1-3	Tiers 4-6	Tiers 1-3	Tiers 4-6
1	full	full	full	full	full	full
2	full	full	partial	nothing	partial	nothing
3	full	full	full	full	partial	partial
4	full	full	partial	nothing	partial	nothing

Economic Summary of the BSAI commercial groundfish fisheries in 2020-2021

The ex-vessel value of all Alaska domestic fish and shellfish catch, which includes the amount paid to harvesters for fish caught, and the estimated value of pre-processed fish species that are caught by catcher/processors, increased from $1,520 million in 2020 to $1,992 million in 2021 (real 2021$). The first wholesale value of 2021 groundfish catch after primary processing was $2,142 million, a decrease from the 2020 value of $2,197 million. The 2021 total groundfish catch decreased by 4%, and the total first wholesale value of groundfish catch decreased by 2.5%, relative to 2020.

The groundfish fisheries accounted for the largest share (38%) of the ex-vessel value of all commercial fisheries off Alaska, with $760 million in revenue, while the Pacific salmon (*Oncorhynchus spp.*) fishery was second with $729 million or 37% of the total Alaska ex-vessel value. The value of the shellfish fishery amounted to $353 million or 18% of the total for Alaska and exceeded the value of Pacific halibut (*Hippoglossus stenolepis*) with $128 million or 7% of the total for Alaska.

The Economic SAFE report (appendix bound separately) contains detailed information about economic aspects of the groundfish fisheries, including figures and tables, economic performance indices, and current year product price and ex-vessel price projections. The final version also presents an Amendment 80 fishery economic data report (EDR) summary, an Amendment 91 fishery economic data report (EDR), market profiles for the most commercially valuable species, and a Gulf Trawl economic data report. The report will now also include a section summarizing in-season harvest and revenue estimates for groundfish and halibut through Sept. 2022. The previous section covering community participation was moved into a separate report, the Annual Community Engagement and Participation Overview (ACEPO).

Data tables are organized into four relatively distinct sections: (1) All Alaska, (2) BSAI, (3) GOA, and (4) Pacific halibut. The figures and tables in the report provide estimates of total groundfish catch, groundfish discards and discard rates, prohibited species catch (PSC) and PSC rates, the ex-vessel value of the groundfish catch, the ex-vessel value of the catch in other Alaska fisheries, the gross product value of the resulting groundfish seafood products, the number and sizes of vessels that participated in the groundfish fisheries off Alaska, vessel activity, and employment on at-sea processors. Generally, the data presented in this report cover 2016-2021, but limited catch and ex-vessel value data are reported for earlier years to illustrate the rapid development of the domestic groundfish fishery in the 1980s and to provide an historical perspective on catch. The data behind the tables from this and past Economic SAFE reports are publicly available online at: https://reports.psmfc.org/akfin and https://psesv.psmfc.org/PSESV-2/.

Summary of wholesale ex-vessel and first wholesale changes in Bering Sea revenues

According to data reported in the current Economic SAFE report, the total real ex-vessel value of Bering Sea and Aleutian Islands (BSAI) groundfish decreased by 10% from $702 million in 2020 to $630 million in 2021 (Figure 3), and real first-wholesale revenues from the processing and production of groundfish in the BSAI decreased by 5% between 2020 ($1,993 million) and 2021 ($1,895 million) (Figure 4). The total quantity of groundfish products from the BSAI decreased by 8% from 753 thousand metric tons to 692 thousand metric tons.

Decomposition of the change in first-wholesale revenues from 2020-2021 in the BSAI

The following brief analysis summarizes the overall nominal revenue changes that occurred from 2020-21 and the quantity produced, and revenue generated from BSAI groundfish and how revenues have been impacted by changes in quantity or prices of each species and product group (Figure 5). Unlike the numbers above, these values are not adjusted for inflation, so enable a simple comparison of how changes in the price and quantity for each group combine to produce revenues.

By BSAI species group, a large positive price effect was much stronger than a negative quantity effect, which resulted in a positive net effect of about $73 million for pollock (Figure 5, top panel). For Pacific cod, a positive price effect was smaller than a larger negative quantity effect, which resulted in a $29.1 million net decrease in first wholesale revenues for Pacific cod from the BSAI for 2020-21 (Figure 5). There was a small negative price effect, and small positive quantity effect, for rockfish that resulted in a net negative effect of $2.3 million. Atka mackerel had a negative price effect and a smaller positive quantity effect, combining for a net negative effect of $7.7 million. Flatfish had a negative price effect combined with a negative quantity effect that resulted in a net revenue decrease of $56.3 million. Sablefish had small positive price and quantity effects, combining for a net positive effect of $6.6 million. The “Other” species group experienced a net revenue decrease of close to $1 million.

By product group, a positive price effect coupled with large negative quantity effect for fillets resulted in a negative net effect of $38.4 million in the BSAI first-wholesale revenue decomposition for 2020-21 (Figure 5, bottom panel). For surimi, a large positive price effect coupled with a positive quantity effect resulted in a positive net effect of $114.3 million. For roe, a positive price effect coupled with a negative quantity effect resulted in a negative net effect of $21.5 million. For whole fish and head & gut, a small negative price effect combined with a much larger negative quantity effect produced a net negative effect of $79.5 million. For ‘other’ products, a positive price effect combined with a smaller negative quantity effect resulted in a net positive effect of $8.3 million.

In summary, the changes in first-wholesale revenues from the BSAI groundfish fisheries decreased significantly from 2020-21 due to negative quantity effects for most species, while pollock demonstrated a very strong positive price effect.

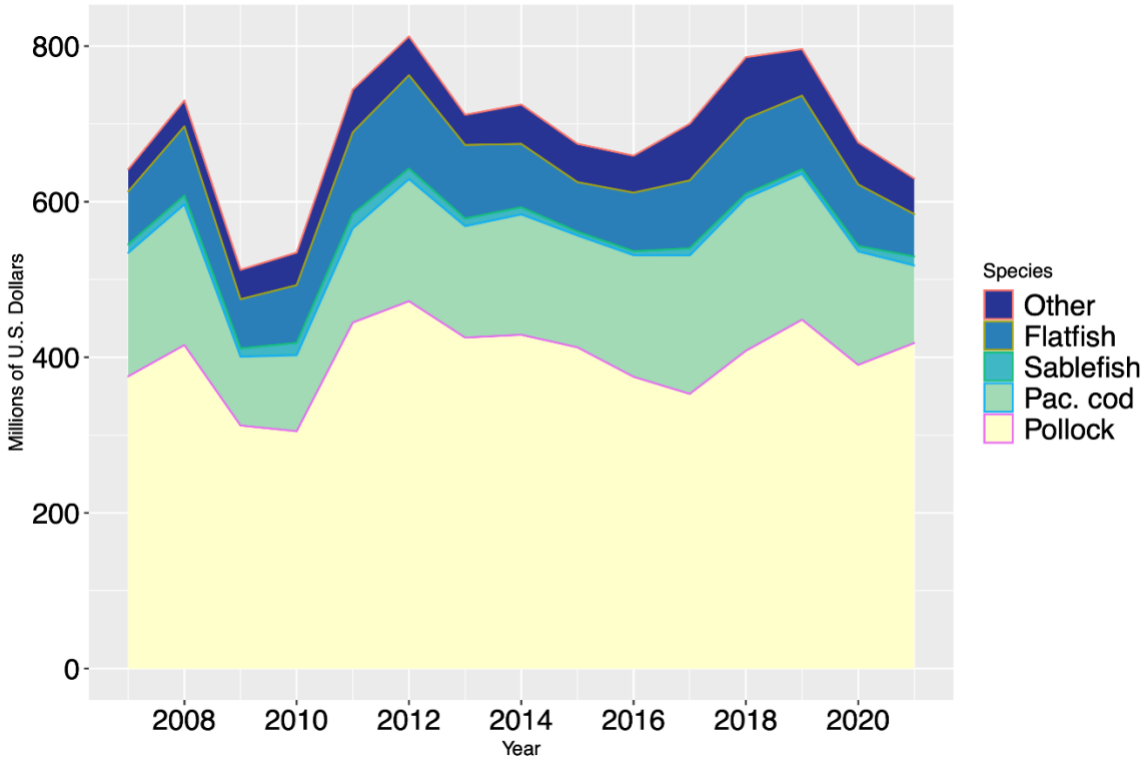

Figure 3. Real ex-vessel value of the groundfish catch in the domestic commercial fisheries in the BSAI area by species, 2007-2021 (base year = 2021).

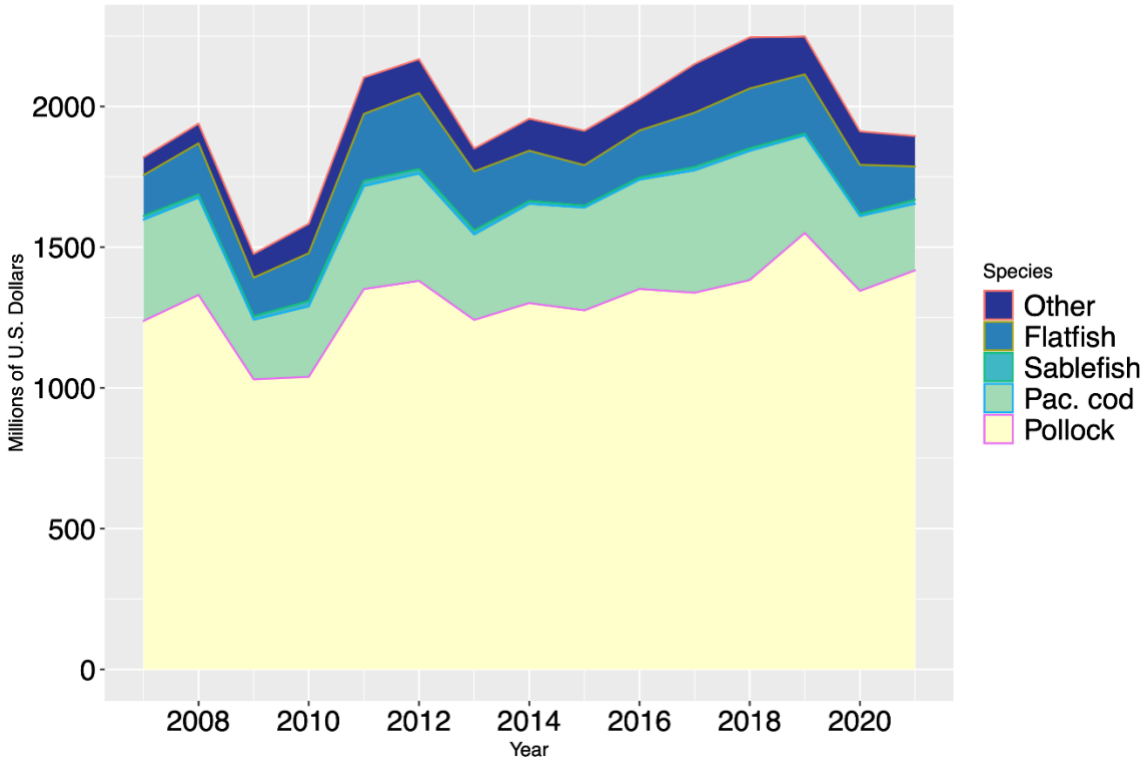

Figure 4. Real gross product value of the groundfish catch in the BSAI area by species, 2007-2021 (base year = 2021).

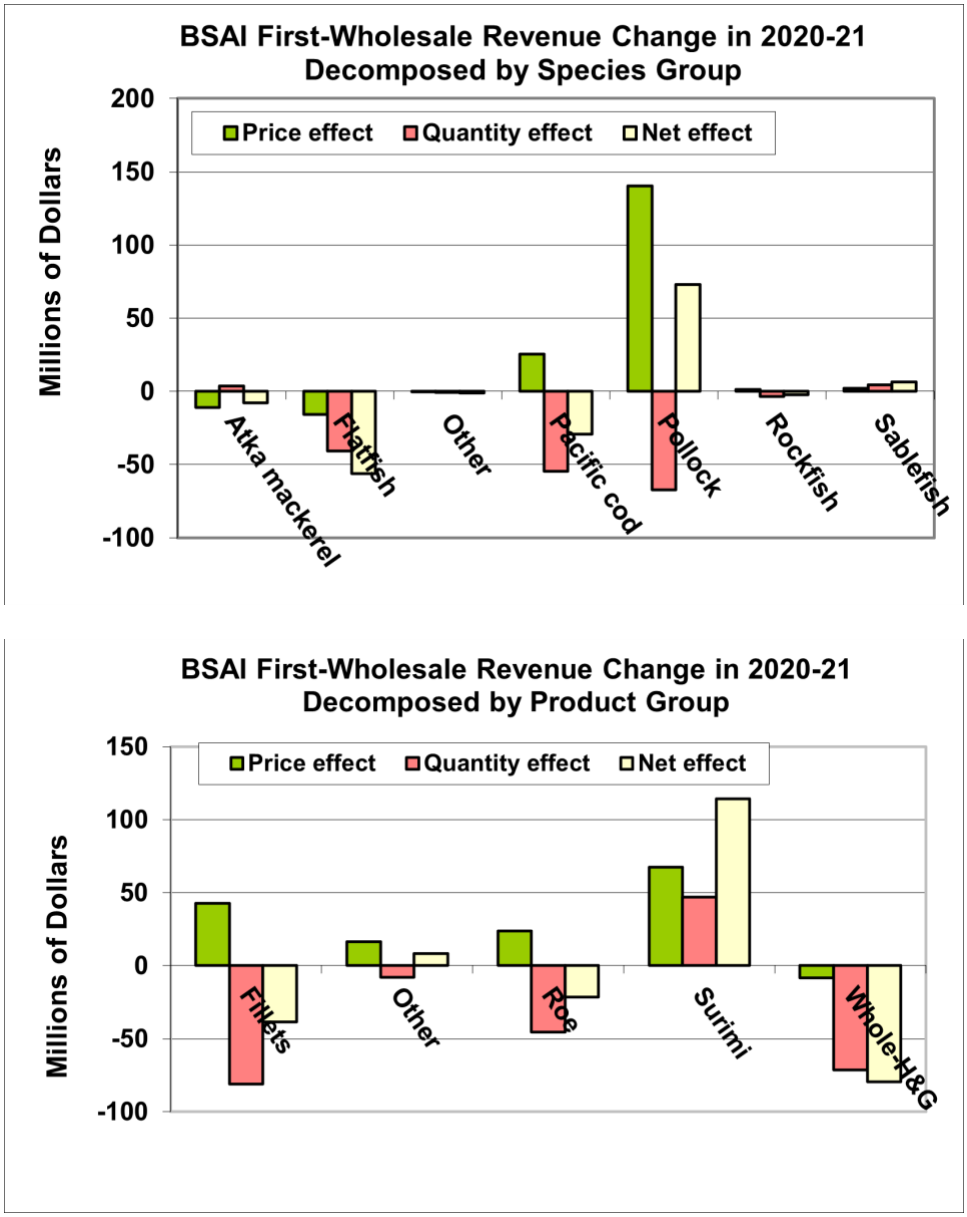

Figure 5. Decomposition of the change in first-wholesale revenues from 2020-21 in the BSAI area. The first decomposition is by the species groups used in the Economic SAFE report, and the second decomposition is by product group. The price effect refers to the change in revenues due to the change in the first-wholesale price index (current dollars per metric ton) for each group. The quantity effect refers to the change in revenues due to the change in production (in metric tons) for each group. The net effect is the sum of price and quantity effects. Year-to-year changes in the total quantity of first-wholesale groundfish products include changes in total catch and the mix of product types (e.g., fillet vs. surimi).

Ecosystem Status Reports for the EBS and AI

Bering Sea Conditions

Although sea ice formation was delayed and melt was early, overall, the Eastern Bering Sea (both NEBS and SEBS) in 2022 has returned to average conditions with the cold pool most similar to 2017. No large category marine heatwaves are underway, although some biological indicators such as reduced abundance of large zooplankton suggest continued lagged effects of previous warm years. However, synthetic review of the indicators suggests that productivity and conditions during critical phenological bottlenecks are favorable for juvenile survival and adult growth of most groundfish species. Notable persistent impacts include large declines in Western Alaska salmon runs, significant rapid declines in snow crab stocks, and persistent reduced populations of Bristol Bay red king crab. Notably, some species like Bristol Bay sockeye, Togiak herring, and sablefish had marked increases in recent years and maturation of year classes is resulting in overall biomass increases this year. Recovery was noted in multiple top predators and seabirds and condition indices suggest favorable conditions for growth across groundfish species. The center of gravity for multiple groundfish stocks has shifted southward consistent with cooler conditions in the SEBS. This year there is increasing evidence from ongoing responses of species to the MHW that climate shocks and long-term warming are likely to impact future distribution and productivity of stocks in the region. Monitoring environmental conditions and ecosystem-wide synthesis identifies some synergies and discrepancies among species that are important for navigating future conditions.

Aleutian Islands

Long-term warming of sea surface temperature is observed across the Aleutian Islands, with an acceleration of warming in the last decade. In the Aleutian Islands (AI) persistent anomalous warm conditions continue to differentially impact species and productivity, especially in the western AI. With the exception of the 2018-2019 winter, the NPI has been in a systematically positive state for the last 6 years, consistent with a weak Aleutian Low during winter months. In the western AI, conditions were favorable for seabirds in early spring and summer and seabird indices and fish forage indices in the region were above average indicating sufficient lower trophic level resources to support productivity. However, overall biomass of fish apex predator biomass (e.g., Kamchatka flounder, Pacific halibut) decreased but was offset somewhat by increases in rougheye and blackspotted rockfish, following a large recruitment event around 2019). Sea lion abundance continued to decline in 2022, while pelagic foragers increased. Similar patterns were seen in the central and eastern AI in terms of anomalously warm conditions throughout most of 2021-2022 and favorable lower trophic level conditions. Apex predator biomass in the eastern-AI was closer to the long-term average, although down slightly from last year. Near-average temperatures are predicted for Alaskan waters through Dec. 2022 with the exception of the western Aleutian Islands, where positive anomalies are predicted.

Environmental indices discussed during the 2022 Nov Plan Team Meeting

Multiple indices provide particular insight into mechanisms of changes in productivity and biomass of various groundfish stocks in the Bering Sea and Aleutian Islands. Water temperature (SST and bottom temperature) influence fish growth and redistribution to favorable thermal habitats, changes in ocean circulation reflected in eddy kinetic energy and model trajectory indices may influence larval survival and recruitment to adult populations, diet, energetics, and metabolic indices provide insight into changes in potential growth and carrying capacity, pH from measured and model-base indices provide new insights into potential mechanisms governing mortality estimates. Advancements in rapid assessment of zooplankton abundances increasingly help provide insight into favorable conditions for groundfish survival in the near future and mortality and recruitment indices, especially those around over-winter

survival (e.g., temperature difference index) help with discussions of changes in future stock productivity in the near future. Continued development of some indices will support future evaluation of mechanisms driving changes in stock abundance and distribution include (but are not limited to) bottom water oxygen indices, validation of model estimates for pH, drift, and zooplankton, and stomach samples for groundfish, especially in seasons outside of summer surveys (e.g., early spring) and for species where mechanisms of increase or decrease in survival remain unclear (e.g., sablefish).

Stock Status Summaries

Except as otherwise noted, the Team's recommended ABCs are set at the maximum permissible levels under their respective tiers.

1. Walleye Pollock

Status and catch specifications (t) of walleye pollock in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The biomass is reported as age 3+ for eastern Bering Sea, age 1+ for the Aleutian Islands, and the survey biomass for Bogoslof, as reported in the respective assessments. The OFL and ABC for 2023 and 2024 are those recommended by the Plan Team. Catch data are current through November 5, 2022.

Area	Year	Biomass	OFL	ABC	TAC*	Catch
Eastern Bering Sea	2021	8,145,000	2,594,000	1,626,000	1,375,000	1,376,258
	2022	6,839,000	1,469,000	1,111,000	1,111,000	1,103,996
	2023	12,389,000	3,381,000	1,688,000	n/a	n/a
	2024	11,445,000	4,639,000	1,815,000	n/a	n/a
Aleutian Islands	2021	292,967	61,856	51,241	19,000	1,840
	2022	308,525	61,264	50,752	19,000	2,895
	2023	264,173	52,383	43,413	n/a	n/a
	2024	281,618	52,043	43,092	n/a	n/a
Bogoslof	2021	378,262	113,479	85,109	250	8
	2022	378,262	113,479	85,109	250	256
	2023	367,880	115,146	86,360	n/a	n/a
	2024	367,880	115,146	86,360	n/a	n/a

* In 2021, NMFS reallocated 14,500 t of pollock TAC from the Aleutian Islands to the Bering Sea, which increased the Bering Sea TAC to 1,389,500 t and decreased the Aleutian Islands TAC to 4,500 t.

Eastern Bering Sea pollock

Changes from previous assessment

1. Observer data for catch-at-age and average weight-at-age from the 2021 fishery were finalized and included.
2. Total catch as reported by NMFS Alaska Regional office was updated and included through 2022.
3. In summer 2022, the AFSC conducted the bottom trawl survey in the EBS and extended into the NBS. A VAST model evaluation (including the cold-pool extent) was used as the main index.
4. An improved treatment of the weight-at-age data from the BTS was presented to the Plan Team and SSC in September 2022 and these have replaced values used in the past where constant length-weight parameters had been assumed.
5. The bottom trawl survey collected acoustic data opportunistically with the index covering 2006-2022 (except for 2020).
6. The MACE Program completed an acoustic-trawl survey (ATS) aboard the NOAA ship Oscar Dyson in 2022. Pollock numbers and biomass at length estimates were generated and a preliminary age composition was included based on the BTS age-length data plus a juvenile sample from the ATS. Transects were also extended northward to investigate the presence of pollock beyond the core EBS shelf area.

The authors' and Team's recommended model for setting harvest specifications is Model 20.0c, which is a minor modification of last year's model (20.0c) in that, in addition to the typical data updates, it includes the VAST weight-at-age adjustments presented to and accepted by the BSAI Plan Team in Sept 2022. Due to uncertainty in the true size of the 2018 year class, final harvest specifications were reduced from the amounts recommended from this model by applying the Tier 3 harvest control rule to the model results from a run done with the 2018 recruitment set as the mean of the highest previous 2 years recruitments.

Spawning biomass and stock trends

Spawning biomass in 2008 was at the lowest level since 1980 but had increased by a factor of 2.30 by 2017, trending downward again. The 2008 low was the result of extremely poor recruitments from the 2002-2005 year classes. Recent increases were fueled by recruitment from the very strong 2008, 2012, 2013, and 2018 year classes, along with spawning exploitation rates at or below 20% from 2008 through 2018.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that EBS pollock qualifies for management under Tier 1 because there are reliable estimates of B_{MSY} and the probability density function for F_{MSY}. The updated estimate of B_{MSY} from the present assessment is 2.674 million t. Projected spawning biomass for 2023 is 4.171 million t, placing EBS walleye pollock in sub-tier "a" of Tier 1. As has been the approach for many years, the maximum permissible ABC harvest rate was based on the ratio between MSY and the equilibrium biomass corresponding to MSY. The harmonic mean of this ratio from the present assessment, after adjusting according to the sloping portion of the harvest control rule, is 0.434. The harvest ratio of 0.434 is multiplied by the geometric mean of the projected fishable biomass for 2023 to obtain the maximum permissible ABC for 2023, which is 2.987 million t. However, as with other recent EBS pollock assessments, the authors recommend setting ABCs well below the maximum permissible levels. Their reasons for doing so are listed in the "ABC Recommendation" section of the SAFE chapter, where the "assessment-related considerations" category in the Risk Table scored as Level 2 ("substantially increased concern"). The authors conclude that this level of concern warrant setting the 2023 and 2024 ABCs at 1,688,000 t and 1,815,000 (reductions of 43% and 56% respectively from the corresponding maxABC in both cases). These values were derived by running the accepted model with the 2018 recruitment specified as the mean of the previous highest 2 years – which put the stock in Tier 3a – and then applying the Tier 3 maxABC harvest control rule. This marks a return to the harvest policy (Tier 3) that *had* been recommended by both the Team and SSC for the EBS pollock stock from 2014 through 2020 but was modified to use the Tier 2 ABC harvest policy for 2022, but with the additional reduction induced by lowering the 2018 recruitment expectation. As the authors note, this reduction is necessary to account for uncertainties in the 2018 recruitment that are likely overestimated in the model, and to ensure stability in the fishery. The Team concurs with the authors' recommendation to conservatively base ABC for the 2023 and 2024 fisheries on the Tier 3 maxABC harvest control rule produced by running the model this way.

The OFL harvest ratio under Tier 1a is 0.491, corresponding to the arithmetic mean of the ratio between MSY and the equilibrium fishable biomass corresponding to MSY, after adjusting according to the sloping portion of the harvest control rule. The product of this ratio and the geometric mean of the projected fishable biomass for 2023 determines the OFL for 2023, which is 3.381 million t. Given a projected 2023 catch of 1.350 million t, the current projection for OFL in 2024 is 4.639 million t.

Status determination

The walleye pollock stock in the EBS is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

Aleutian Islands pollock

Changes from previous assessment

There were no changes to the recommended model for ABC/OFL advice. Catches for 1978 to 2022 were updated to latest estimates from the catch accounting system (CAS). The 2021 Aleutian Islands survey index and the 2019 and 2020 fishery age composition data were added. Survey age data from 2022 were not yet available. All survey age composition data prior to 1991 were removed from the model to be consistent with the use of Aleutian Islands bottom trawl survey data prior to 1991.

There was no directed fishery catch of pollock in 2021, but there was a small, directed fishery in 2022 (217 t as of October 10, 2022). As of October 9, 2022, the total catch of pollock across the Aleutian Islands was 2,726 t.

Spawning biomass and stock trends

This year's assessment estimates that spawning biomass reached a minimum level of about $B_{27\%}$ in 2010 but has generally increased since; the estimates from the authors' preferred model showed a slight decline in female SSB from 2021 (82,121 t) to 2022 (79,828 t), with another slight decline projected for 2023. The status of AI pollock in 2021 and 2022 was assessed to be well above $B_{20\%}$. Mean recruitment was high in the late 1970s and mid-1980s, with the 1978 year class having a strong influence on the model. Mean recruitment of age-1 pollock from 1978-1989 was almost eight times higher than that from 1998-2008; no year class since the 1989 year class has exceeded the overall 1978-2018 overall mean recruitment of 131 million age-1 recruits. The most recent strong year classes were the 2011 and 2012 year classes, with 93 and 127 million age-1 recruits, respectively. Lower year class strength since 1990 has led to lower abundance of pollock in the Aleutian Islands, despite the fact that exploitation rates have remained low since 1999.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The official total catch for 2021 was 1,840 t, which is a small fraction of the 2021 OFL of 61,856 t; therefore, the stock is not being subjected to overfishing. The projected spawning biomass for 2023 is 78,628 t and for 2024 is 80,432 which are above the $B_{40\%}$ value of 69,687 t, placing the AI pollock stock in sub-tier "a" of Tier 3. The model estimated the values of $F_{40\%}$ as 0.305 and $F_{35\%}$ as 0.380. Under Tier 3a, the 2023 and 2024 maximum permissible ABCs 43,413 t and 43,092, respectively. The 2023 and 2024 OFLs are 52,383 t and 52,043, respectively. The Team recommended setting the 2023 and 2024 ABCs and OFLs at these values. Projections assumed catches of 3,000 t for 2022 and 1,670 t for 2023 based on the five-year average (2017-2021) F of 0.26.

Status determination

The walleye pollock stock in the Aleutian Islands is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

Bogoslof pollock

Changes from previous assessment

Estimated catches for 2021 and 2022 were updated, the 2020 acoustic-trawl survey biomass estimate was revised to correct how nearest-tow data were assigned to pollock backscatter, and the natural mortality estimate was reevaluated. Survey biomass estimates were computed using a random effects model. Natural mortality was estimated using an updated version of the age-structured model presented in 2015.

Spawning biomass and stock trends

NMFS acoustic-trawl survey biomass estimates are the primary data source used in this assessment. Between 1997 and 2020, the values varied between a low of 67,063 t in 2012 and a high of 663,070 t in 2018. The most recent acoustic-trawl survey of the Bogoslof spawning stock was conducted in February 2020 and resulted in a biomass estimate of 353,069 t. The random-effects method of survey averaging resulted in 367,880 t.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that this stock qualifies for management under Tier 5. The assessment authors and the Team recommend that the maximum permissible ABC and OFL continue to be based on the random-effects survey averaging approach, and accept the re-evaluated estimate of M. The assessment authors and the Team recommend using the biomass estimate based on the random effects model (367,880 t) and the age-structured model-based estimate of M (0.313) for calculating the Tier 5 ABC.

The maximum permissible ABC value for 2023 is 86,360 t (assuming M = 0.313 and F_{ABC} = 0.75 x M = 0.235 and the random effects survey estimate for biomass). The ABC for 2024 is the same.

The OFL was calculated using the random effects estimate for the survey biomass. Following the Tier 5 formula with M = 0.313, OFL for 2023 is 115,146 t. The OFL for 2024 is the same.

Status determination

The walleye pollock stock in the Bogoslof district is not being subjected to overfishing. It is not possible to determine whether this stock is overfished or whether it is approaching an overfished condition because it is managed under Tier 5.

2. Pacific cod

Status and catch specifications (t) of Pacific cod in recent years are shown below. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Team. Catch data are current through November 5, 2022.

Area	Year	Age 0+ biomass	OFL	ABC	TAC*	Catch
Eastern Bering Sea	2021	754,000	147,949	123,805	111,380	109,202
	2022	879,978	183,012	153,383	136,466	127,885
	2023	844,578	172,495	144,834	n/a	n/a
	2024	831,566	166,814	140,159	n/a	n/a
Aleutian Islands	2021	80,700**	27,400	20,600	13,796	7,298
	2022	80,700**	27,400	20,600	13,796	6,178
	2023	54,165**	18,416	13,812	n/a	n/a
	2024	54,165**	18,416	13,812	n/a	n/a

**Biomass shown for AI Pacific cod is survey biomass (Tier 5), not age 0+ biomass.

Eastern Bering Sea Pacific cod

Changes from previous assessment

In 2022, authorship of EBS Pacific cod transitioned from Grant Thompson, who led the assessment from 1988-2021, to Steve Barbeaux. The ensemble of models presented and accepted for use in 2021 were re-run with new data as parameterized in last year's assessment. In addition, a set of models (22.x, "New Series") were presented that were introduced in the September update (Appendix 2.1). In the New Series, the seasonally corrected annual weight-at-length adjustments were removed from the set of ensemble models. The post-2007 aging bias parameters were removed from the ensemble models to match recommendations from the Age and Growth Laboratory assuming no bias for the most recent ages but retaining bias for those fish aged prior to 2008. Following guidance from the SSC, the ensemble used the 2021 ensemble model weighting scheme, which was developed during the 2021 review by the Center for Independent Experts.

The following changes to the input data have been made in the EBS Pacific cod assessment.

1. Catches for 1991-2021 were updated, and a preliminary catch estimate for 2022 was incorporated.
2. Commercial fishery size compositions for 1991-2021 were updated, and a preliminary size composition from the 2022 commercial fishery was incorporated.
3. A new script was developed for pulling and processing data, the script included a change in weighting of catch for commercial fishery size compositions and was presented in September. Although the change in data processing did not lead to changes in model results it was deemed by the authors significant enough to trigger a change in model names for 2022.
4. The VAST approach for the AFSC Bering Sea bottom trawl and winter longline fishery CPUE indices were used as in 2021, but with some adjustments and updated for both time series through 2022.
5. The size composition from the 2022 EBS+NBS survey was incorporated.
6. The VAST approach was used to estimate the age compositions from the combined EBS+NBS survey time series through 2021.
7. The seasonally corrected annual weight-at-length relationship adjustments were calculated using a new algorithm developed in R based on a Generalized Additive Modeling (GAM) approach presented in September.

Spawning biomass and stock trends

Recruitment is estimated to have been below average for the 2014-2017- and 2019-year classes, above average for 2018, and near average for 2020. Estimated spawning biomass from the ensemble increased from 2010 through 2019 to 332,967 t and has been on a downward trajectory since that time. Spawning biomass is projected to be 245,594 in 2023.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

This stock is assigned to Tier 3b for the determination of 2023 and 2024 ABCs and OFLs. The 2023 maxABC in this tier as calculated using the weighted average of the models in the ensemble is 144,834 t and the projected 2024 maxABC is 140,159 t. The 2023 OFL from the weighted ensemble is 172,495 t. The 2024 projected OFL is 166,814 t. Risk table scores were level 1 (normal conditions), and the authors and Team did not recommend a reduction in the ABC.

Status determination

EBS Pacific cod is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

Aleutian Islands Pacific cod

Changes from previous assessment

This stock has been assessed separately from Eastern Bering Sea Pacific cod since 2013 and managed separately since 2014. The stock has been managed under Tier 5 since it was first assessed separately. The authors presented two alternative age-structured models this year. However, these models were not accepted for management by the Team. Therefore, no changes were made to the methodology used for recommending harvest specifications. Catch data from 1991-2021 were updated and preliminary catch data for 2022 were included in the assessment, but these have no impact on recommended harvest specifications under Tier 5. The 2022 Aleutian Islands bottom trawl survey biomass index was added to the Tier 5 random effects model.

Spawning biomass and stock trends

After declining by more than 50% between 1991 and 2002, survey biomass has since stayed in the range of 50-90 kilotons. The 2018 Aleutians survey biomass estimate (81,272 t) was down approximately 4% from the 2016 estimate (84,409 t). There was no Aleutian Island survey in 2020 and the most recent Aleutian Island survey for Pacific cod conducted in 2022 was 51,539 t, 37% below the 2018 estimate.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Team supported the author's recommendation to use the Tier 5 assessment again for setting 2023 and 2024 harvest specifications. The Team's recommended ABC is 13,812 t, and OFL is 18,416 t. The estimate of the natural mortality rate is 0.34, which is unchanged from the previous assessment.

Status determination

This stock is not being subjected to overfishing. It is not possible to determine whether this stock is overfished or whether it is approaching an overfished condition because it is managed under Tier 5.

3. Sablefish

Status and catch specifications (t) of sablefish in the Bering Sea and Aleutian Islands in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Plan Team. Beginning in the 2020 fishery year, the OFL was made Alaska-wide (i.e., for both BSAI and GOA FMPs combined). Catch data are current through November 5, 2022.

Area	Year	Age 4+ Biomass	OFL	ABC	TAC	Catch
Alaska (all areas)	2021	707,000	60,426			21,255
	2022	529,800	40,432			24,929
	2023	621,000	47,390			
	2024	605,000	48,561			
Bering Sea	2021	142,000		3,396	3,396	4,169
	2022	168,000		5,264	5,264	5,205
	2023	151,000		8,417	n/a	n/a
	2024	147,000		10,145	n/a	n/a
Aleutian Islands	2021	175,000		4,717	4,717	1,578
	2022	121,200		6,463	6,463	2,193
	2023	153,000		8,884	n/a	n/a
	2024	149,000		10,299	n/a	n/a

Changes from the previous assessment

New data in the assessment model included relative abundance and length data from the 2022 longline survey, length data from the fixed gear fishery for 2021, length data from the trawl fisheries for 2021, age data from the longline survey and fixed gear fishery for 2021, updated catch for 2021, and projected 2022-2024 catches. Estimates of killer and sperm whale depredation in the fishery were updated and projected for 2022-2024. Fixed gear fishery catch-per-unit effort (CPUE) data from logbooks and observers were updated through 2021 (including the 2020 data that was not available for the 2021 SAFE) and the CPUE index was updated through 2021.

No changes were made to the assessment methodology and model 21.12 was utilized as described in the 2021 SAFE. However, Francis data reweighting was preformed to account for the new data available in 2022, which resulted in slightly different data weights from the 2021 model.

Spawning biomass and stock trends

Survey abundance and biomass indices continued to increase in 2022. The longline survey abundance index increased by 17% in 2022 following a 9% increase in 2021 and a 32% increase in 2020. The biennial trawl survey biomass index has increased nearly five-fold since 2013, with a 40% increase from 2019 to 2021. The data and model indicate strong year classes from 2014, 2016, 2017, 2018, and now in 2019, as well. Based on the strength of these recent year classes, age-2+ biomass has almost tripled from a time series low of 228,000 t in 2015 to 665,000 t in 2022, sablefish population levels that have not been estimated since the early 1970s. Although growth in SSB has lagged compared to total biomass, given that recent year classes are not fully mature, SSB has still increased by 60% from the time series low of 84,000 t in 2017 to 134,000 t in 2022. Thus, the current SSB is at 44% of the unfished SSB (i.e., SSB0) in 2022. However, the lack of sablefish greater than 10 years of age (i.e., the age when sablefish are greater than 90% mature) remains concerning for such an extremely long-lived species and needs to be carefully monitored. As recent year classes grow towards full maturity, the population age structure is beginning to expand. It is important that each of these cohorts can survive in large numbers to fully mature ages to ensure long-term productivity.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Sablefish are managed under Tier 3 of the NPFMC harvest control rule that primarily aims to maintain the population at $B_{40\%}$. Since projected female spawning biomass (combined areas) for 2023 is equivalent to $B_{52\%}$, sablefish is in sub-tier "a" of Tier 3. Spawning biomass is projected to increase rapidly in the near-term, and the maximum permissible value of FABC under Tier 3a is 0.081, which translates into a 2023 maximum permissible ABC (combined areas) of 40,861 t. The OFL fishing mortality rate is 0.096, which

translates into a 2023 OFL (combined areas) of 47,857 t. Adjusting for estimated whale depredation, the 2023 combined areas ABC is 40,502 t. The Teams agree with these recommendations.

Status determination

This stock is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

Area apportionment

In 2013, the Plan Team and SSC agreed that a fixed apportionment scheme was acceptable. In 2020, results of a simulation analysis resulted in recommending a five-year average survey apportionment method. The authors continue to recommend this approach and the Teams agreed. In 2021, the SSC recommended a phased transition to this method. This year, the authors noted that the SSC procedure would mean a "75% stair step" from the 2020 fixed apportionment values towards the 2022 five-year average survey apportionment. This gives the following area-specific ABCs (including deductions for estimated whale depredation):

	2022			2023		2024	
Region	**OFL_w**	**ABC_w**	**TAC**	**OFL_w**	**ABC_w**	**OFL_w**	**ABC_w**
BS	--	5,264	5,264	--	8,417	--	10,145
AI	--	6,463	6,463	--	8,884	--	10,299
BSAI	--	**11,727**	**11,727**	--	**17,301**	--	**20,444**
GOA[1]	-	**22,794**	**22,794**	--	**23,201**	--	**21,095**
Alaska-wide	**40,432**			**47,390**	**40,502**	**48,561**	**41,539**

[1]GOA information included to show total breakdown. For details please see the GOA SAFE Intro document.

4. Yellowfin sole

Status and catch specifications (t) of yellowfin sole in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Plan Team. Catch data are current through November 5, 2022.

Area	Year	Age 6+ Biomass	OFL	ABC	TAC	Catch
BSAI	2021	2,755,870	341,571	313,477	200,000	108,788
	2022	2,479,370	377,071	354,014	250,000	149,869
	2023	3,321,640	404,882	378,499	n/a	n/a
	2024	4,062,230	495,155	462,890	n/a	n/a

There were no adjustments to TAC through the Flatfish Flexibility Exchange program in 2021 or 2022.

Changes from previous assessment

Changes to the input data include:

1. The 2021 fishery age composition was added.
2. The estimate of the total catch made through the end of 2021 was updated as reported by the NMFS Alaska Regional office. The catch through the end of 2022 was estimated to be 127,712 t. Catch for the 2022 and 2023 projections were assumed to be equal to the mean of the past 5 years (126,157 t).
3. The 2022 NMFS survey biomass estimate and standard error were included.

Changes to the model include:

Three models were presented in this year's assessment. Model 18.2 was the accepted model in 2021 and was presented with updated data. Models 22.0 and 22.1 are based on Model 18.2, except that a single sex

survey selectivity was used rather than a separate survey selectivity for males and females. Survey index data (1982-2022) used design-based eastern Bering Sea estimates. Model 22.0 is the same as Model 18.2 except a single-sex survey selectivity is used rather than a separate survey selectivity for males and females. Model 22.1 is the same as Model 22.0 except that the survey index data and age compositions (1982-2022) are based on model-based indices (VAST) for the combined Northern Bering Sea and eastern Bering Sea survey region.

The authors and Team recommend using Model 22.1 for use in setting 2023 and 2024 harvest specifications.

Spawning biomass and stock trends

The projected estimate of total biomass for 2023 was higher by 45% from the 2021 assessment of 2,284,820 t to 3,321,640 t. The model projection of spawning biomass for 2023, was 885,444 t, 22% higher than the projected 2022 spawning biomass from the 2021 assessment of 727,101 t. The 2023 and 2024 ABCs using FABC from this assessment model were higher than last year's 2023 ABC of 326,235 t; 378,499 t and 462,890 t. The 2023 and 2024 OFLs estimated by Model 22.1 were 404,882 t and 495,155 t. A general slow decline in spawning biomass has prevailed for the most part since 1995, however in the total biomass is showing an increase with an uptick in recent recruitment.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that reliable estimates of B_{MSY} and the probability density function for F_{MSY} exist for this stock. The estimate of B_{MSY} from the present assessment is 475,199 t, and projected spawning biomass for 2023 is 885,444 t, meaning that yellowfin sole qualifies for management under Tier 1a. Corresponding to the approach used in recent years, the 1978-2016 age-1 recruitments (and corresponding spawning biomass estimates) were used this year to determine the Tier 1 harvest recommendations. This provided a maximum permissible ABC harvest ratio (the harmonic mean of the F_{MSY} harvest ratio) of 0.114. The current value of the OFL harvest ratio (the arithmetic mean of the F_{MSY} ratio) is 0.122. The product of the maximum permissible ABC harvest ratio and the geometric mean of the 2023 biomass estimate produced the 2023 maximum ABC of 378,499 t. The OFL for 2023 was set at 404,882 t. For 2024, the corresponding quantities are a maximum ABC of 462,890 t and an OFL of 495,155 t. No reduction from maxABC was deemed warranted for this stock for 2023 or 2024.

Status determination

Yellowfin sole is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

5. Greenland turbot

Status and catch specifications (t) of Greenland turbot in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Plan Team. Catch data for 2022 are current through November 5, 2022.

Area	Year	Age 1+ Biomass	OFL	ABC	TAC	Catch
BSAI	2021	87,849	8,568	7,326	6,025	1,597
	2022	84,341	7,687	6,572	6,572	1,477
	2023	53,907	4,645	3,722	n/a	n/a
	2024	48,850	3,947	3,162	n/a	n/a
Eastern Bering Sea	2021	n/a	n/a	6,176	5,125	1,130
	2022	n/a	n/a	5,540	5,540	1,038
	2023	n/a	n/a	3,180	n/a	n/a
	2024	n/a	n/a	2,666	n/a	n/a
Aleutian Islands	2021	n/a	n/a	1,150	900	467
	2022	n/a	n/a	1,032	1,032	439
	2023	n/a	n/a	592	n/a	n/a
	2024	n/a	n/a	496	n/a	n/a

Changes from previous assessment

New data for the assessment included the 2021 and 2022 NMFS shelf bottom trawl survey biomass estimates and size compositions and the Alaska Fisheries Science Center (AFSC) longline survey relative population numbers for 2021 and 2022. Length at age data from the 2021 and 2022 NMFS shelf bottom trawl surveys were also available and were used in this assessment. Fishery catch estimates were updated and included a preliminary estimate for 2022. Data on fishery size composition from 2021 and 2022 were also included. Model changes were minor. The AFSC longline survey length data were included in models 16.4b and 16.4c and its selectivity was estimated. The EBS slope bottom trawl survey mean length at age data were also included in Model 16.4c.

Spawning biomass and stock trends

The projected 2023 female spawning biomass is 33,554 t, which is a 29% decrease from last year's 2023 projection of 47,376 t. This decrease is due to declining survey biomass in the EBS shelf and improved model fits to the AFSC longline survey relative population numbers in recent years. Exploitation rates are generally low (less than 5% since 2013), and catches are generally well below TACs. Between 2018-2021, an average of 40% of the TAC and 23% of ABC was caught in the fishery. Female spawning biomass is projected to decrease slightly to 30,484 t in 2024. The 2007-2009 recruitment classes appear to be fully integrated into the fishery, and overall, the stock is continuing its downward trend from the last several years. The 2022 EBS shelf survey showed a 26% reduction in survey biomass from the 2021 survey.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The $B_{40\%}$ value, using the mean recruitment estimated for the period 1978-2020 is 27,058 t. Because the projected spawning biomass in year 2023 is above $B_{40\%}$, Greenland turbot ABC and OFL levels will be determined under Tier 3a of Amendment 56. Based on information presented in the risk table, the author recommended reducing the ABC below the maximum permissible values for 2023 and 2024. The author provided a range of reduction values for consideration based on a sensitivity analysis of the maturity curve. The Team approved this recommendation and support using the lower range of the reduction values, therefore reducing the ABC by 6% for 2023 and 2024.

Area apportionment

The authors and Team recommend that apportionment of ABC between the EBS and the Aleutian Islands be based on the assumption that 15.7% of the biomass is in the Aleutian Islands. This is documented in the 2018 and 2020 assessments, and as in previous assessments, is based on unweighted averages of EBS slope and AI survey biomass estimates from the three most recent years in which both areas were

surveyed (2010, 2012, and 2016). As in previous years, area apportionment of the OFL is not recommended.

Status determination

Greenland turbot is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

6. Arrowtooth flounder

Status and catch specifications (t) of arrowtooth flounder in recent years are below. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Plan Team. Catch data are current through November 5, 2022.

Area	Year	Age 1+ Bio	OFL	ABC	TAC	Catch
BSAI	2021	923,646	90,873	77,349	15,000	9,014
	2022	921,690	94,445	80,389	20,000	7,626
	2023	929,274	98,787	83,852	n/a	n/a
	2024	919,797	103,070	87,511	n/a	n/a

Changes from previous assessment

There were no changes in the assessment methodology. Changes in the input data include:

1. Estimates of catch through October 14, 2022, for Bering Sea Aleutian Islands (BSAI).
2. Fishery size compositions for 2020 and 2021.
3. Biomass point-estimates and standard errors from the 2021 and 2022 eastern Bering Sea (EBS) shelf bottom trawl survey (BTS) and 2022 Aleutian Islands (AI) BTS.
4. Age data from the 2021 eastern Bering Sea shelf.
5. The recommended model did not include fishery size compositions prior to the start of the Observer Program (pre-1991), or fishery size compositions with fewer than 300 samples, or Aleutian Islands survey data prior to the standardization of the survey (pre-1991).

Spawning biomass and stock trends

The projected age 1+ total biomass for 2023 is 929,274 t, which is a slight decrease from the 914,915 t projected for 2023 in last year's assessment. The projected female spawning biomass for 2023 is 514,577 t, which is a slight decrease from last year's 2023 estimate of 528,725 t. Overall, this stock increased steadily from 1985 to 2009, dipped slightly until 2017 and then increased to current levels that are similar to the 2009 time series peak.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock. Arrowtooth flounder therefore qualifies for management under Tier 3. The point estimates of $B_{40\%}$ and $F_{40\%}$ from this year's assessment are 224,487 t and 0.146. The projected 2023 spawning biomass is well above $B_{40\%}$, so ABC and OFL recommendations for 2023 were calculated under sub-tier "a" of Tier 3. The authors recommend setting F_{ABC} at the $F_{40\%}$ level, which is the maximum permissible level under Tier 3a, resulting in 2023 and 2024 ABCs of 83,852 t and 87,511 t, respectively. Projected harvesting at $F_{35\%}$ (0.174) gives 2023 and 2024 OFLs of 98,787 t and 103,070 t respectively.

Status determination

Arrowtooth flounder is a lightly exploited stock in the BSAI. Arrowtooth flounder is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

7. Kamchatka flounder

Status and catch specifications (t) of Kamchatka flounder in recent years are below. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Plan Team. Catch data are current through November 5, 2022.

Area	Year	Age 2+ Biomass	OFL	ABC	TAC	Catch
BSAI	2021	144,671	10,630	8,982	8,982	6,561
	2022	143,983	10,903	9,214	9,214	1,477
	2023	121,977	8,946	7,579	n/a	n/a
	2024	118,713	8,776	7,435	n/a	n/a

Changes from previous assessment

Changes to the input data include:

1. Estimates of catch were updated for all years.

2. The 2021 and 2022 fishery length composition data were added to the assessment.

3. The 2021 and 2022 EBS shelf bottom trawl survey biomass and length composition estimates were added to the assessment.

No changes were made to the assessment model methodology.

Spawning biomass and stock trends

The projected 2023 female spawning biomass is 47,877 t, above the $B_{40\%}$ level of 37,748 t, and spawning biomass is projected to remain above $B_{40\%}$ for the foreseeable future. The decreasing biomass and biomass trend scaling lower than the 2020 assessment correspond to fitting a lower survey biomass. The addition of the new survey data does result in an overall decrease in the spawning stock biomass, total biomass, numbers, and age-2 recruits trends through time, particularly after 2010.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

This stock was managed under Tier 3 for the first time in 2014. As noted above, projected spawning biomass for 2023 is above $B_{40\%}$, placing Kamchatka flounder in sub-tier "a" of Tier 3. For the 2023 fishery, the authors and Team recommend setting 2023 ABC at the maximum permissible value of 7,579 t from the projection model. This value is a decrease of 18% from the 2022 ABC currently specified (9,214 t). The recommended 2023 OFL is 8,946 t, a 18% decrease from the 10,903 t currently specified for 2022. The author listed the assessment-related considerations as a Level-2 area of concern due to degrading model fit to the survey biomass. However, the Team did not recommend any reductions from the maximum permissible ABC.

Status Determination

Kamchatka flounder is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

8. Northern rock sole

Status and catch specifications (t) of northern rock sole in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2022 and 2023 are those recommended by the Plan Team. Catch data are current through November 5, 2022.

Area	Year	Age 6+ Biomass	OFL	ABC	TAC	Catch
BSAI	2021	923,197	145,180	140,306	54,500	14,393
	2022	1,361,360	214,084	206,896	66,000	18,242
	2023	941,359	166,034	121,719	n/a	n/a
	2024	1,111,320	196,011	119,969	n/a	n/a

Changes from previous assessment

No changes were made to the assessment methodology in the accepted model. However, 2 alternative models *were* used, but only as a method for deriving the reductions from maxABC (see below). Changes to the input data include:

1. 2022 catch biomass through October 10, 2022, and 2021 catches were added to the model
2. 2020 catch biomass was updated to reflect October – December 2020 catches
3. 2020-2021 fishery age composition data were added to the model
4. 2020-2021 survey age composition data were added to the model
5. 2021-2022 Eastern Bering Sea (EBS) shelf survey biomass was added to the model

Spawning biomass and stock trends

Spawning biomass was at a low in 2008, increased through the early 2010s, steadily decreased from 2015-2020, and models indicate steady decline. Recruitment was maintained at near historic lows for several years straight in the mid-2010s. More recently a pulse of recruits has begun to show up in the surveys including a strong 2020-year class – however there is a lot of uncertainty regarding the true strength of this year class. The stock assessment model projects a 2023 female spawning biomass of 260,887 t, an 18.6% decrease from the previous 2023 female spawning biomass estimate of 320,399 t. The projected spawning biomass for 2024 is 291,774 t. Exploitation rates are relatively low and recent catches have typically been well below TAC's.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that northern rock sole qualifies for management under Tier 1. Spawning biomass for 2023 is projected to be well above the B_{MSY} estimate of 155,293, placing northern rock sole in sub-tier "a" of Tier 1. The Tier 1 2023 and 2024 maxABC's are 158,935 t and 187,631 t respectively. However, the authors identified "assessment-level concerns" in the Risk Table that they felt warranted a reduction from maxABC (score of 3 – major concerns). New alternative models – and the resulting harvest specifications – that addressed these concerns were presented to the Team; however, these were not presented for consideration of acceptance as the new base model, but rather as a quantitative approach to deriving the *value* for a recommendation for reduction from maxABC while keeping the base model status-quo (since the alternative models were not presented to the Team at the September meeting).

The Team agreed that there were sufficient retrospective biases, diminishing fits to recent indices, and a tendency to overestimate recruitment and survey biomass in the base model to justify either model rejection or a reduction from maxABC, but were reluctant to throw out the base model for this Tier 1 stock. The Team accepted the base model with the Risk Table score of 3 and the "alternative model" approach to deriving the reduction from maxABC - with a recommendation to move forward with the alternative models for acceptance in the next assessment cycle. The Team generally agreed that the alternative models do a better job of fitting the data, reducing retrospective biases, and more realistically representing the most recent recruitment event while also incorporating a more defensible data-weighting approach, but these models were not presented as alternatives but rather as a method of deriving the reduction value. This method sets the ABC equal to the lowest of the OFL's derived from the alternative models presented in order to ensure that "the risk of the ABC exceeding the true (but unknown) OFL" (SSC Risk Table guidance). This reduction sets the 2023 and 2024 ABC's at 121,719 t and 119,969 t

respectively (using F_{ABC} = 0.174 from model 22.1). The 2023 and 2024 OFLs are 166,034 t and 196,011 t respectively (using F_{OFL} = 0.183 from model 22.1).

This is a stable fishery that lightly exploits the stock because it is constrained by PSC limits and the BSAI optimum yield cap. Usually the average catch/biomass ratio is about 3-4 percent.

Status determination

Northern rock sole is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

9. Flathead sole

Status and catch specifications (t) of flathead sole in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024are those recommended by the Plan Team. Catch data are current through November 5, 2022.

Area	Year	Age 3+Biomass	OFL	ABC	TAC	Catch
BSAI	2021	602,497	75,863	62,567	25,000	10,259
	2022	608,631	77,967	64,288	35,500	14,559
	2023	606,522	79,256	65,344	n/a	n/a
	2024	606,080	81,167	66,927	n/a	n/a

Changes from previous assessment

This assessment was changed to a biennial cycle beginning with the 2014 assessment; this was supposed to be a full assessment year, but due to limited staff resources, a partial assessment is presented this year. Changes to the input data in this analysis include updated catch information for 2021 and estimated catches for 2022 and 2023-2024. There were no changes to the assessment methodology.

Spawning biomass and stock trends

Spawning biomass is projected to increase slightly in 202 and in 2024. Age 3+ biomass is also projected to have small decreases in 2023 and 2024.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, thereby qualifying flathead sole for management under Tier 3. The current values of these reference points are $B_{40\%}$=81,463 t, $F_{40\%}$=0.37, and $F_{35\%}$=0.46. Because projected spawning biomass for 2023 (158,962 t) is above $B_{40\%}$, flathead sole is in Tier 3a. The authors and Team recommend setting ABCs for 2023 and 2024 at the maximum permissible values under Tier 3a, which are 65,3448 t and 66,927 t, respectively. The 2023 and 2024 OFLs under Tier 3a are 79,256 t and 81,167 t, respectively.

Status determination

Flathead sole is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

10. Alaska plaice

Status and catch specifications (t) of Alaska plaice in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2022 and 2023 are those recommended by the Plan Team. Catch data are current through November 6, 2021.

Area	Year	Age 3 + Biomass	OFL	ABC	TAC	Catch
BSAI	2020	428,800	37,600	31,600	17,000	20,078
	2021	427,587	37,924	31,657	24,500	15,653
	2022	442,946	40,823	33,946	n/a	n/a
	2023	454,030	43,328	36,021	n/a	n/a

Changes from previous assessment

In accordance with the approved schedule, a full assessment was conducted for Alaska plaice this year. Changes to the input data included updated catch data through 2020, estimated catch for 2021, projected catches for 2022-2023, 2021 eastern Bering Sea (EBS) trawl survey biomass estimates and standard errors (no survey in 2020 due to COVID-19), 2019 survey ages (no otoliths collected in 2020 due to no survey), and 2019 and 2020 fishery length compositions. There were no changes to the assessment methodology.

Spawning biomass and stock trends

The survey biomass estimate for 2021 (333,830 t) was 9% lower than the 2019 estimate and is the lowest value in the survey time series. Similarly, model estimates of female spawning biomass (158,090 t in 2021) continued their decline since 2013. In contrast, model estimates of total biomass (455,187 t in 2021) show an increasing trend since 2019. These results are likely due to estimates of relatively strong recruitment since 2017, a pattern which began to emerge in the 2019 assessment. The Alaska plaice stock is projected to remain above the $B_{35\%}$ level of female spawning biomass while declining over the next several years. Alaska plaice continue to be found in high abundance in the northern Bering Sea (NBS) and the 2021 NBS estimate (344,578 t) exceeded the EBS estimate for the first time.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, therefore qualifying it for management under Tier 3. The current estimates are $B_{40\%}$ = 114,635 t, $F_{40\%}$ = 0.140, and $F_{35\%}$ = 0.170. Given that the projected 2022 spawning biomass of 141,838 t exceeds $B_{40\%}$, the ABC and OFL recommendations for 2022 were calculated under sub-tier "a" of Tier 3. Projected harvesting at the $F_{40\%}$ level gives a 2022 ABC of 32,697 t and a 2023 ABC of 32,998 t. The recommended Tier 3a OFLs are 39,305 t and 39,685 t for 2022 and 2023, respectively.

Status determination

Alaska plaice is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

11. Other Flatfish Complex

In accordance with the approved schedule, no assessment was conducted for the other flatfish complex this year. However, a full stock assessment will be conducted in 2024. Until then, the values generated from the previous stock assessment (below) will be rolled over for 2023-2024 specifications. Please refer to the previous stock assessment for details regarding the rolled overestimates. The grayed-out text following the table below summarizes the 2020 assessment.

Status and catch specifications (t) of other flatfish in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Plan Team. Catch data are current through November 5, 2022.

Area	Year	Total Biomass	OFL	ABC	TAC	Catch
BSAI	2021	146,679	22,919	17,189	6,500	2,638
	2022	146,679	22,919	17,189	10,000	2,550
	2023	146,679	22,919	17,189	n/a	n/a
	2024		22,919	17,189	n/a	n/a

Changes from previous assessment

This stock is managed on a four-year cycle and 2021 was an off year. Therefore there was no update to this assessment. The last full assessment was in 2020 and the next full assessment is scheduled for 2024.

Spawning biomass and stock trends

EBS shelf survey biomass estimates for this complex were all below 100,000 t from 1983-2003, and reached a high of 150,480 t in 2006. This is a not-targeted species complex and in 2019 approximately 23% of the ABC was caught. The random effects model estimates indicate that the other flatfish species group is at a high level relative to the time series average and is lightly exploited.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has classified other flatfish as a Tier 5 species complex with harvest recommendations calculated from estimates of biomass and natural mortality. Natural mortality rates for rex (0.17) and Dover sole (0.085) borrowed from the Gulf of Alaska are used, along with a value of 0.15 for all other species in the complex. The resultant 2022 OFL and ABC are 22,919 t and 17,189 t respectively.

Status determination

This assemblage is not being subjected to overfishing. It is not possible to determine whether this assemblage is overfished or whether it is approaching an overfished condition because it is managed under Tier 5.

12. Pacific ocean perch

Status and catch specifications (t) of Pacific ocean perch (POP) in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Team. Catch data are current through November 5, 2022.

Area	Year	Age 3+ Bio	OFL	ABC	TAC	Catch
BSAI	2021	756,011	44,376	37,173	35,899	35,479
	2022	738,710	42,605	35,688	35,385	32,294
	2023	888,722	50,133	42,038	n/a	n/a
	2024	876,140	49,279	41,322	n/a	n/a
Eastern Bering Sea	2021			10,782	10,782	10,693
	2022			10,352	10,352	9,665
	2023			11,903	n/a	n/a
	2024			11,700	n/a	n/a
Eastern Aleutian Islands	2021			8,419	8,419	8,288
	2022			8,083	8,083	5,924
	2023			8,152	n/a	n/a
	2024			8,013	n/a	n/a
Central Aleutian Islands	2021			6,198	6,198	5,993
	2022			5,950	5,950	5,823
	2023			5,648	n/a	n/a
	2024			5,551	n/a	n/a
Western Aleutian Islands	2021			11,774	10,500	10,505
	2022			11,303	11,000	10,882
	2023			16,335	n/a	n/a
	2024			16,058	n/a	n/a

Changes from previous assessment

This chapter was presented as a full assessment. Changes to the input data included updated catch data through 2021, projected 2022-2024 catch estimates, 2022 Aleutian Islands (AI) survey biomass estimate and length compositions, 2020 and 2021 fishery age composition, and reweighted age and length data using the iterative reweighting procedure (McAllister-Ianelli method). There were no changes to the assessment methodology.

Spawning biomass and stock trends

The high survey biomass estimates over the past five years have contributed to a substantial increase in estimated stock size in recent years; however, there remains a poor residual pattern in the fit to the AI survey index. The 2022 AI survey biomass estimate is a 5% increase from the 2018 AI survey biomass estimate. Spawning biomass is projected to be 359,074 t in 2023 and decline to 352,616 t in 2024. The recent year classes of 2011-2012, 2014, and 2016 appear to be relatively strong, but the retrospective analysis suggests that recruitment estimates for these year classes may not have stabilized.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, thereby qualifying POP for management under Tier 3. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ are 261,050 t, 0.074, and 0.089, respectively. Spawning biomass for 2023 (359,074 t) is projected to exceed $B_{40\%}$, thereby placing POP in sub-tier "a" of Tier 3. The maximum permissible value of F_{ABC} under Tier 3a is 0.074, which results in the author and Plan Team recommended 2023 ABC of 42,038 t and 2024 ABC of 41,322 t. The OFL fishing mortality rate is 0.089 which results in a 2023 OFL of 50,133 t and 2024 OFL of 49,279 t.

Area apportionment

The Team agreed with the author's recommendation that ABCs be set regionally based on the proportions in combined survey biomass as follows (values are for 2023): EBS = 11,903 t, Eastern Aleutians (Area 541) = 8,152 t, Central Aleutians (Area 542) = 5,648 t, and Western Aleutians (Area 543) = 16,335 t. The recommended OFLs for 2023 and 2024 are not regionally apportioned.

Status determination

This stock is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

13. Northern rockfish

Status and catch specifications (t) of northern rockfish in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Team. Catch data are current through November 5, 2022.

Area	Year	Age 3+ Biomass	OFL	ABC	TAC	Catch
BSAI	2021	244,600	18,917	15,557	13,000	6,212
	2022	279,584	23,420	19,217	17,000	7,801
	2023	277,133	22,776	18,687	n/a	n/a
	2024	273,414	22,105	18,135	n/a	n/a

Changes from previous assessment

This chapter was presented in a partial assessment format because it was a scheduled "off-year" assessment under the stock assessment prioritization guidelines. Therefore, only the projection model was run, with updated catches. New data in the 2022 assessment included updated 2021 catch and estimated 2022 catches. No changes were made to the assessment model. Exploitation rates (i.e., catch/biomass) well below the exploitation rate associated with fishing at $F_{40\%}$.

Spawning biomass and stock trends

The 2021 catch was 6,212 t, xx% larger than the estimate of 8,828 t that was used in the 2020 projection. The 2022 catch is projected to be 8,129 t, close (within 1%) the estimate of 8,213 t in the 2021 projection. Spawning biomass is projected to be 118,251 t in 2023 and to decline to 115,215 t in 2024. The exploitation rates from the BSAI subareas are below $F_{40\%}$. The exploitation rate in the eastern Aleutian Islands peaked in 2015 and 2019, but was substantially lower in 2020 through 2022. The exploitation rates in the central Aleutian Islands have been increasing since 2014.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, thereby qualifying northern rockfish for management under Tier 3. The current estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ are 68,707 t, 0.069, and 0.085, respectively. Spawning biomass for 2023 (171,768 t) is projected to exceed $B_{40\%}$, thereby placing northern rockfish in sub-tier "a" of Tier 3. The maximum permissible value of F_{ABC} under Tier 3a is 0.069, which results in the author and Plan Team recommended 2023 ABC of 18,687 t and 2024 ABC of 18,135 t. The OFL fishing mortality rate is 0.085 which results in a 2023 OFL of 22,776 t and 2024 OFL of 22,105 t.

Status determination

This stock is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

14. Blackspotted and rougheye rockfish

Status and catch specifications (t) of blackspotted and rougheye rockfish complex in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through November 5, 2022.

Area/subarea	Year	Total Biomass (t)	OFL	ABC	TAC	Catch
BSAI	2021	19,003	576	482	482	515
	2022	19,145	598	503	503	386
	2023		703	525	n/a	n/a
	2024		763	570	n/a	n/a
Western/ Central Aleutian Islands	2021			169	169	319
	2022			177	177	249
	2023			166	n/a	n/a
	2024			182	n/a	n/a
Eastern AI/ Eastern Bering Sea	2021			313	313	196
	2022			326	326	137
	2023			359	n/a	n/a
	2024			388	n/a	n/a

Changes from previous assessment

This assessment was changed to a biennial cycle beginning with the 2014 assessment; this is a full assessment year. Changes to the input data include

1. Catch data was updated through 2021, and total catch for 2022 was projected.
2. The 2022 AI survey biomass estimate and length composition were included in the assessment.
3. The 2013 and 2019 AI fishery length compositions were replaced by the age compositions, and the 2020 and 2021 AI fishery age compositions were included in the model.
4. The input multinomial sample sizes for the age and length composition data were reweighted using the Francis iterative reweighting procedure

There were no changes to the assessment methodology except that the very large estimated 2010 year class was reduced by setting it to the next largest year class to reduce large changes in the reference points (e.g. $B_{40\%}$).

Spawning biomass and stock trends

Since 2014, spawning biomass has increased from 2,656 t to 3,471 t in 2023 and the total biomass has increased since 2002 to 23,883 t in 2023. Much of this increase in total biomass can be attributed to relatively recent year classes, especially the estimated large 2010-year class that is just beginning to mature. Spawning biomass for AI blackspotted/rougheye rockfish is projected to increase slightly in 2024 to 3,642 t.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The stock assessment is separated into AI and EBS. For the AI, this stock qualifies for management under Tier 3 due to the availability of estimates for $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ and qualifies as Tier 3b but is projected to exceed $B_{40\%}$ in 2023, putting it in Tier 3a. The EBS stock is managed under Tier 5 with a projected biomass of 1,544 t applied to both 2023 and 2024.

The authors and Team recommend an overall 2023 ABC of 525 t and a 2023 OFL of 703 t. The apportionment of the 2021 ABC to subareas is 166 t for the Western and Central Aleutian Islands and 359 t for the eastern Aleutian Islands and eastern Bering Sea.

Area apportionment

Ongoing concerns about fishing pressure relative to biomass in the Western Aleutians have been noted by the Team. The maximum subarea species catch (MSSC) levels within the WAI/CAI, based on the random effects model, are as follow:

	WAI	CAI
2023 MSSCs	61	105
2024 MSSCs	67	115

Status determination

The BSAI blackspotted and rougheye stock complex is not being subjected to overfishing. For the AI region, the blackspotted and rougheye rockfish complex is not overfished, and is not approaching an overfished condition. It is not possible to determine whether the complex in the EBS region is overfished or whether it is approaching an overfished condition because it is managed under Tier 5.

15. Shortraker rockfish

Status and catch specifications (t) of shortraker rockfish in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Plan Team. Catch data are current through November 5, 2022.

Area	Year	Survey Biomass	OFL	ABC	TAC	Catch
BSAI	2021	24,055	722	541	500	496
	2022	24,055	722	541	541	284
	2023	23,547	706	530	n/a	n/a
	2024	23,547	706	530	n/a	n/a

Changes from previous assessment

This assessment was changed to a biennial cycle beginning with the 2014 assessment; this is a full assessment year.

Changes to the input data:

1) Catch data have been revised and updated through November 5, 2022.
2) 2022 Aleutian Islands (AI) bottom trawl survey (BTS).
3) AFSC longline survey (LLS) relative population weights (RPWs) on the eastern Bering Sea (EBS) slope, 1997-2021. The EBS slope is sampled by the LLS in odd years.

Changes in the assessment methodology:

The random effects model was fit in Template Model Builder (TMB; Kristensen et al. 2016) using the new *rema* R library. The models presented as follows:

1) Model 18.9: The accepted model in the last full assessment as implemented in 2018 and 2020 using the univariate version of the random effects (RE) model. Model 18.9 was bridged from AD Model Builder (ADMB) to TMB and to the multivariate version of the random effects (REM) model. This bridging analysis was presented to and accepted by the BSAI Groundfish Plan Team in September 2022. In the bridged Model 18.9, three separate strata (AI, EBS slope, southern Bering Sea; SBS) are fit and share process error across strata.
2) Model 22 (author-recommended): Same as the bridged Model 18.9 and also fits to the EBS slope LLS RPWs.

Spawning biomass and stock trends

Estimated shortraker rockfish biomass in the BSAI slowly decreased from 1998 to 2010 and remained relatively stable to 2022. Survey biomass estimates decreased in the western and eastern AI and increased in the central AI in 2022 compared to 2018. Relative population weights have been variable over time in the EBS slope portion of the longline survey (LLS) with an increase in 2019 followed by a decrease in

2021. Exploitation rates have generally been well below the ABC levels, and have been close to ABC in 2013 and 2021.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has previously determined that reliable estimates of only biomass and natural mortality exist for shortraker rockfish, qualifying the species for management under Tier 5. The Team recommends basing the biomass estimate on the random effects model. The Team recommended setting F_{ABC} at the maximum permissible level under Tier 5, which is 75 percent of M. The accepted value of M for this stock is 0.03 for shortraker rockfish, resulting in a $maxF_{ABC}$ value of 0.0225. The ABC is 530 t for 2023 and 2024 and the OFL is 706 t for 2023 and 2024.

Status determination

Shortraker rockfish is not being subjected to overfishing. It is not possible to determine whether this stock is overfished or whether it is approaching an overfished condition because it is managed under Tier 5.

16. Other rockfish complex

A full stock assessment was conducted in 2022. Status and catch specifications (t) of other rockfish in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Plan Team. Catch data are current through November 5, 2022.

Area	Year	Survey Biomass	OFL	ABC	TAC	Catch
BSAI	2021	53,248	1,751	1,313	916	1,002
	2022	53,248	1,751	1,313	1,144	1,224
	2023	52,733	1,680	1,260	n/a	n/a
	2024	52,733	1,680	1,260	n/a	n/a
Eastern Bering Sea	2021	n/a	n/a	956	522	392
	2022	n/a	n/a	919	750	647
	2023	n/a	n/a	880	n/a	n/a
	2024	n/a	n/a	880	n/a	n/a
Aleutian Islands	2021	n/a	n/a	394	394	610
	2022	n/a	n/a	394	394	577
	2023	n/a	n/a	380	n/a	n/a
	2024	n/a	n/a	380	n/a	n/a

Changes from previous assessment

A full stock assessment was conducted this year.

Changes to the input data:

1. Catch and fishery lengths updated through October 3, 2022.
2. The 2022 AI bottom trawl survey (BTS) for both SST and non-SST species. The 2021 and 2022 Eastern Bering Sea (EBS) shelf BTS for non-SST species. New in 2022: NMFS longline survey (LLS) relative population weights (RPWs) for SST on the EBS slope, 1997-2021. The EBS slope is sampled by the LLS in odd years.
3. The 2021 and 2022 Eastern Bering Sea (EBS) shelf BTS for non-SST species.
4. New in 2022: NMFS longline survey (LLS) relative population weights (RPWs) for SST on the EBS slope, 1997-2021 (Table 1). The EBS slope is sampled by the LLS in odd years.

Changes in the assessment methodology. The random effects model was fit in Template Model Builder (TMB; Kristensen et al. 2016) using the new rema R library. Model 22 (author-recommended): Same as Model 20 and also fits to the EBS slope LLS RPWs for SST (Sullivan et al. 2022a). The non-SST model is the same as Model 20.

Spawning biomass and stock trends

This is a Tier 5 complex, thus trends in spawning biomass are unknown. The random effects survey biomass estimates for shortspine thornyhead (SST) in the Aleutian Islands and EBS slope have been variable. The non-SST portion of the complex varies dramatically among surveys. Biomass estimates are frequently zero or very small for the non-SST portion of the complex in both the eastern Bering Sea slope and shelf surveys.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Team agrees with the approach recommended by the author of setting F_{ABC} at the maximum allowable under Tier 5 (F_{ABC} = 0.75M). The accepted values of M for species in this complex are 0.03 for SST and 0.09 for all other species. Multiplying these rates by the best biomass estimates of shortspine thornyhead and the non-SST portion of the complex yields 2023 and 2024 ABCs of 880 t in the eastern Bering Sea and 380 t in the Aleutian Islands. The Team recommends that OFL be set for the entire BSAI area, which under Tier 5 is calculated by multiplying the best estimates of total biomass for the area by the separate natural mortality values and adding the results, yielding an OFL of 1,680 t for 2023 and 2024.

Status determination

The "other rockfish" complex is not being subjected to overfishing. It is not possible to determine whether this complex is overfished or whether it is approaching an overfished condition because it is managed under Tier 5.

17. Atka mackerel

Status and catch specifications (t) of Atka mackerel in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Plan Team. Catch data are current through November 5, 2022.

Area	Year	Age 1+ Biomass	OFL	ABC	TAC	Catch
BSAI	2021	560,360	85,580	73,590	62,257	61,354
	2022	554,490	91,870	78,510	66,481	54,311
	2023	615,027	118,787	98,588	n/a	n/a
	2024	606,661	101,188	86,464	n/a	n/a
E Aleutian Islands/EBS	2021	n/a	n/a	25,760	25,760	25,183
	2022	n/a	n/a	27,260	27,260	15,504
	2023	n/a	n/a	43,281	n/a	n/a
	2024	n/a	n/a	37,958	n/a	n/a
Central Aleutian Islands	2021	n/a	n/a	15,450	15,450	15,308
	2022	n/a	n/a	16,880	16,880	16,599
	2023	n/a	n/a	17,351	n/a	n/a
	2024	n/a	n/a	15,218	n/a	n/a
Western Aleutian Islands	2021	n/a	n/a	32,380	21,047	20,863
	2022	n/a	n/a	34,370	22,341	22,208
	2023	n/a	n/a	37,956	n/a	n/a
	2024	n/a	n/a	33,288	n/a	n/a

Changes from previous assessment

The following new data were included in this year's assessment:

1. The 2021 catch estimate was updated and estimated total catch for 2022 was set equal to the TAC (66,481 t).
2. Estimated 2023 and 2024 catches are 83,800 t and 73,495 t, respectively.
3. The 2021 fishery age composition data were added.
4. The estimated average selectivity calculated from 2017-2021 was used for projections.

5. We assume that approximately 85% of the BSAI-wide ABC is likely to be taken under the revised Steller Sea Lion Reasonable and Prudent Alternatives (SSL RPAs) implemented in 2015. This percentage was applied to the 2023 and 2024 maximum permissible ABCs, and those reduced amounts were assumed to be caught in order to estimate the 2023 and 2024 ABCs and OFL values.

There were no changes to the assessment methodology.

Spawning biomass and stock trends

Spawning biomass in 2005 was at the highest level since 1983, after which it decreased through 2013, increased through 2017, and subsequently decreased through 2023 although with a slight uptick in 2021 and 2022. Continued decline is projected for 2023 and 2024 (the estimated spawning biomass in 2023 is projected to be roughly 45% of what it was in 2005). Age 1+ biomass is variable in recent years with a 9.6% increase from 2022 to 2023. Some strong recruitment in the early 2000's was followed by above average recruitment in 2006, 2007, 2012, and 2017. The projected female spawning biomass for 2023 (122,541 t) is projected to be above $B_{40\%}$ (112,182 t), and the stock is projected to drop slightly below $B_{40\%}$ through 2027.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The projected female spawning biomass under the recommended harvest strategy is estimated to be above $B_{40\%}$, thereby placing BSAI Atka mackerel in Tier 3a. The projected 2023 yield (ABC) at F_{ABC} = 0.61 is 98,588 t, up 26% from the 2022 ABC and substantially greater than last year's projected ABC for 2023. The projected 2023 overfishing level at F_{OFL} = 0.65 is 118,787 t, up 29% from the 2022 OFL and up substantially from last year's projected OFL for 2023. Projections to 2024 are

A risk table was completed for this stock with Level 1 ratings for population dynamics considerations and fishery performance considerations, and Level 2 for assessment-related considerations and environmental/ecosystem considerations. No adjustment to maximum permissible ABC was proposed.

Area apportionment

A weighted averaging method using the most recent four surveys was used to apportion ABC among areas. The recommended ABC apportionments by subarea for 2023 are 43,281 t for Area 541 and the EBS region (a 59% increase from 2022), 17,351 t for Area 542 (a 3% increase from 2022), and 37,956 t for Area 543 (a 70% increase from 2022).

Status determination

Atka mackerel is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

18. Skates

No assessment was conducted for the skate stock complex this year. A full assessment in scheduled for 2023 as resources allow. Until then, the values generated from the previous stock assessment are used for the Tier 5 2023 and 2024 specifications; and updated catch values are used in the Tier 3 projection for 2023 and 2024 specifications.

Status and catch specifications (t) of skates in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Plan Team. Catch data are current through November 5, 2022.

Area	Year	Age 0+ Biomass	OFL	ABC	TAC	Catch
BSAI	2021	611,865	49,297	41,257	20,000	20,029
	2022	597,042	47,790	39,958	30,000	27,799
	2023	580,701	46,220	38,605	n/a	n/a
	2024	557,853	44,168	36,837	n/a	n/a

For 2021, NMFS increased the TAC to 20,000 t with a reallocation of 2,000 t from the non-specified reserves.

Changes from previous assessment

The following new data were included in this year's assessment:

1. Catch data have been updated through October 11, 2022. The 2021 catch data used in the projection model have been updated, and new estimates of 2022 and 2023 catches were created for use in the projection model.
2. Survey biomass estimates from the 2022 eastern Bering Sea (EBS) shelf bottom trawl survey were reported for informational purposes, but the assessment model was not re-run.

There were no changes to the assessment methodology. The projection model for harvest recommendations was re-run with updated catch data.

Spawning biomass and stock trends

Last year's assessment estimated that recruitment of Alaska skate was above average for all but two cohorts spawned between 1995 and 2011, but has been below average for all cohorts spawned since 2012. Spawning biomass of Alaska skate increased continuously from 2006 (198,418 t) through 2020 (284,268 t), and in 2020 was at an all-time high for the post-1976 environmental regime. With lower recent recruitment, spawning biomass is expected to decrease in the future. The biomass of Other Skates on the EBS shelf is declining but is still above the long-term mean.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Since 2011, the Alaska skate portions of the ABC and OFL have been specified under Tier 3, while the "other skates" portions have been specified under Tier 5.

Because projected spawning biomass for 2023 (114,804 t) exceeds $B_{40\%}$ (71,370 t), Alaska skates are managed in sub-tier "a" of Tier 3. Other reference points are $maxF_{ABC} = F_{40\%} = 0.079$ and $F_{OFL} = F_{35\%} = 0.092$. The Alaska skate portions of the 2023 and 2024 ABCs are 30,567 t and 28,799 t, respectively, and the Alaska skate portions of the 2023 and 2024 OFLs are 35,503 t and 33,451 t. The "other skates" component is assessed under Tier 5, based on a natural mortality rate of 0.10 and a biomass estimated using the random effects model. The "other skates" portion of the 2023 and 2024 ABCs is 8,038 t for both years and the "other skates" portion of the 2023 and 2024 OFLs is 10,717 t for both years.

Status determination

Alaska skate, which may be viewed as an indicator stock for the complex, is not overfished and is not approaching an overfished condition. The skate complex is not being subjected to overfishing.

19. Sharks

Status and catch specifications (t) of sharks in recent years. The OFL and ABC for 2023 and 2024 are those recommended by the Plan Team. Catch data are current through November 5, 2022.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2021	n/a	689	517	200	221
	2022	n/a	689	517	500	125
	2023	n/a	689	450	n/a	n/a
	2024	n/a	689	450	n/a	n/a

Changes from previous assessment

This assessment was changed to a biennial cycle beginning with the 2014 assessment; this is a full assessment.

Changes to the input data in this analysis include:

1. Total catch for BSAI sharks is updated for 2003-2022 (as of Oct 8, 2022)

The authors presented alternative models for Pacific sleeper shark, other/unidentified sharks and spiny dogfish this year. However, these models were not accepted for management by the Team. Therefore, no changes were made to the methodology used for recommending harvest specifications.

Spawning biomass and stock trends

The main shark species taken in the BSAI fisheries (mainly pollock and Pacific cod) are Pacific sleeper sharks and salmon sharks. Beginning around 2000, catch rates of sleeper sharks in both the IPHC longline survey and the bycatch fisheries declined steeply for several years, causing possible concern about depletion. All sleeper sharks taken in the survey and fisheries are likely juveniles, so it is impossible to know what effect those catches have on spawning stock biomass. Bycatch of salmon sharks has generally increased since 2010. Recent catch levels have been well below the ABC.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has placed sharks in Tier 6, where OFL and ABC are typically based on historical catches. The OFL is fixed at the maximum catch during 2003–2015 (689 t) and ABC at 75% of OFL, 517 t. The author and PT recommended a reduction from the maximum ABC due to concerns regarding the Pacific sleeper shark stock as highlighted in the risk table. The recommended ABC is 450 t.

Status determination

The shark complex is not being subjected to overfishing. It is not possible to determine whether this species complex is overfished or whether it is approaching an overfished condition because it is managed under Tier 6.

20. Octopus

No assessment was conducted for the octopus stock complex this year. A full assessment is scheduled for 2023 as resources allow. Until then, the values generated from the previous stock assessment are rolled over for 2023-2024 specifications. The grayed-out text following the table below summarizes the 2020 assessment.

Status and catch specifications (t) of the octopus complex in recent years. The octopus stock complex is made up of at least nine distinct species and is assessed on even years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2023 and 2024 are those recommended by the Team. Catch data are current through November 5, 2022.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2021	n/a	4,769	3,576	700	170
	2022	n/a	4,769	3,576	700	254
	2023	n/a	4,769	3,576	n/a	n/a
	2024	n/a	4,769	3,576	n/a	n/a

Changes from previous assessment

The following new data were included in this year's assessment:

1. Updated 2019 and preliminary 2020 incidental catch
2. Biomass estimates from the 2019 EBS shelf survey have been added. No relevant surveys were conducted during 2020.

Since the 2015 assessment, no changes have been made in the methodology for assessing octopus based on consumption of octopus by Pacific cod. The consumption estimate using Pacific cod predation of octopus as an estimator of biomass lost due to natural mortality first was accepted in 2011. New Pacific cod stomach data through 2015 were added previously. Increases in both Pacific cod and percentage of octopus in Pacific cod diet increased the annual consumption estimates from 2009-2015.

Spawning biomass and stock trends

Species composition and size frequencies from the surveys were similar to previous years. Survey biomass estimates increased in 2019 for the EBS shelf survey when compared to 2018 estimates and the 2018 estimate decreased in the AI survey when compared to the 2016 estimate.

On the EBS shelf and in the commercial catch, giant Pacific octopus is the most abundant of at least nine octopus species found in the BSAI. Octopuses are commonly caught in pot and trawl fisheries, especially in the Pacific cod pot fishery. Trawl surveys sample octopus poorly, and biomass estimates from trawl surveys are not considered reliable.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The ABC and OFL values were determined under Tier 6. Usually, Tier 6 specifications are based on average catch, but starting in 2011, the assessment authors recommended setting harvest specifications using an alternative mortality estimate based on species composition of Bering Sea Pacific cod diet from 1984-2008 survey data and weight-at-age data. This method was also recommended for 2017 and 2018 with additional years from 1984-2015 of Pacific cod diet data based on the requested five-year review of Pacific cod diet estimates. Data availability has not changed from the 2016 assessment, so harvest recommendations are the same as in 2016. The recommended ABCs and OFLs for 2020 and 2021 are 3,576 t and 4,769 t, respectively.

A risk table was completed for this stock with Level 1 ratings for all four categories and no adjustment to maxABC was proposed.

Status determination

The octopus complex is not being subjected to overfishing. It is not possible to determine whether the octopus complex is overfished or whether it is approaching an overfished condition because it is managed under Tier 6.

Tables

Table 1. BSAI Groundfish Plan Team Recommended OFLs and ABCs for 2023 and 2024 (metric tons); OFL, ABC, TAC and catch through November 5, 2022.

		2022		Catch as of	2023		2024	
Species	**Area**	**OFL**	**ABC**	**11/5/2022**	**OFL**	**ABC**	**OFL**	**ABC**
Pollock	EBS	1,469,000	1,111,000	1,103,996	3,381,000	1,688,000	4,639,000	1,815,000
	AI	61,264	50,752	2,895	52,383	43,413	52,043	43,092
	Bogoslof	113,479	85,109	256	115,146	86,360	115,146	86,360
Pacific cod	BS	183,012	153,383	127,885	172,495	144,834	166,814	140,159
	AI	27,400	20,600	6,178	18,416	13,812	18,416	13,812
	BSAI/GO/	40,432	34,521		47,390	40,502	48,561	41,539
Sablefish	BS	n/a	5,264	5,205	n/a	8,417	n/a	10,145
	AI	n/a	6,463	2,193	n/a	8,884	n/a	10,299
Yellowfin sole	BSAI	377,071	354,014	149,869	404,882	378,499	495,155	462,890
Greenland turbot	BSAI	7,687	6,572	1,477	4,645	3,722	3,947	3,162
	BS	n/a	5,540	1,038	n/a	3,180	n/a	2,666
	AI	n/a	1,032	439	n/a	592	n/a	496
Arrowtooth flounder	BSAI	94,445	80,389	7,626	98,787	83,852	103,070	87,511
Kamchatka flounder	BSAI	10,903	9,214	8,349	8,946	7,579	8,776	7,435
Northern rock sole	BSAI	214,084	206,896	18,242	166,034	121,719	196,011	119,969
Flathead sole	BSAI	77,967	64,288	14,559	79,256	65,344	81,167	66,927
Alaska plaice	BSAI	39,305	32,697	11,006	40,823	33,946	43,328	36,021
Other flatfish	BSAI	22,919	17,189	2,550	22,919	17,189	22,919	17,189
Pacific Ocean perch	BSAI	42,605	35,688	22,629	50,133	42,038	49,279	41,322
	BS	n/a	10,352	9,665	n/a	11,903	n/a	11,700
	EAI	n/a	8,083	5,924	n/a	8,152	n/a	8,013
	CAI	n/a	5,950	5,823	n/a	5,648	n/a	5,551
	WAI	n/a	11,303	10,882	n/a	16,335	n/a	16,058
Northern rockfish	BSAI	23,420	19,217	7,801	22,776	18,687	22,105	18,135
Blackspotted/Rougheye Rockfish	BSAI	598	503	386	703	525	763	570
	EBS/EAI	n/a	326	137		359		388
	CAI/WAI	n/a	177	249		166		182
Shortraker rockfish	BSAI	722	541	284	706	530	706	530
Other rockfish	BSAI	1,751	1,313	1,224	1,680	1,260	1,680	1,260
	BS	n/a	919	647		880		880
	AI	n/a	394	577		380		380
Atka mackerel	BSAI	91,870	78,510	54,311	118,787	98,588	101,188	86,464
	EAI/BS	n/a	27,260	15,504	n/a	43,281	n/a	37,958
	CAI	n/a	16,880	16,599	n/a	17,351	n/a	15,218
	WAI	n/a	34,370	22,208	n/a	37,956	n/a	33,288
Skates	BSAI	47,790	39,958	27,799	46,220	38,605	44,168	36,837
Sharks	BSAI	689	517	125	689	450	689	450
Octopuses	BSAI	4,769	3,576	254	4,769	3,576	4,769	3,576
Total	BSAI	2,953,182	2,383,653	1,586,764	4,859,585	2,933,080	6,219,700	3,130,210
Sources: 2021 OFLs, ABCs, and TACs and 2022 OFLs and ABCs are from harvest specifications								

Table 2. Summary of groundfish tier designations under Amendment 56, maximum permissible ABC fishing mortality rate (max F_{ABC}), the Plan Team's recommended tier designation, ABC fishing mortality rate (F_{ABC}), the maximum permissible value of ABC (max ABC), the Plan Team's recommended ABC, and the percentage reduction (% Red.) between max ABC and the Plan Team's recommended ABC for 2023-2024. Stock-specific max ABC and ABC are in metric tons, reported to three significant digits (four significant digits are used EBS pollock and when a stock-specific ABC is apportioned among areas on a percentage basis). Fishing mortality rates are reported to two significant digits.

Species or Complex	**Area**	**2023**					
		Tier	**maxF_{ABC}**	**F_{ABC}**	**max ABC**	**ABC**	**% Red.**
Pollock	EBS	1a	0.434	0.365	2,987,000	1,688,000	43%
Northern rock sole	BSAI	1a	0.129	0.108	158,935	121,719	23%
Blackspotted Rougheye rockfish	AI	3b	0.034	$0.030	533	467	12%
Greenland turbot	BSAI	3a	0.17	$0.160	3,960	3,722	6%
Sharks	BSAI	6	n/a	n/a	517	450	13%
		2024					
		Tier	**maxF_{ABC}**	**F_{ABC}**	**max ABC**	**ABC**	**% Red.**
Pollock	EBS	1a	0.434	0.365	4,099,000	1,815,000	56%
Northern rock sole	BSAI	1a	0.129	0.108	187,631	119,969	36%
Blackspotted Rougheye rockfish	AI	3b	0.034	0.030	584	512	12%
Greenland turbot			0.17	0.160	3,364	3,162	6%
Sharks	BSAI	6	n/a	n/a	517	450	13%

Table 3 Groundfish catches (metric tons) in the eastern Bering Sea, 1954-2022.

Year	Pollock	Pacific Cod	Sablefish	Yellowfin Sole	Greenland Turbot	Arrowtooth Flounder/a	Kamchatka Flounder/b	Rock Sole	Flathead Sole	Alaska Plaice	Other Flatfish/c	Pacific Ocean Perch Complex/d
1954				12,562								
1955				14,690								
1956				24,697								
1957				24,145								
1958	6,924	171	6	44,153								
1959	32,793	2,864	289	185,321								
1960			1,861	456,103	36,843							6,100
1961			15,627	553,742	57,348							47,000
1962			25,989	420,703	58,226							19,900
1963			13,706	85,810	31,565						35,643	24,500
1964	174,792	13,408	3,545	111,177	33,729						30,604	25,900
1965	230,551	14,719	4,838	53,810	9,747						11,686	16,800
1966	261,678	18,200	9,505	102,353	13,042						24,864	20,200
1967	550,362	32,064	11,698	162,228	23,869						32,109	19,600
1968	702,181	57,902	4,374	84,189	35,232						29,647	31,500
1969	862,789	50,351	16,009	167,134	36,029						34,749	14,500
1970	1,256,565	70,094	11,737	133,079	19,691	12,598					64,690	9,900
1971	1,743,763	43,054	15,106	160,399	40,464	18,792					92,452	9,800
1972	1,874,534	42,905	12,758	47,856	64,510	13,123					76,813	5,700
1973	1,758,919	53,386	5,957	78,240	55,280	9,217					43,919	3,700
1974	1,588,390	62,462	4,258	42,235	69,654	21,473					37,357	14,000
1975	1,356,736	51,551	2,766	64,690	64,819	20,832					20,393	8,600
1976	1,177,822	50,481	2,923	56,221	60,523	17,806					21,746	14,900
1977	978,370	33,335	2,718	58,373	27,708	9,454					14,393	2,654
1978	979,431	42,543	1,192	138,433	37,423	8,358					21,040	2,221
1979	913,881	33,761	1,376	99,017	34,998	7,921					19,724	1,723
1980	958,279	45,861	2,206	87,391	48,856	13,761					20,406	1,097
1981	973,505	51,996	2,604	97,301	52,921	13,473					23,428	1,222
1982	955,964	55,040	3,184	95,712	45,805	9,103					23,809	224
1983	982,363	83,212	2,695	108,385	43,443	10,216					30,454	221
1984	1,098,783	110,944	2,329	159,526	21,317	7,980					44,286	1,569
1985	1,179,759	132,736	2,348	227,107	14,698	7,288					71,179	784
1986	1,188,449	130,555	3,518	208,597	7,710	6,761					76,328	560
1987	1,237,597	144,539	4,178	181,429	6,533	4,380					50,372	930
1988	1,228,000	192,726	3,193	223,156	6,064	5,477					137,418	1,047
1989	1,230,000	164,800	1,252	153,165	4,061	3,024					63,452	2,017
1990	1,353,000	162,927	2,329	80,584	7,267	2,773					22,568	5,639
1991	1,268,360	165,444	1,128	94,755	3,704	12,748		46,681			30,401	4,744
1992	1,384,376	163,240	558	146,942	1,875	11,080		51,720			34,757	3,309
1993	1,301,574	133,156	669	105,809	6,330	7,950		63,942			28,812	3,763
1994	1,362,694	174,151	699	144,544	7,211	13,043		60,276			29,720	1,907
1995	1,264,578	228,496	929	124,746	5,855	8,282		54,672	14,699		20,165	1,210
1996	1,189,296	209,201	629	129,509	4,699	13,280		46,775	17,334		18,529	2,635
1997	1,115,268	209,475	547	166,681	6,589	8,580		67,249	20,656		22,957	1,060
1998	1,101,428	160,681	586	101,310	8,303	14,985		33,221	24,550		15,355	1,134
1999	988,703	146,738	678	69,275	5,401	10,585		40,505	18,534		15,515	654
2000	1,132,736	151,372	742	84,057	5,888	12,071		49,186	20,342		16,453	704
2001	1,387,452	142,452	863	63,563	4,252	12,836		28,949	17,757		9,930	1,148
2002	1,481,815	166,552	1,143	74,956	3,150	10,821		40,700	15,464		2,588	858
2003	1,492,039	174,687	1,039	81,050	2,565	13,667		36,375	14,132	10,118	2,922	1,391
2004	1,480,552	183,745	1,041	75,502	1,825	17,367		47,862	17,361	7,888	4,755	
2005	1,483,022	182,936	1,070	94,383	2,140	13,409		36,814	16,074	11,194	4,566	
2006	1,488,031	168,814	1,079	99,156	1,453	11,966		35,878	17,942	17,318	3,123	
2007	1,354,502	140,129	1,182	120,962	1,481	11,082		36,364	18,929	19,522	5,699	
2008	990,587	139,802	1,141	148,893	2,089	18,897		50,934	24,521	17,377	3,578	
2009	810,857	147,174	916	107,512	2,252	19,212		48,145	19,535	13,944	2,133	
2010	810,390	142,868	755	118,624	2,273	14,782		52,644	20,097	16,165	2,158	
2011	1,199,216	209,222	705	151,166	3,136	16,864	4,478	60,353	13,546	23,655	3,121	
2012	1,205,276	232,674	743	147,186	3,058	18,978	2,510	75,777	11,355	16,612	3,501	
2013	1,270,823	236,700	634	164,944	1,449	14,056	2,110	59,590	17,344	23,522	1,501	
2014	1,297,846	238,735	315	156,772	1,479	14,928	3,268	51,569	16,505	19,447	4,340	
2015	1,322,312	232,832	210	126,937	2,090	10,330	3,386	45,347	11,293	14,614	2,386	
2016	1,353,711	231,511	532	135,350	2,117	9,777	3,165	44,860	10,358	13,385	2,827	
2017	1,356,445	196,761	1,150	125,620	2,691	5,680	3,166	34,877	8,859	15,549	4,089	
2018	1,379,320	186,702	1,598	131,539	1,672	6,182	1,373	28,059	11,045	23,342	5,945	
2019	1,409,235	164,092	3,157	128,046	2,678	9,410	2,940	25,403	15,831	16,163	3,716	
2020	1,367,232	155,584	5,301	133,788	1,648	8,406	2,929	25,810	9,368	20,075	4,098	
2021	1,376,265	121,749	4,169	108,734	1,130	7,119	2,355	14,295	10,245	15,862	2,574	
2022	1,104,252	136,847	5,205	149,861	1,038	5,818	2,961	18,126	14,544	11,006	2,496	

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69. b/ Kamchatka flounder included in Arrowtooth flounder prior to 2011. c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in other flatfish catch statistics. d/ Includes POP, northern, rougheye, shortraker, and sharpchin rockfish until 2004. e/ Octopus, sculpin, sharks, skates included in Other species prior to 2011. Sculpins moved in 2019 d sculpins moved in 2020 to Ecosystem Component Data through November 5, 2022. Note: Numbers don't include fish taken for research.

Table 3 cont; Groundfish catches (metric tons) in the eastern Bering Sea, 1954-2022.

Year	Pacific Ocean Perch	Northern Rockfish	Blackspotted/ Rougheye Rockfish	Shortraker Rockfish	Other Rockfish	Atka Mackerel	Other Species/e	Skates	Sculpins/e	Sharks	Squids/e	Octopus	Total (All Species)
1954													12,562
1955													14,690
1956													24,697
1957													24,145
1958							147						51,401
1959							380						221,647
1960													500,907
1961													673,717
1962													524,818
1963													191,224
1964							736						393,891
1965							2,218						344,369
1966							2,239						452,081
1967							4,378						836,308
1968							22,058						967,083
1969							10,459						1,192,020
1970							15,295						1,593,649
1971							13,496						2,137,326
1972							10,893						2,149,092
1973							55,826						2,064,444
1974							60,263						1,900,092
1975							54,845						1,645,232
1976							26,143						1,428,565
1977					311		35,902				4,926		1,168,144
1978					2,614	831	61,537				6,886		1,302,509
1979					2,108	1,985	38,767				4,286		1,159,547
1980					459	4,955	34,633				4,040		1,221,944
1981					356	3,027	35,651				4,182		1,259,666
1982					276	328	18,200				3,838		1,211,483
1983					220	141	15,465				3,470		1,280,285
1984					176	57	8,508				2,824		1,458,299
1985					92	4	11,503				1,611		1,649,109
1986					102	12	10,471				848		1,633,911
1987					474	12	8,569				108		1,639,121
1988					341	428	12,206				414		1,810,470
1989					192	3,126	4,993				300		1,630,382
1990					384	480	5,698				460		1,644,109
1991					396	2,265	16,285				544		1,647,455
1992					675	2,610	29,993				819		1,831,954
1993					190	201	21,413				597		1,674,406
1994					261	190	23,430				502		1,818,628
1995					629	340	20,928				364		1,745,893
1996					364	780	19,717				1,080		1,653,828
1997					161	171	20,997				1,438		1,641,829
1998					203	901	23,156				891		1,486,704
1999					141	2,267	18,916				392		1,318,304
2000					239	239	23,098				375		1,497,502
2001					296	264	23,148				1,761		1,694,671
2002					401	572	26,639				1,334		1,826,993
2003					336	6,362	26,986				1,246		1,864,915
2004	731	116	24	119	318	7,159	27,588				1,000		1,874,953
2005	879	112	12	108	178	3,540	28,066				1,170		1,879,673
2006	1,041	246	7	47	157	3,176	25,077				1,403		1,875,914
2007	870	70	10	114	220	3,005	24,746				1,175		1,740,061
2008	513	22	22	41	222	392	27,152				1,494		1,427,678
2009	623	48	13	69	208	244	25,369				269		1,198,523
2010	3,547	299	30	161	268	151	20,697				305		1,206,215
2011	5,601	196	36	106	328	1,217		22,422	4,872	103	237	576	1,721,158
2012	5,589	91	17	117	211	966		23,740	4,991	94	560	126	1,754,172
2013	5,051	137	26	104	191	147		25,972	5,222	99	158	185	1,829,966
2014	7,437	147	23	96	323	136		26,326	4,487	134	1,568	410	1,846,290
2015	7,918	199	31	75	185	267		26,871	4,055	103	2,281	423	1,814,145
2016	8,221	208	41	51	280	360		27,952	4,381	117	1,328	585	1,851,117
2017	8,904	218	32	89	252	255		27,002	4,152	174	2,057	187	1,798,209
2018	9,635	188	15	170	212	1,146		29,475	4,397	96	1,701	132	1,823,944
2019	14,022	478	55	298	697	1,128		18,867	4,816	148		175	1,821,355
2020	11,944	307	53	186	352	1,064		17,613	4,355	168		457	1,770,739
2021	10,693	329	103	368	392	1,242		18,626		210		121	1,696,581
2022	9,665	565	59	196	647	2,607		26,727		100		177	1,492,897

Table 4 Groundfish catches (metric tons) in the Aleutian Islands, 1954-2022.

Year	Pollock	Pacific Cod	Sablefish	Yellowfin Sole	Greenland Turbot	Arrowtooth Flounder/a	Kamchatka Flounder/b	Rock Sole	Flathead Sole	Alaska Plaice	Other Flatfish/c	Pacific Ocean Perch Complex/d
1954												
1955												
1956												
1957												
1958												
1959												
1960												
1961												
1962												200
1963			664		7							20,800
1964		241	1,541		504							90,300
1965		451	1,249		300							109,100
1966		154	1,341		63							85,900
1967		293	1,652		394							55,900
1968		289	1,673		213							44,900
1969		220	1,673		228							38,800
1970		283	1,248		285	274						66,900
1971		2,078	2,936		1,750	581						21,800
1972		435	3,531		12,874	1,323						33,200
1973		977	2,902		8,666	3,705						11,800
1974		1,379	2,477		8,788	3,195						22,400
1975		2,838	1,747		2,970	784						16,600
1976		4,190	1,659		2,067	1,370						14,000
1977	7,625	3,262	1,897		2,453	2,035						8,080
1978	6,282	3,295	821		4,766	1,782						5,286
1979	9,504	5,593	782		6,411	6,436						5,487
1980	58,156	5,788	274		3,697	4,603						4,700
1981	55,516	10,462	533		4,400	3,640						3,622
1982	57,978	1,526	955		6,317	2,415						1,014
1983	59,026	9,955	673		4,115	3,753						280
1984	81,834	22,216	999		1,803	1,472						631
1985	58,730	12,690	1,448		33	87						308
1986	46,641	10,332	3,028		2,154	142						286
1987	28,720	13,207	3,834		3,066	159						1,004
1988	43,000	5,165	3,415		1,044	406						1,979
1989	156,000	4,118	3,248		4,761	198						2,706
1990	73,000	8,081	2,116		2,353	1,459						14,650
1991	78,104	6,714	2,071	1,380	3,174	938					88	2,545
1992	54,036	42,889	1,546	4	895	900		236			68	10,277
1993	57,184	34,234	2,078	0	2,138	1,348		318			59	13,375
1994	58,708	22,421	1,771	0	3,168	1,334		308			55	16,959
1995	64,925	16,534	1,119	6	2,338	1,001		356	16		31	14,734
1996	28,933	31,389	720	654	1,677	1,330		371	10		51	20,443
1997	26,872	25,166	779	234	1,077	1,071		271	32		7	15,687
1998	23,821	34,964	595	5	821	694		446	19		35	13,729
1999	981	28,117	671	13	460	774		580	34		20	18,501
2000	1,244	39,684	1,070	13	1,086	1,157		480	80		32	14,893
2001	824	34,207	1,074	15	1,060	1,220		526	54		43	15,587
2002	1,177	30,801	1,118	29	485	1,032		1,165	111		39	14,996
2003	1,653	32,459	1,009	0	965	913		964	49		32	18,765
2004	1,158	28,873	955	9	434	818		818	38	0	33	
2005	1,621	22,699	1,481	2	468	834		549	34	0	26	
2006	1,745	24,211	1,151	4	537	1,476		578	39	0	36	
2007	2,519	34,356	1,168	2	523	834		762	29	0	25	
2008	1,278	31,229	899	0	822	2,473		342	18	0	46	
2009	1,662	28,582	1,100	1	2,263	10,688		570	23	0	45	
2010	1,235	29,001	1,097	0	1,873	24,098		577	29		41	
2011	1,208	10,858	1,024	1	532	3,269	5,493	279	7		56	
2012	975	18,220	1,205	1	1,658	3,400	6,995	322	12	0	42	
2013	2,964	13,607	1,062	0	296	6,485	5,656	210	10	0	35	
2014	2,375	10,595	818	0	177	4,181	3,190	155	9	0	51	
2015	915	9,225	430	0	114	937	1,608	120	14	0	29	
2016	1,257	12,359	349	0	121	1,328	1,685	241	26	0	21	
2017	1,492	12,286	588	1	122	509	1,296	246	19	0	32	
2018	1,860	14,719	660	4	161	820	1,735	216	17	0	39	
2019	1,663	12,941	663	5	171	642	1,547	318	27	0	49	
2020	3,205	14,250	1,210	11	678	2,278	4,513	127	23	3	77	
2021	1,840	13,966	1,578	54	467	1,895	4,312	99	15	0	65	
2022/f	2,895	11,580	2,193	9	439	1,808	5,388	116	15	0	54	

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69. b/ Kamchatka flounder included in Arrowtooth flounder prior to 2011. c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in other flatfish catch statistics. d/ Includes POP, northern, rougheye, shortraker, and sharpchin rockfish until 2004. e/ Octopus, sculpin, sharks, skates included in Other species prior to 2011. Sculpins moved in 2019 and sculpins moved in 2020 to Ecosystem Component f/ Data through November 5, 2022. Note: Numbers don't include fish taken for research.

Table 4 cont Groundfish catches (metric tons) in the Aleutian Islands, 1954-2022.

Year	Pacific Ocean Perch	Northern Rockfish	Blackspotted/ Rougheye Rockfish	Shortraker Rockfish	Other Rockfish	Atka Mackerel	Other Species/e	Skates	Sculpins /e	Sharks	Squids/ e	Octopus	Total (All Species)
1954													0
1955													0
1956													0
1957													0
1958													0
1959													0
1960													0
1961													0
1962													200
1963													21,471
1964							66						92,652
1965							768						111,868
1966							131						87,589
1967							8,542						66,781
1968							8,948						56,023
1969							3,088						44,009
1970						949	10,671						80,610
1971							2,973						32,118
1972						5,907	22,447						79,717
1973						1,712	4,244						34,006
1974						1,377	9,724						49,340
1975						13,326	8,288						46,553
1976						13,126	7,053						43,465
1977					3,043	20,975	16,170				1,808		67,348
1978					921	23,418	12,436				2,085		61,092
1979					4,517	21,279	12,934				2,252		75,195
1980					420	15,533	13,028				2,332		108,531
1981					328	16,661	7,274				1,763		104,199
1982					2,114	19,546	5,167				1,201		98,233
1983					1,045	11,585	3,675				510		94,617
1984					56	35,998	1,670				343		147,022
1985					99	37,856	2,050				9		113,310
1986					169	31,978	1,509				20		96,259
1987					147	30,049	1,155				23		81,364
1988					278	21,656	437				3		77,383
1989					481	14,868	108				6		186,494
1990					864	21,725	627				11		124,886
1991					549	22,258	91				30		117,942
1992					3,689	46,831	3,081				61		164,513
1993					495	65,805	2,540				85		179,659
1994					301	69,401	1,102				86		175,614
1995					220	81,214	1,273				95		183,862
1996					278	103,087	1,720				87		190,750
1997					307	65,668	1,555				323		139,049
1998					385	56,195	2,448				25		134,182
1999					657	53,966	1,670				9		106,453
2000					601	46,990	3,010				8		110,348
2001					610	61,296	4,029				5		120,550
2002					551	44,722	1,980				10		98,216
2003					401	52,988	1,326				36		111,560
2004	11,165	4,567	185	123	337	53,405	1,866				14		104,798
2005	9,548	3,852	78	62	286	58,474	1,417				17		101,446
2006	11,826	3,582	196	165	426	58,719	1,943				15		106,650
2007	17,581	3,946	157	210	435	55,742	2,053				13		120,357
2008	16,923	3,265	171	91	390	57,690	2,322				49		118,010
2009	14,725	3,064	184	116	403	72,563	2,514				91		138,594
2010	14,304	4,033	202	139	503	68,496	2,713				105		148,446
2011	18,403	2,566	129	227	616	50,600		732	502	4	99	11	96,616
2012	18,554	2,388	174	227	736	46,863		1,083	808	2	128	11	103,804
2013	26,311	1,900	296	267	623	23,034		1,058	606	17	141	39	84,619
2014	24,944	2,195	173	101	621	30,815		1,185	373	3	110	18	82,089
2015	23,507	6,998	150	78	501	53,003		1,252	925	4	83	23	99,916
2016	23,097	4,333	117	54	506	54,125		1,174	511	11	50	10	101,375
2017	23,240	4,461	165	62	568	63,401		1,387	882	4	42	21	110,824
2018	25,114	5,579	223	80	775	69,248		1,733	712	8	35	158	123,896
2019	29,097	8,581	336	82	569	56,081		1,272	786	3		93	114,926
2020	28,473	8,136	464	109	739	57,820		1,515	814	11		234	124,687
2021	24,786	5,883	412	128	610	60,111		1,403		12		49	117,685
2022/f	22,629	7,236	327	87	577	51,704		1,072		25		77	108,231

Table 5 Groundfish catches (metric tons) in the Bering Sea and Aleutian Islands, 1954-2022.

Year	Pollock	Pacific Cod	Sablefish	Yellowfin Sole	Greenland Turbot	Arrowtooth Flounder/a	Kamchatka Flounder/b	Rock Sole	Flathead Sole	Alaska Plaice	Other Flatfish/c	Pacific Ocean Perch Complex/d	Pacific Ocean Perch
1954	0	0	0	12,562	0	0	0	0		0	0	0	0
1955	0	0	0	14,690	0	0	0	0		0	0	0	0
1956	0	0	0	24,697	0	0	0	0		0	0	0	0
1957	0	0	0	24,145	0	0	0	0		0	0	0	0
1958	6,924	171	6	44,153	0	0	0	0		0	0	0	0
1959	32,793	2,864	289	185,321	0	0	0	0		0	0	0	0
1960	0	0	1,861	456,103	36,843	0	0	0		0	0	6,100	0
1961	0	0	15,627	553,742	57,348	0	0	0		0	0	47,000	0
1962	0	0	25,989	420,703	58,226	0	0	0		0	0	20,100	0
1963	0	0	14,370	85,810	31,572	0	0	0		0	35,643	45,300	0
1964	174,792	13,649	5,086	111,177	34,233	0	0	0		0	30,604	116,200	0
1965	230,551	15,170	6,087	53,810	10,047	0	0	0		0	11,686	125,900	0
1966	261,678	18,354	10,846	102,353	13,105	0	0	0		0	24,864	106,100	0
1967	550,362	32,357	13,350	162,228	24,263	0	0	0		0	32,109	75,500	0
1968	702,181	58,191	6,047	84,189	35,445	0	0	0		0	29,647	76,400	0
1969	862,789	50,571	17,682	167,134	36,257	0	0	0		0	34,749	53,300	0
1970	1,256,565	70,377	12,985	133,079	19,976	12,872	0	0		0	64,690	76,800	0
1971	1,743,763	45,132	18,042	160,399	42,214	19,373	0	0		0	92,452	31,600	0
1972	1,874,534	43,340	16,289	47,856	77,384	14,446	0	0		0	76,813	38,900	0
1973	1,758,919	54,363	8,859	78,240	63,946	12,922	0	0		0	43,919	15,500	0
1974	1,588,390	63,841	6,735	42,235	78,442	24,668	0	0		0	37,357	36,400	0
1975	1,356,736	54,389	4,513	64,690	67,789	21,616	0	0		0	20,393	25,200	0
1976	1,177,822	54,671	4,582	56,221	62,590	19,176	0	0		0	21,746	28,900	0
1977	985,995	36,597	4,615	58,373	30,161	11,489	0	0		0	14,393	10,734	0
1978	985,713	45,838	2,013	138,433	42,189	10,140	0	0		0	21,040	7,507	0
1979	923,385	39,354	2,158	99,017	41,409	14,357	0	0		0	19,724	7,210	0
1980	1,016,435	51,649	2,480	87,391	52,553	18,364	0	0		0	20,406	5,797	0
1981	1,029,021	62,458	3,137	97,301	57,321	17,113	0	0		0	23,428	4,844	0
1982	1,013,942	56,566	4,139	95,712	52,122	11,518	0	0		0	23,809	1,238	0
1983	1,041,389	93,167	3,368	108,385	47,558	13,969	0	0		0	30,454	501	0
1984	1,180,617	133,160	3,328	159,526	23,120	9,452	0	0		0	44,286	2,200	0
1985	1,238,489	145,426	3,796	227,107	14,731	7,375	0	0		0	71,179	1,092	0
1986	1,235,090	140,887	6,546	208,597	9,864	6,903	0	0		0	76,328	846	0
1987	1,266,317	157,746	8,012	181,429	9,599	4,539	0	0		0	50,372	1,934	0
1988	1,271,000	197,891	6,608	223,156	7,108	5,883	0	0		0	137,418	3,026	0
1989	1,386,000	168,918	4,500	153,165	8,822	3,222	0	0		0	63,452	4,723	0
1990	1,426,000	171,008	4,445	80,584	9,620	4,232	0	0		0	22,568	20,289	0
1991	1,346,464	172,158	3,199	96,135	6,878	13,686	0	46,681		0	30,489	7,289	0
1992	1,438,412	206,129	2,104	146,946	2,770	11,980	0	51,956		0	34,825	13,586	0
1993	1,358,758	167,390	2,747	105,809	8,468	9,298	0	64,260		0	28,871	17,138	0
1994	1,421,402	196,572	2,470	144,544	10,379	14,377	0	60,584		0	29,775	18,866	0
1995	1,329,503	245,030	2,048	124,752	8,193	9,283	0	55,028	14,715	0	20,196	15,944	0
1996	1,218,229	240,590	1,349	130,163	6,376	14,610	0	47,146	17,344	0	18,580	23,078	0
1997	1,142,140	234,641	1,326	166,915	7,666	9,651	0	67,520	20,688	0	22,964	16,747	0
1998	1,125,249	195,645	1,181	101,315	9,124	15,679	0	33,667	24,569	0	15,390	14,863	0
1999	989,684	174,855	1,349	69,288	5,861	11,359	0	41,085	18,568	0	15,535	19,155	0
2000	1,133,980	191,056	1,812	84,070	6,974	13,228	0	49,666	20,422	0	16,485	15,597	0
2001	1,388,276	176,659	1,937	63,578	5,312	14,056	0	29,475	17,811	0	9,973	16,735	0
2002	1,482,992	197,353	2,261	74,985	3,635	11,853	0	41,865	15,575	0	2,627	15,854	0
2003	1,493,692	207,146	2,048	81,050	3,530	14,580	0	37,339	14,181	10,118	2,954	20,156	0
2004	1,481,710	212,618	1,996	75,511	2,259	18,185	0	48,681	17,398	7,888	4,788		11,896
2005	1,484,643	205,635	2,551	94,385	2,608	14,243	0	37,362	16,108	11,194	4,592		10,427
2006	1,489,776	193,025	2,229	99,160	1,989	13,442	0	36,456	17,981	17,318	3,160		12,867
2007	1,357,021	174,485	2,350	120,964	2,004	11,916	0	37,126	18,958	19,522	5,724		18,451
2008	991,865	171,030	2,040	148,894	2,911	21,370	0	51,276	24,540	17,377	3,624		17,436
2009	812,520	175,756	2,016	107,513	4,515	29,900	0	48,716	19,558	13,944	2,178		15,347
2010	811,625	171,869	1,852	118,624	4,146	38,880	0	53,221	20,127	16,165	2,199		17,852
2011	1,200,424	220,080	1,730	151,168	3,668	20,133	9,971	60,632	13,553	23,655	3,177		24,004
2012	1,206,252	250,894	1,948	147,187	4,716	22,378	9,505	76,099	11,366	16,612	3,543	0	24,143
2013	1,273,787	250,307	1,697	164,944	1,745	20,541	7,766	59,800	17,354	23,522	1,535	0	31,362
2014	1,300,221	249,330	1,133	156,772	1,656	19,109	6,458	51,724	16,514	19,447	4,391	0	32,381
2015	1,323,227	242,057	640	126,937	2,204	11,267	4,994	45,467	11,307	14,614	2,415		31,425
2016	1,354,968	243,870	881	135,350	2,238	11,105	4,850	45,101	10,384	13,385	2,848	0	31,318
2017	1,357,937	209,047	1,738	125,621	2,813	6,189	4,462	35,123	8,878	15,549	4,121	0	32,144
2018	1,381,180	201,421	2,258	131,543	1,833	7,002	3,108	28,275	11,062	23,342	5,984	0	34,749
2019	1,410,898	177,033	3,820	128,051	2,849	10,052	4,487	25,721	15,858	16,163	3,765	0	43,119
2020	1,370,437	169,834	6,511	133,799	2,326	10,684	7,442	25,937	9,392	20,078	4,174	0	40,417
2021	1,378,105	135,715	5,747	108,788	1,597	9,014	6,667	14,394	10,260	15,862	2,639	0	35,479
2022/f	1,107,147	148,428	7,398	149,870	1,477	7,626	8,349	18,242	14,559	11,006	2,550	0	32,294

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69. b/ Kamchatka flounder included in Arrowtooth flounder prior to 2011.c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in other flatfish catch statistics. d/ Includes POP, northern, rougheye, shortraker, and sharpchin rockfish until 2004. e/ Octopus, sculpin, sharks, skates included in Other species prior to 2011. Sculpins moved in 2019 and sculpins moved in 2020 to Ecosystem Component f/ Data through November 5, 2022. Note: Numbers don't include fish taken for research.

Table 5 cont: Groundfish catches (metric tons) in the Bering Sea and Aleutian Islands, 1954-2022.

Year	Northern Rockfish	Blackspotted/ Rougheye Rockfish	Shortraker Rockfish	Other Rockfish	Atka Mackerel	Other Species/e	Skates	Sculpins/e	Sharks	Squids/e	Octopus	Total (All Species)
1954	0	0	0	0	0	0				0		12,562
1955	0	0	0	0	0	0				0		14,690
1956	0	0	0	0	0	0				0		24,697
1957	0	0	0	0	0	0				0		24,145
1958	0	0	0	0	0	147				0		51,401
1959	0	0	0	0	0	380				0		221,647
1960	0	0	0	0	0	0				0		500,907
1961	0	0	0	0	0	0				0		673,717
1962	0	0	0	0	0	0				0		525,018
1963	0	0	0	0	0	0				0		212,695
1964	0	0	0	0	0	802				0		486,543
1965	0	0	0	0	0	2,986				0		456,237
1966	0	0	0	0	0	2,370				0		539,670
1967	0	0	0	0	0	12,920				0		903,089
1968	0	0	0	0	0	31,006				0		1,023,106
1969	0	0	0	0	0	13,547				0		1,236,029
1970	0	0	0	0	949	25,966				0		1,674,259
1971	0	0	0	0	0	16,469				0		2,169,444
1972	0	0	0	0	5,907	33,340				0		2,228,809
1973	0	0	0	0	1,712	60,070				0		2,098,450
1974	0	0	0	0	1,377	69,987				0		1,949,432
1975	0	0	0	0	13,326	63,133				0		1,691,785
1976	0	0	0	0	13,126	33,196				0		1,472,030
1977	0	0	0	3,354	20,975	52,072				6,734		1,235,492
1978	0	0	0	3,535	24,249	73,973				8,971		1,363,601
1979	0	0	0	6,625	23,264	51,701				6,538		1,234,742
1980	0	0	0	879	20,488	47,661				6,372		1,330,475
1981	0	0	0	684	19,688	42,925				5,945		1,363,865
1982	0	0	0	2,390	19,874	23,367				5,039		1,309,716
1983	0	0	0	1,265	11,726	19,140				3,980		1,374,902
1984	0	0	0	232	36,055	10,178				3,167		1,605,321
1985	0	0	0	191	37,860	13,553				1,620		1,762,419
1986	0	0	0	271	31,990	11,980				868		1,730,170
1987	0	0	0	621	30,061	9,724				131		1,720,485
1988	0	0	0	619	22,084	12,643				417		1,887,853
1989	0	0	0	673	17,994	5,101				306		1,816,876
1990	0	0	0	1,248	22,205	6,325				471		1,768,995
1991	0	0	0	945	24,523	16,376				574		1,765,397
1992	0	0	0	4,364	49,441	33,074				880		1,996,467
1993	0	0	0	685	66,006	23,953				682		1,854,065
1994	0	0	0	562	69,591	24,532				588		1,994,242
1995	0	0	0	849	81,554	22,201				459		1,929,755
1996	0	0	0	642	103,867	21,437				1,167		1,844,578
1997	0	0	0	468	65,839	22,552				1,761		1,780,878
1998	0	0	0	588	57,096	25,604				916		1,620,886
1999	0	0	0	798	56,233	20,586				401		1,424,757
2000	0	0	0	840	47,229	26,108				383		1,607,850
2001	0	0	0	906	61,560	27,177				1,766		1,815,221
2002	0	0	0	952	45,294	28,619				1,344		1,925,209
2003	0	0	0	737	59,350	28,312				1,282		1,976,475
2004	4,684	209	242	656	60,564	29,454				1,014		1,979,752
2005	3,964	90	170	465	62,014	29,482				1,186		1,981,119
2006	3,828	203	212	583	61,895	27,021				1,418		1,982,564
2007	4,016	168	323	655	58,747	26,799				1,188		1,860,418
2008	3,287	193	133	612	58,082	29,474				1,542		1,545,687
2009	3,111	197	184	611	72,807	27,883				360		1,337,116
2010	4,332	232	300	771	68,647	23,410				410		1,354,662
2011	2,762	165	333	944	51,817	0	23,154	5,374	107	336	587	1,817,774
2012	2,479	191	344	947	47,829	0	24,823	5,799	96	688	137	1,857,977
2013	2,038	322	371	815	23,181	0	27,030	5,828	116	300	224	1,914,585
2014	2,342	196	197	944	30,951	0	27,511	4,860	137	1,678	428	1,928,379
2015	7,197	181	153	686	53,270	0	28,123	4,980	107	2,364	446	1,914,061
2016	4,541	158	105	786	54,485	0	29,126	4,892	128	1,378	595	1,952,492
2017	4,679	197	151	820	63,656	0	28,389	5,034	178	2,099	208	1,909,033
2018	5,767	238	250	987	70,394	0	31,208	5,109	104	1,736	290	1,947,840
2019	9,059	391	380	1,266	57,209	0	20,139	5,602	151	0	268	1,936,281
2020	8,443	517	294	1,090	58,884	0	19,128	5,169	179	0	691	1,895,427
2021	6,212	515	496	1,002	61,353	0	20,029		222		170	1,814,266
2022/f	7,801	386	283	1,224	54,311	0	27,799		125		254	1,601,129

Table 6. Final 2023 and 2024 Pacific halibut Discard Mortality Rates (DMR) for the BSAI

Gear	Sector	Halibut discard mortality rate (percent)
Pelagic trawl	All	100
Non-pelagic trawl	Mothership and catcher/processor	85
Non-pelagic trawl	Catcher vessel	62
Hook-and-line	Catcher vessel	9
Hook-and-line	Catcher/processor	9
Pot	All	26