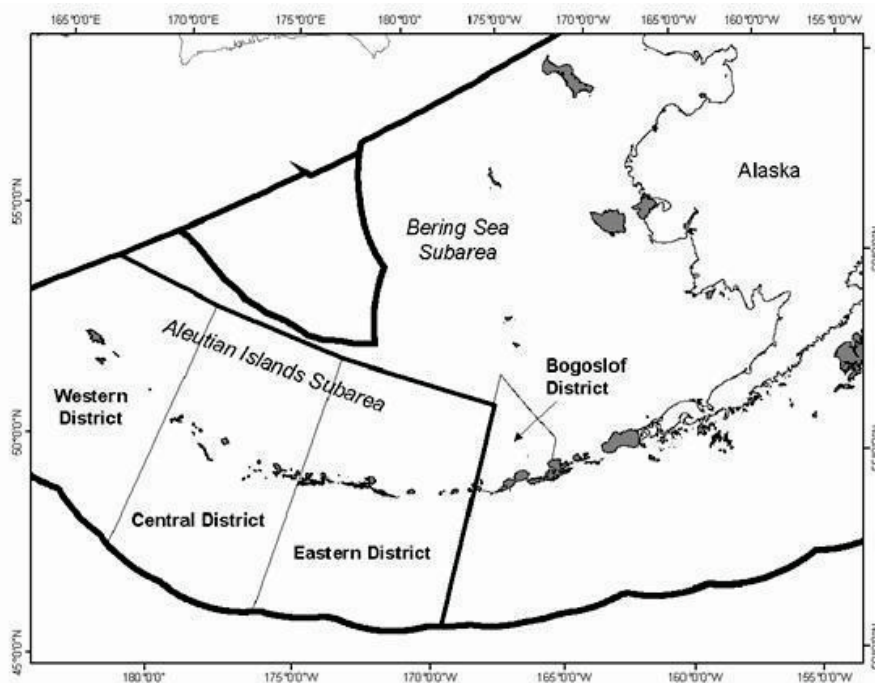


**STOCK ASSESSMENT AND FISHERY EVALUATION REPORT**  
**FOR THE GROUND FISH RESOURCES**  
**OF THE BERING SEA/ALEUTIAN ISLANDS REGIONS**

Compiled by:

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



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**November 2023**  
**North Pacific Fishery Management Council**  
**1007 West Third, Suite 400**  
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# **Stock Assessment and Fishery Evaluation Report**

## **for the Groundfish Resources of the Bering Sea/Aleutian Islands Region**

### **BSAI Introduction Contents**

Summary .....	3
Introduction.....	3
Background Information.....	3
Historical Catch Statistics .....	5
Recent Total Allowable Catches.....	5
Definition of Acceptable Biological Catch and the Overfishing Level .....	6
Standard Harvest and Recruitment Scenarios and Projection Methodology .....	7
Overview of “Stock Assessment” Section.....	8
Summary and Use of Terms.....	9
Two-Year OFL and ABC Projections.....	9
Stock Assessment Frequency.....	11
Economic Summary of the BSAI commercial groundfish fisheries in 2021-2022 .....	12
Ecosystem Status Reports for the EBS and AI (2023) .....	16
Bering Sea Conditions .....	16
Aleutian Islands.....	16
Environmental indices discussed during the 2023 Nov Plan Team Meeting.....	17
Multi-species model.....	17
Stock Status Summaries.....	18
1. Walleye Pollock.....	18
Eastern Bering Sea pollock.....	18
Aleutian Islands pollock.....	19
Bogoslof pollock.....	20
2. Pacific cod.....	21
Eastern Bering Sea Pacific cod .....	21
Aleutian Islands Pacific cod.....	22
3. Sablefish.....	23
4. Yellowfin sole.....	25
5. Greenland turbot .....	26
6. Arrowtooth flounder .....	28
7. Kamchatka flounder.....	29
8. Northern rock sole.....	30
9. Flathead sole .....	31
10. Alaska plaice.....	32
11. Other Flatfish Complex.....	34
12. Pacific ocean perch .....	34
13. Northern rockfish .....	36
14. Blackspotted and rougheye rockfish .....	37
15. Shortraker rockfish.....	38
16. Other rockfish complex.....	39
17. Atka mackerel .....	41
18. Skates .....	42
19. Sharks.....	44
20. Octopus .....	45
Appendix 1. Forage Species.....	46
Appendix 2. Sculpins .....	46
Tables.....	48

**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 13-17, 2023 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), Steve Whitney, Michael Smith, Allan Hicks, Kirstin Holsman, Andy Kingham, Phillip Joy, Andrew Seitz, Beth Matta, and Lukas DeFillipo.

## 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.

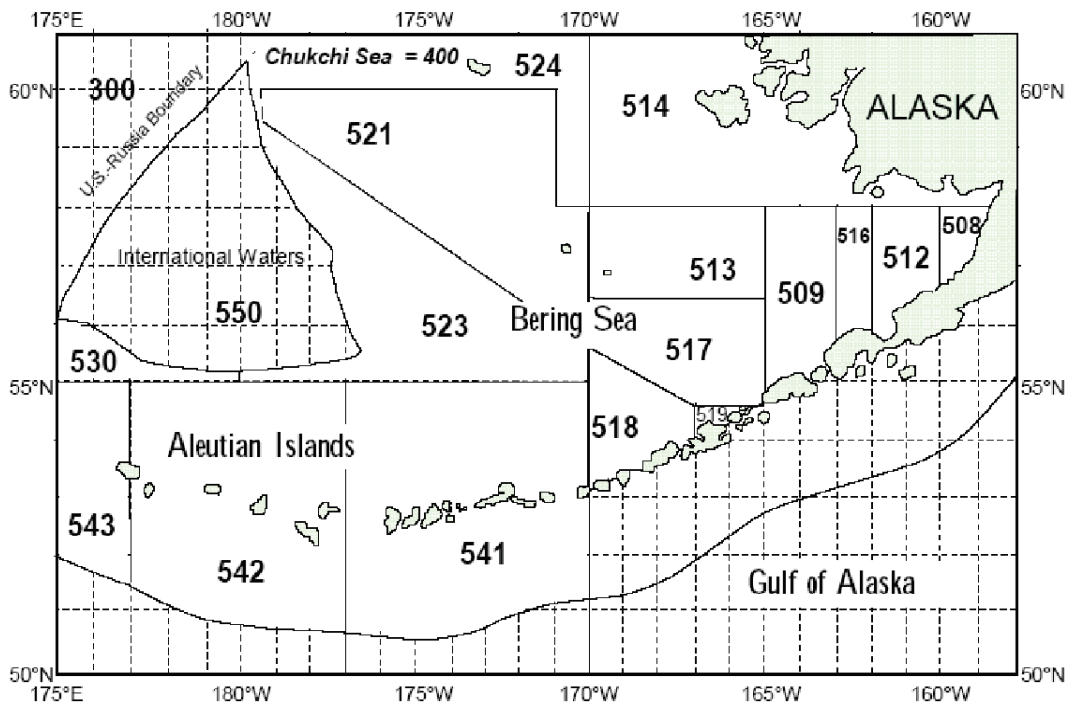


Figure 1. Bering Sea/Aleutian Islands statistical and reporting areas.

*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	
<b>Target species<sup>1</sup></b>	<b>Prohibited species<sup>2</sup></b>	<b>Forage fish species<sup>3</sup></b>
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 sand lance)
Greenland turbot	King crab	Trichodontidae family (Pacific sand fish)
Arrowtooth flounder	Tanner crab	Pholidae family (gunnells)
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		

<sup>1</sup> TAC for each listing. Species and species groups may or may not be targets of directed fisheries.

<sup>2</sup> Must be immediately returned to the sea, except when retention is required or authorized.

<sup>3</sup> 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 BSAI in 2022 totaled 1,602,431t (80% of OY). Catches in 2023 through November 5, 2023, totaled 1,748,036 t (87% 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 ' $\alpha$ ' 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  $F=F_{40\%}$ .

<b>Tier</b>	<p>1) Information available: <i>Reliable point estimates of B and B<sub>MSY</sub> and reliable pdf of F<sub>MSY</sub>.</i></p> <p>1a) Stock status: <math>B/B_{MSY} &gt; 1</math>  <math>F_{OFL} = \mu_A</math>, the arithmetic mean of the pdf  <math>F_{ABC} \leq \mu_H</math>, the harmonic mean of the pdf</p> <p>1b) Stock status: <math>\alpha &lt; B/B_{MSY} \leq 1</math>  <math>F_{OFL} = \mu_A \times (B/B_{MSY} - \alpha)/(1 - \alpha)</math>  <math>F_{ABC} \leq \mu_H \times (B/B_{MSY} - \alpha)/(1 - \alpha)</math></p> <p>1c) Stock status: <math>B/B_{MSY} \leq \alpha</math>  <math>F_{OFL} = 0</math>  <math>F_{ABC} = 0</math></p> <p>2) Information available: <i>Reliable point estimates of B, B<sub>MSY</sub>, F<sub>MSY</sub>, F<sub>35%</sub>, and F<sub>40%</sub>.</i></p> <p>2a) Stock status: <math>B/B_{MSY} &gt; 1</math>  <math>F_{OFL} = F_{MSY}</math>  <math>F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%})</math></p> <p>2b) Stock status: <math>\alpha &lt; B/B_{MSY} \leq 1</math>  <math>F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)</math>  <math>F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)</math></p> <p>2c) Stock status: <math>B/B_{MSY} &lt; \alpha</math>  <math>F_{OFL} = 0</math>  <math>F_{ABC} = 0</math></p> <p>3) Information available: <i>Reliable point estimates of B, B<sub>40%</sub>, F<sub>35%</sub>, and F<sub>40%</sub>.</i></p> <p>3a) Stock status: <math>B/B_{40\%} &gt; 1</math>  <math>F_{OFL} = F_{35\%}</math>  <math>F_{ABC} \leq F_{40\%}</math></p> <p>3b) Stock status: <math>\alpha &lt; B/B_{40\%} &lt; 1</math>  <math>F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)</math>  <math>F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)</math></p> <p>3c) Stock status: <math>B/B_{40\%} &lt; \alpha</math>  <math>F_{OFL} = 0</math>  <math>F_{ABC} = 0</math></p> <p>4) Information available: <i>Reliable point estimates of B, F<sub>35%</sub>, and F<sub>40%</sub>.</i>  <math>F_{OFL} = F_{35\%}</math>  <math>F_{ABC} \leq F_{40\%}</math></p> <p>5) Information available: <i>Reliable point estimates of B and natural mortality rate M.</i>  <math>F_{OFL} = M</math>  <math>F_{ABC} &lt; 0.75 \times M</math></p> <p>6) Information available: <i>Reliable catch history from 1978 through 1995.</i>  <math>OFL =</math> 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  <math>ABC \leq 0.75 \times OFL</math></p>
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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 2024 and 2025, are as follows (“ $max F_{ABC}$ ” 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 2024 recommended in the assessment to the  $max F_{ABC}$  for 2023, and where catches for 2023 and 2024 are estimated at their most likely values given the 2023 and 2024 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 2024 and 2025,  $F$  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 2025 or 2) above 1/2 of its MSY level in 2025 and expected to be above its MSY level in 2035 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 2024 and 2025 ABCs and OFLs are summarized in Tables 1.

The sum of the Plan Team’s recommended ABCs for target species for 2024 and 2025 (including Alaska wide Sablefish ABC) are 3,454,506 t and 3,528,297 t, respectively. These compare with the 2,383,653 t in 2022 and 3,132,067 in 2023. 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, AI Pacific cod, 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).



## Bering Sea and Aleutian Islands

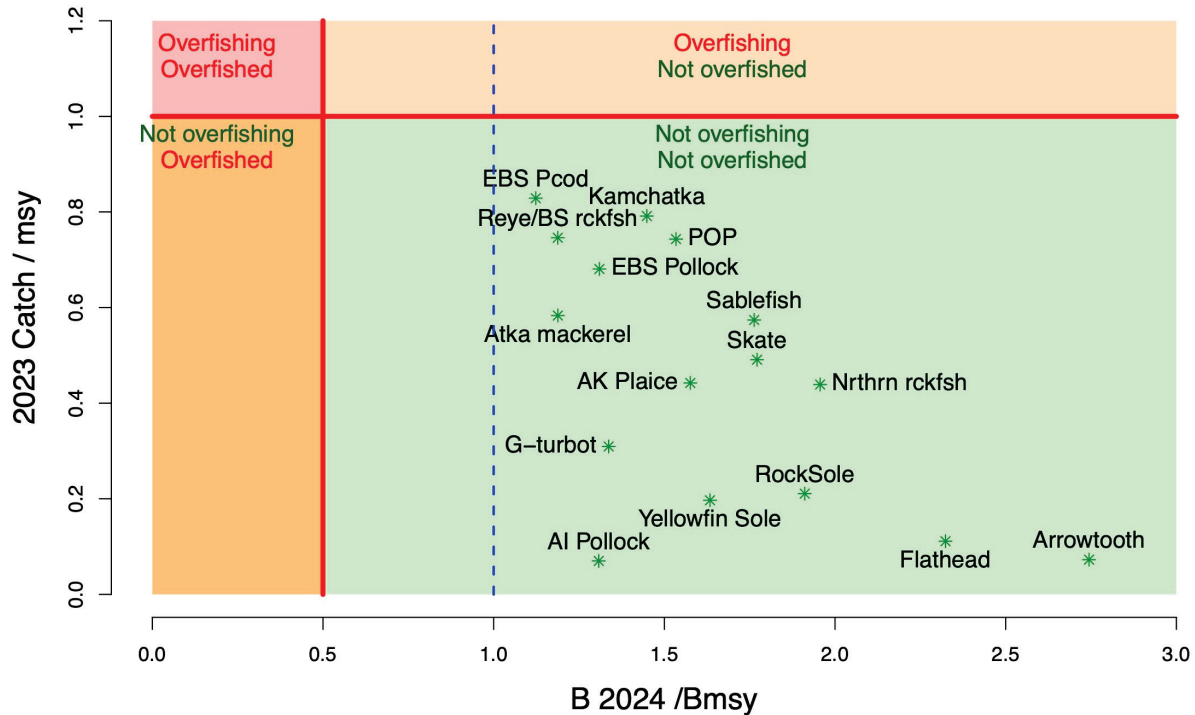


Figure 2. Summary of Bering Sea stock status next year (spawning biomass relative to  $B_{msy}$ ; horizontal axis) and current year catch relative to fishing at  $F_{msy}$  (vertical axis) where  $F_{OFL}$  is taken to equal  $F_{msy}$ .

### 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, 2023.

### 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 2024 harvest specifications (from Council recommendations in December 2022) are in place to start the fishery on

January 1, 2024, but these will be replaced by final harvest specifications that will be recommended by the Council in December 2023. The final 2024 and 2025 harvest specifications will become effective when final rulemaking occurs in February or March 2024. 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 2025 ABC and OFL values recommended in next year's SAFE report are likely to differ from this year's projections for 2025 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.

## Stock Assessment Frequency

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 the Alaska Fisheries Science Center's stock assessment frequency schedule for 2023-2026. Here the type of assessment is indicated by year with OP indicating operational full or update, HP indicating harvest projection, CR indicating catch report, and NA indicating no assessment.

Stock	Tier	Freq.	Last Full	2023	2024	2025	2026
EBS Pollock	1	1	2022	OP	OP	OP	OP
AI Pollock	3	2	2022	HP	OP	HP	OP
Bogoslof Pollock	5	2	2022	CR	OP	CR	OP
EBS Cod	3	1	2022	OP	OP	OP	OP
AI Pacific Code	3	1	2022	OP	OP	OP	OP
Sablefish	3	1	2022	OP	OP	OP	OP
Yellowfin Sole	1	1	2022	OP	OP	OP	OP
Greenland Turbot	3	2	2022	HP	OP	HP	OP
Arrowtooth Flounder	3	4	2022	HP	HP	HP	OP
Kamchatka Flounder	3	2	2022	HP	OP	HP	OP
Northern Rock Sole	1	2	2022	HP	OP	HP	OP
Flathead Sole	3	4	2020	HP	OP	HP	HP
Alaska Plaice	3	4	2021	HP	OP	HP	HP
Other Flatfish	5	4	2020	CR	OP	CR	CR
Pacific Ocean Perch	3	2	2022	HP	OP	HP	OP
Northern Rockfish	3	2	2021	OP	HP	OP	HP
Blackspotted & Rougheye Rockfish	3	2	2022	HP	OP	HP	OP
Shortraker Rockfish	5	2	2022	CR	OP	CR	OP
Other Rockfish	5	2	2022	CR	OP	CR	OP
Atka Mackerel	3	2	2022	HP	OP	HP	OP
Skates	3, 5	2	2020	OP	HP	OP	HP
Sharks	6	4	2022	CR	CR	CR	OP
Octopus	6	4	2020	OP	CR	CR	CR
Grenadiers	ESR Report	4	2020	NA	OP	NA	NA
Sculpins	ESR Report	4	2020	OP	NA	NA	NA
Forage Fish	ESR Report	2	2021	OP	NA	OP	NA

## Economic Summary of the BSAI commercial groundfish fisheries in 2021-2022

The ex-vessel value of all Alaska domestic fish and shellfish catch, which represents the amount paid to harvesters for fish caught, and the estimated value of pre-processed fish species that are caught by catcher/processors, decreased from \$2,143 million in 2021 to \$2,035 million in 2022 (real 2022\$). The first wholesale value of 2022 groundfish catch after primary processing was \$2,603 million, an increase from the 2021 value of \$2,302 million. The 2022 total quantity of groundfish catch decreased by 7.5%, because of decreased pollock (*Gadus chalcogrammus*) harvest in the BSAI, and the total first wholesale value of groundfish catch increased by 13%, relative to 2021. The rise in wholesale prices for groundfish products in general, and above all, for pollock fillets, more than offset the decrease in catch, explaining the increased 2022 first wholesale value over 2021.

The groundfish fisheries collectively accounted for the largest share (46%) of the ex-vessel value of all commercial fisheries off Alaska in 2022, with \$945 million in revenue, while the Pacific salmon (*Oncorhynchus spp.*) fishery was second with \$775 million, or 38% of the total Alaska ex-vessel value. The ex-vessel value of the shellfish fishery amounted to \$148 million, or 7% of the total for Alaska. Likewise, the ex-vessel value of Pacific halibut (*Hippoglossus stenolepis*) was \$148 million, or 7% of the total for Alaska in 2022.

The Economic SAFE report contains detailed information about economic aspects of the groundfish fisheries, including figures and tables that report historical catch, finished production, and ex-vessel and wholesale value, for harvesting and processing sectors for a range of factors (gear, species, management area, product type), and a set of economic performance indices. The report includes a section summarizing in-season catch and ex-vessel revenue estimates for groundfish and halibut, and wholesale market profiles for the most commercially valuable species. Data tables in the Economic SAFE report are organized into four 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; fishing effort; and, crew employment. The data behind the tables from this and past Economic SAFE reports are publicly available online at <https://reports.psmfc.org/akfin>.

### 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 (i.e., inflation-adjusted) ex-vessel value of Bering Sea and Aleutian Islands (BSAI) groundfish increased by 12% from \$669 million in 2021 to \$749 million in 2022 (Figure 3), and real first-wholesale revenues from the processing and production of groundfish in the BSAI increased by 9% between 2021 (\$2,034 million) and 2022 (\$2,220 million) (Figure 4). The total quantity of groundfish products from the BSAI decreased by 3% from 2021 (692 thousand metric tons) to 2022 (666 thousand metric tons).

### Decomposition of the change in first-wholesale revenues from 2021-2022 in the BSAI

The following brief analysis summarizes the overall nominal revenue changes that occurred from 2021 to 2022 and the quantity produced, and revenue generated from BSAI groundfish and how revenues have been affected by changes in quantity or prices of each species and product group (Figure 5). Unlike the numbers cited above, these values are not adjusted for inflation, so enable a simple comparison of how changes in the price and quantity for each group contribute to the overall change in first-wholesale revenues for groundfish from 2021 to 2022 in the BSAI.

In results presented by species group, a large positive price effect was much stronger than a negative quantity effect, which resulted in a positive net effect of about \$64.3 million for pollock (Figure 5, top panel). For Pacific cod, positive price and quantity effects contributed to a \$142.3 million net increase in first-wholesale revenues. Positive price and quantity effects for rockfish resulted in a net positive effect of \$11.6 million. Atka mackerel had a positive price effect and a smaller negative quantity effect, combining for a net positive effect of \$3.5 million. Flatfish exhibited a positive price effect combined with a positive quantity effect that resulted in a net revenue increase of \$82.9 million. Sablefish had a

small positive price effect, and positive quantity effect, combining for a net positive effect of \$17.7 million. The “Other” species group experienced small and positive price and quantity effects for a net revenue increase of \$3.2 million.

In results presented by product group, a large positive price effect for fillets was supported by a modest positive quantity effect which resulted in a positive net effect of \$186.8 million in the BSAI first-wholesale revenue decomposition for 2021 to 2022 (Figure 5, bottom panel). For surimi, a positive price effect coupled with a negative quantity effect resulted in a negative net effect of \$55.5 million. For roe, a positive price effect coupled with a negative quantity effect resulted in a negative net effect of \$13.1 million. For whole fish and head & gut, a large positive price effect supported by a positive quantity effect produced a positive net effect of \$193.9 million. For ‘other’ products, a positive price effect combined with a larger negative quantity effect resulted in a negative net effect of \$12.9 million.

In summary, the changes in first-wholesale revenues from the BSAI groundfish fisheries increased by \$325.4 million from 2021 to 2022 due to positive price effects that combined were worth \$412.6 million, which outweighed the overall negative quantity effect of \$87.1 million that was driven almost entirely by the reduction in finished production of pollock.

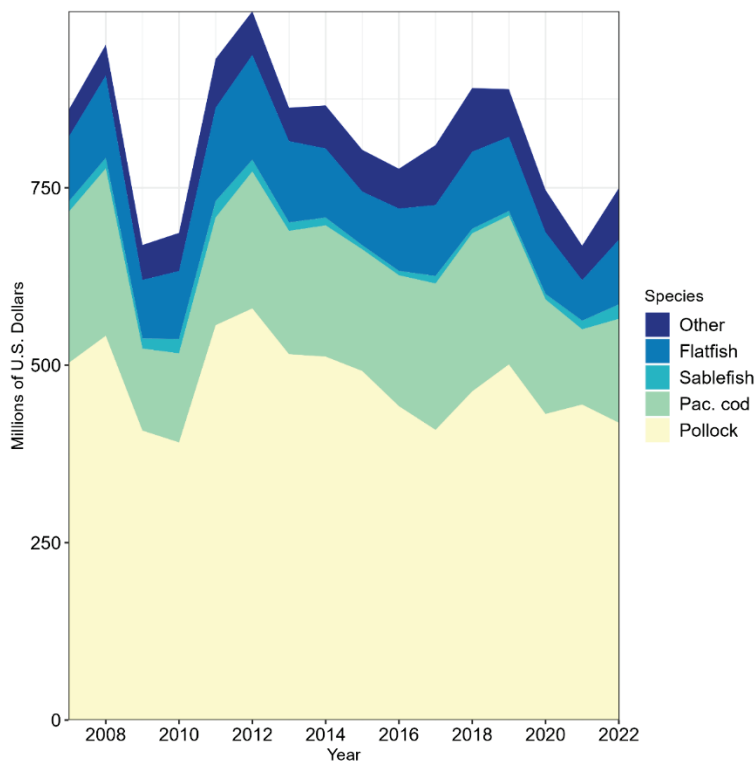


Figure 3. Real (2022 dollars) ex-vessel value of the groundfish catch in the domestic commercial fisheries in the BSAI area by species, 2007-2022.

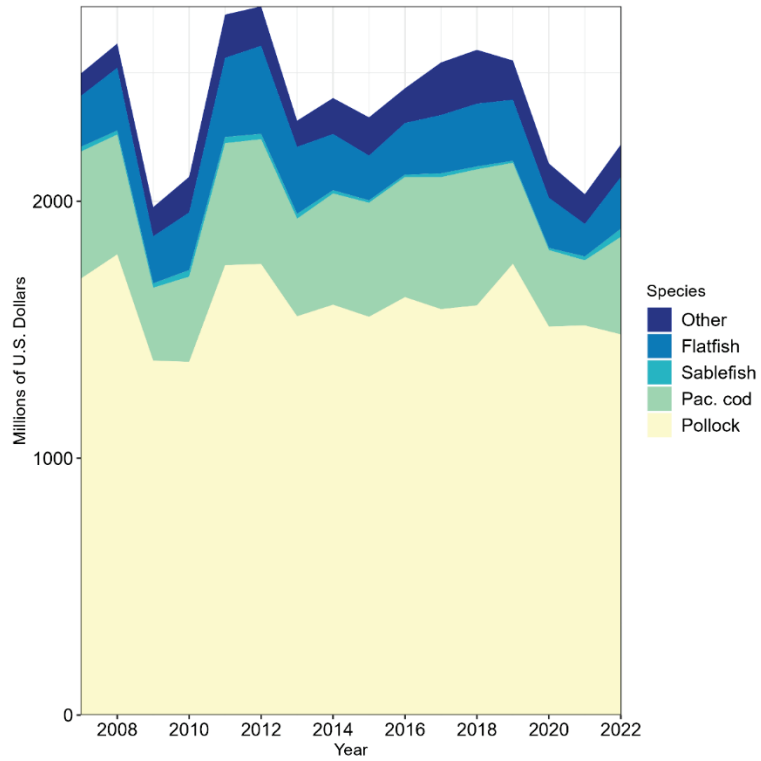


Figure 4. Real (2022 dollars) gross product value of the groundfish catch in the BSAI area by species, 2007-2022.

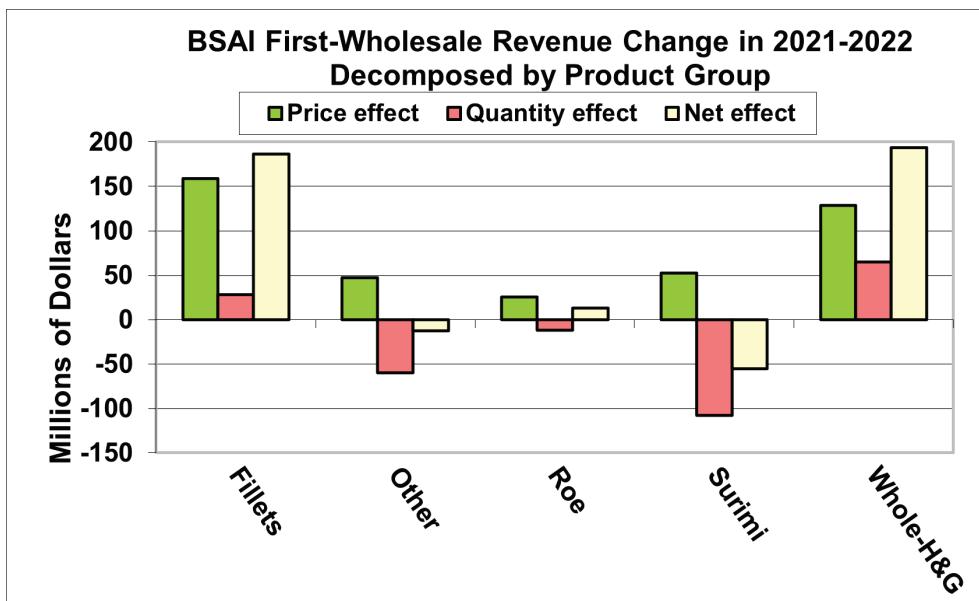
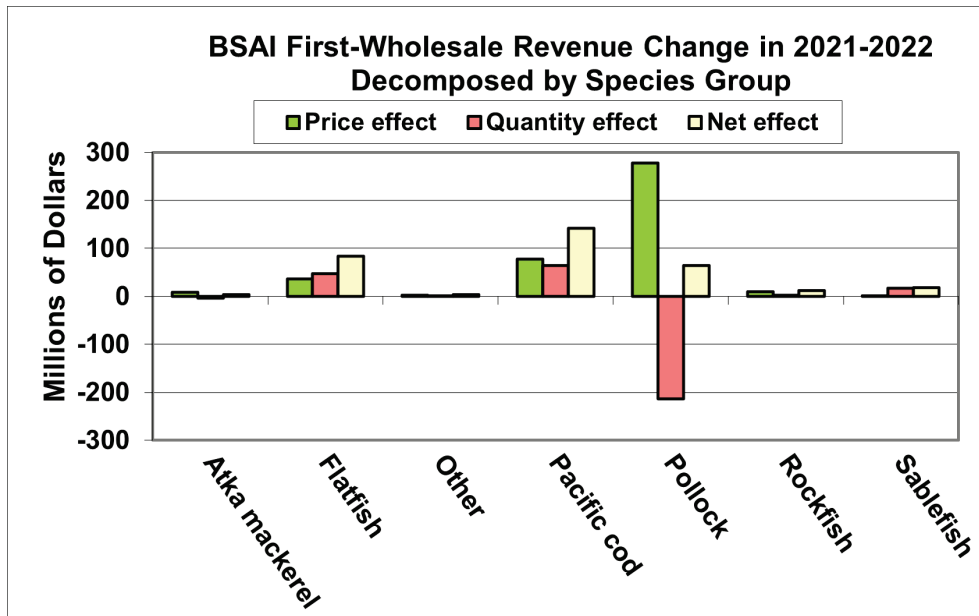


Figure 5. Decomposition of the change in first-wholesale revenues from 2021 to 2022 in the BSAI management area. The first decomposition is by the species groups used in the Economic SAFE report, and the second decomposition is by product group. The price effect refers to the change in revenues due to 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 (2023)

## Bering Sea Conditions

While the Bering Sea has cooled from the prolonged warm stanza between 2014 and 2021, temperatures remain above the long-term average and biological systems have not recovered as of 2023. The cold pool extent was similar to the long-term average while annual sea ice extent increased, although it remains similar to low ice years prior to 2010. Warmer sea-surface temperatures have continued to result in delayed freeze-up. Biological responses have differed between the Southeastern and Northern Bering Sea but productivity at most trophic levels remains low indicating potential bottom-up limitations throughout the foodweb. Chlorophyll-a concentrations and large diatoms indicate poor primary productivity in the Southeastern Bering Sea which also saw the largest Coccolithophore bloom since the start of the time series in 1997. Secondary productivity was also low as evidenced by low abundance and low lipid content in copepods and euphausiids in the spring and fall. Indicators about pelagic productivity were mixed with poor condition evident in pollock of all ages and juvenile salmon while Togiak herring and Bristol Bay sockeye biomass remained high and seabird reproductive success was mixed. Benthic productivity largely demonstrated declines with a few exceptions. Motile epifauna and various crab stocks declined, benthic foragers remained below the long-term mean, and flatfishes showed signs of experiencing prey limitations.

There have been no prolonged marine heatwaves in the Northern Bering Sea since January of 2021, sea ice thickness remained above the time series median and sea surface temperatures were close to the long-term average. The Northern Bering Sea has also shown more signs of recovery than the south. Similar to the Southeastern Bering Sea, primary productivity in the north was low, however unlike the Southeastern Bering Sea the north experienced higher secondary productivity with hot spots for large copepods and euphausiids around St. Lawrence Island. This may suggest improved bottom-up conditions relative to the southern shelf. Pelagic productivity in the north was also mixed with high condition in pollock and average condition in cod. Sea birds nesting success was up in the Northern Bering Sea in 2023 while juvenile salmon condition was higher in 2022 and there was a slight increase in juvenile Chinook and chum salmon indices in 2023. Traditional ecological knowledge of chum salmon population dynamics were examined alongside western science demonstrating similar declining trends in the species at all life stages. Patterns in benthic productivity in the north were similar to the south with low anemone biomass, continued low biomass of eelpout and poachers, and the lowest condition on record in yellowfin sole.

## Aleutian Islands

The Aleutian Islands have experienced sustained warmer temperatures for the last 10 years and the past winter saw the warmest sea surface temperatures on record. A thermal regime shift has been identified in the North Pacific mean temperature in 2013/2014 suggesting that the PDO indicator may not be as useful an indicator of biological processes as it has in the past. Changes in Pacific cod diets was noteworthy with less fish in diets and an increase in squid and shrimp. Even when similar amounts of prey were consumed cod were in worse condition as a result of lower prey quality and potentially higher bioenergetic costs associated with warmer conditions. The warming conditions in the Aleutian Islands was particularly evident in the warmest winter sea surface temperature in 124 years. Spring and summer sea surface temperatures were cooler than recent years, however they remain above the 1985-2015 mean. Eddy kinetic energy remains below average with reduced transport of heat, salt and nutrients through the passes. Primary productivity has demonstrated a long-term decline as evident in spring phytoplankton biomass. Reproductive success of sea birds in the Aleutian Islands was good in the eastern islands and mixed in the west. Harmful algal blooms were more prevalent than last year (toxins 47x above FDA limit vs 3.4 in 2022t), but below the maximum observed in 2020 (140x above limit) and indicate potential risk to predators in the ecosystem. Pink salmon abundance has been record high in odd years and high in even years while there has been a shift in pelagic foragers from Atka mackerel and walleye pollock to Pacific ocean perch and northern rockfish. The shift means longer mean lifespan in the groundfish community and a slower turnover rate as well as less preferred prey such as juvenile mackerel and pollock. The persistent warm conditions, rockfish dominance, and increasing pink salmon abundance jointly may



indicate there is a transition of the ecosystems to a state where rockfish and pink salmon are the main pathway of zooplankton into the food web.

## **Environmental indices discussed during the 2023 Nov Plan Team Meeting**

Multiple indices provide insight into mechanisms of changes in productivity and biomass of various groundfish stocks in the Bering Sea and Aleutian Islands. Water temperature (SST, bottom temperature, and cold pool extent) influence fish growth and redistribution to favorable thermal habitats, and diet, energetics, and metabolic indices provide insight into changes in potential growth and carrying capacity. Understanding how marine heatwaves impact groundfish mortality rates remains important, including gaining a better understanding of lags in ecosystems processes. Groundfish growth and survival are affected by the quality and quantity of prey fields and further development of indices of prey abundance and quality are important in understanding and projecting groundfish population dynamics. Continued development of other 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). The effects of changing fisheries markets were noted as drivers of fishery distribution and weight-at-age data and a better understanding of these processes would be beneficial to standardizing indices and understanding fisheries dependent data.

## **Multi-species model**

The climate enhanced multispecies assessment for walleye pollock (*Gadus chalcogrammus*), Pacific cod (*Gadus macrocephalus*) and arrowtooth flounder (*Atheresthes stomias*), from the Eastern Bering Sea (EBS), Alaska is updated and included annually, although previously as an appendix to the BS pollock assessment. The assessment quantitatively incorporates climate effects on growth, mortality (via predation) and recruitment. Results are presented from catch at age stock assessment models estimated and projected with climate effects on recruitment and growth and with trophic interactions (multispecies mode, MSM) or without trophic interactions (single-species mode, SSM). Outputs of the assessment include as a reference (not for harvest recommendation), climate-informed single- and multispecies Tier-3 reference points, ABC, and OFL. This year's assessment is based on updated survey, fishery, and climate information, the latter of which includes historical bottom temperature and future projected changes in temperature, oceanographic conditions, and lower trophic level productivity linked to recruitment, growth, and future ABC. Climate-specific risk assessments for near term (1-2 years), medium term (+10yr) and long-term (+30y) are provided for reference based on ABC harvest rates (and assuming no climate adaptation in the fish, fishery, or management system). Additional information presented includes estimates of predation pressure on key prey species of pollock, Pacific cod and arrowtooth flounder which provide context for historical or potential future ecological shifts in Bering sea carrying capacity.

## 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 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

Area	Year	Biomass	OFL	ABC	TAC*	Catch
Eastern Bering Sea	2022	6,839,000	1,469,000	1,111,000	1,111,000	1,105,419
	2023	12,389,000	3,381,000	1,910,000	1,314,500	1,307,997
	2024	10,184,000	3,162,000	2,313,000		
	2025	9,437,000	3,449,000	2,401,000		
Aleutian Islands	2022	308,525	61,264	50,752	19,000	3,058
	2023	264,173	52,383	43,413	4,500	3,665
	2024	279,764	51,516	42,654		
	2025	302,068	53,030	43,863		
Bogoslof	2022	378,262	113,479	85,109	250	259
	2023	367,880	115,146	86,360	300	118
	2024	367,880	115,146	86,360		
	2025	367,880	115,146	86,360		

\* In 2023, NMFS reallocated 14,500 t of pollock TAC from the Aleutian Islands to the Bering Sea

### Eastern Bering Sea pollock

#### *Changes from previous assessment*

Relative to last year’s BSAI SAFE report, the following substantive changes have been made in the EBS pollock stock assessment. This includes the 2023 NMFS bottom-trawl survey (BTS) covering the EBS and NBS. As before, these data were treated with a spatio-temporal model for index standardization. Age data from this survey effort was compiled and included (also with an extensive spatio-temporal model treatment). The NMFS acoustic-trawl survey (ATS) age composition data were revised from the preliminary estimates developed in 2022. The BTS chartered boats also collected acoustic data and the series was updated this year (AVO).

The following are changes in the data:

1. Observer data for catch-at-age and average weight-at-age from the 2022 fishery were finalized and included.
2. Total catch as reported by NMFS Alaska Regional office was updated and included through 2023.
3. In summer 2023, 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. Estimates of weight-at-age data were used to compute spawning biomass.
5. A new time series from the acoustic data collected from the bottom trawl survey covering 2006-2023 (except for 2020) was used.
6. Updated age-composition from the 2022 ATS survey was applied.

The relative weights specified as input variances and sample sizes were reevaluated. Different tuning approaches were applied which achieved a balance between the observation errors and model process errors, specifically for the acoustic time series. Alternative estimates of weight-at-age were applied to the spawning biomass calculations. The modified estimates are intended to reflect data available closest to the peak spawning season.

### *Spawning biomass and stock trends*

The results from the 2023 assessment are in agreement with the 2022 assessment: the 2018 year class appears to be one of the most abundant on record. Nonetheless, the bottom-trawl survey was lower than expected (about 28% below the long-term mean and the eleventh lowest over the 41 survey observations). Ancillary data indicate that the pollock in 2023 are substantially skinnier than average given their length. The average weight-at-age was about average for the 2018 year class, but lighter for most other ages.

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. The  $maxF_{ABC}$  is 0.379 resulting in a maximum permissible ABC for 2024 of 2.837 million t. However, the authors recommend setting ABCs well below the maximum permissible levels because of concerns related to environmental indicators. Their reasons for doing so are listed in the “ABC Recommendation” section of the SAFE chapter where the “environmental ecosystem considerations” category in the Risk Table scored as Level 2 (“major concern”). The authors conclude that this level of concern warrants setting the 2024 and 2025 ABCs using Tier 3 calculations resulting in 2.313 and 2.401 million t, respectively. 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 and further justifies the decrease based on the high variability in the estimate of the large 2018 year class.

### *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**

In accordance with the approved schedule, only harvest projections were conducted for AI pollock this year. However, a full stock assessment will be conducted in 2024. Until then, the values generated from the previous stock assessment (below) updated with the most recent catch will be used for 2024-2025 specifications. Please refer to the previous stock assessment for details regarding the assessment model and trends. The grayed-out text below summarizes the 2022 assessment and the status and catch specifications (t) of AI pollock 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 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

### *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**

In accordance with the approved schedule, a catch report was provided for Bogoslof pollock 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 used for 2024-2025 specifications. Please refer to the previous stock assessment for details regarding the assessment model and trends. The grayed-out text below summarizes the 2022 assessment and the status and catch specifications (t) of Bogoslof pollock in recent years. The OFL and ABC for 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

### *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  $F_{abc} = 0.75 \times M = 0.235$  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 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

<b>Area</b>	<b>Year</b>	<b>Age-0+ Biomass*</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
Eastern Bering Sea	2022	879,978	183,012	153,383	136,466	127,885
	2023	844,578	172,495	144,834	127,409	112,963
	2024	808,203	200,995	167,952		
	2025	787,837	180,798	150,876		
Aleutian Islands	2022	80,700	27,400	20,600	13,796	6,762
	2023	54,165	18,416	13,812	8,425	3,750
	2024	54,166	18,416	12,732		
	2025	54,166	18,416	12,732		

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

### **Eastern Bering Sea Pacific cod**

#### *Changes from previous assessment*

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

1. Catches for 1991-2022 were updated, and a preliminary catch estimate for 2023 was incorporated,
2. Commercial fishery size compositions for 1991-2022 were updated, and a preliminary size composition from the 2023 commercial fishery was incorporated,
3. Size composition from the 2023 EBS+NBS survey were incorporated
4. The VAST approach for the AFSC Bering Sea (EBS+NBS) bottom trawl index was updated for 2023, and
5. The VAST approach was used to estimate the age compositions from the combined EBS+NBS survey time series through 2022.

In September 2023 the authors recommended and the Teams and SSC agreed that the stock no longer employ the ensemble approach that had been used since 2021. There were several issues with the suite of models in the ensemble including poor stability and a tendency for the Dirichlet multinomial  $\log(\Theta)$  parameters on the length composition data to be fit at the upper bounds were of considerable concern. The authors instead proposed a new single model, Model 23.1.0.d, based on Model 22.2 from the ensemble with the following changes:

1. Input sample sizes for the size and age composition data used a bootstrap approach developed by Hulson et al. (2023),
2. Multinomial for size and age composition data instead of the Dirichlet multinomial used in the 2022 ensemble models,
3. Fixed natural mortality,
4. two time blocks for fishery selectivity, and
5. annually varying parameters on growth (L1.5 and Richard's  $\rho$ ) and survey selectivity.

Model 23.1.0.d was compared to the 2022 ensemble models and Model 23.2 which was Model 23.1.0.d with conditional-age-at-length data included. Model 23.1.0.d had improved performance and stability overall in comparison to the four 2022 ensemble models and had better residual behavior and fit compared to Model 23.2. Considering overall model performance, Model 23.1.0.d was the Authors' and Teams recommended model for management of the Bering Sea Pacific cod stock.

### *Spawning biomass and stock trends*

Recruitment is estimated to have been below average for the 2014-2017 and 2019-2021 year classes, and above average for 2013 and 2018. Estimated spawning biomass from Model 23.1.0.d increased from 2010 through 2017 to 335,350 t and has been on a downward trajectory since that time with an estimated low of 213,565 t in 2023 or  $B_{38\%}$ . Spawning biomass is projected to increase slightly to 223,107 t or  $B_{39\%}$  in 2024.

### *Tier determination/Plan Team discussion and resulting ABCs and OFLs*

This stock is assigned to Tier 3b for the determination of 2024 and 2025 ABCs and OFLs. The 2024 maxABC in this tier as calculated from Model 23.1.0.d is 167,952 t and the projected 2025 maxABC is 150,879 t. The 2024 OFL from Model 23.1.0.d is 200,995 t. The 2025 projected OFL is 180,798 t. Risk table scores were level 1 (no concerns), 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 alternative age-structured models this year.

Catch data from 1991-2022 were updated and preliminary catch data for 2023 were included in the assessment. Model 13.4 is the Tier 5 random effects model implemented using the REMA R package.

### *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 did not support the author's recommendation to move AI Pacific cod to Tier 3. The Team appreciated the time and effort the authors put into developing the models presented in this stock assessment. Model 23.2 shows substantial improvement in many ways. However, given the author's concern over the retrospective patterns in the first two alternative models (Models 23.0 and 23.1) and how divergent the author recommended model (Model 23.2) was from the models presented in September 2023, the Team determined that Model 23.2 required additional review before it could be accepted for

management. As the Team was only provided the projection choices and the resulting change in specifications from the document during the author’s presentation, the Team was unprepared to make a final decision and set precedence on the most appropriate projection method given the lack of documentation on the matter. Therefore, the Team recommended the Tier 5 model with a reduction from maximum ABC due to the Level 2 - Major Concern provided in the risk table for the population dynamics and ecosystem considerations sections. Both the trawl and longline survey indices and fishery CPUE are at their lowest in the time series and there continues to be sustained warm temperatures at the surface and bottom in the AI. The reduction from the Tier 5 maximum ABC is set equal to that which would match the ABC to the 2024 OFL from the author recommended model projected using the mean M and growth values for 2004-2023. This reduction was intended to reduce the probability that the ABC exceeds the true but unknown OFL, per SSC recommendation. The reasoning behind this decision mirrors that employed in 2022 in reducing the ABC from the maximum for BSAI northern rock sole when the Team was faced with a compelling, but not adequately reviewed, new model and indications from the risk table of potential cause for concern. The Team further recommended the use of the projected OFL from the model in 2024 for both 2024-2025 due to unresolved questions regarding the conflicting trends of the increase in OFL as compared to the static projected ABC from the model in 2025.

*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 2024 and 2025 are those recommended by the 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, 2023.

Area	Year	Age-4+ Biomass	OFL	ABC	TAC	Catch
Alaska (all areas)	2022	529,800	40,432			
	2023	621,000	47,390			
	2024	701,300	55,084			
	2025	686,500	55,317			
Bering Sea	2022	168,000		5,264	5,264	5,514
	2023	151,000		8,417	7,996	5,164
	2024	194,100		11,450		
	2025	190,000		11,499		
Aleutian Islands	2022	121,200		6,463	6,463	2,230
	2023	153,000		8,884	8,440	2,319
	2024	169,900		13,100		
	2025	166,300		13,156		

*Changes from the previous assessment*

New data included in the author recommended assessment Model 23.5 were:

1. Relative abundance and length data from the 2023 NOAA domestic longline survey.
2. Relative biomass and length data from the 2023 NOAA Gulf of Alaska trawl survey, and removal of the 1984 and 1987 trawl survey index and length data (per AFSC best practice guidance).
3. Length data from the fixed gear fishery for 2022.

4. Length data from the trawl fisheries for 2022.
5. Age data from the longline survey and fixed gear fishery for 2022.
6. Updated catch for 2022.
7. Observed catch for 2023 and projected catch for the portion of the fishing year not yet completed.
8. Non-commercial catch of sablefish in federal waters was included (per SSC request) and added to the fixed gear fishery total catch for 1977 to 2023.
9. For 2023, estimates of killer and sperm whale depredation in the fishery were held constant at 2022 values.
10. Fixed gear fishery catch-per-unit effort (CPUE) data from logbooks and observers were updated through 2022 and a new CPUE standardization approach (Cheng et al., 2023) that combined data from both hook-and-line and pot gear was implemented, which replaced the previously used nominal CPUE index that included only hook-and-line gear.

A total of five new model runs were developed for the 2023 SAFE, which culminated in the final author recommended Model 23.5 that incorporated all individual changes.

The models explored for 2023 were:

- Model 21.12: the continuity model matching the 2022 SAFE model but with updated data for 2023.
- Model 23.1: removed the 1984 and 1987 trawl survey biomass index and length composition data.
- Model 23.2: incorporated all sources of non-commercial catch in federal waters in the total catch.
- Model 23.3: revised the stock-recruit bias correction, updated selectivity parameter sharing, and remove unnecessarily estimated fishing mortality parameters.
- Model 23.4: implemented a standardized CPUE index that combined data from both the hook-and-line and pot gear types (Cheng et al., 2023).
- Model 23.5: integrated all updates from models 23.1-23.4; this is the final author recommended model for sablefish management advice in 2023.

### *Spawning biomass and stock trends*

The model estimates that all year classes since 2014 have been at or well above the time series average. Age-2+ biomass has nearly tripled from a time series low of 233,000 t in 2015 to 695,000 t in 2023, which represents sablefish population levels on par with those at the time the fishery developed in the 1960s. Similarly, spawning stock biomass (SSB) has nearly doubled from the time series low of 82,000 t in 2017 to 157,000 t in 2023. Thus, the SSB in 2023 is at 52% of the unfished SSB (i.e.,  $B_{100\%}$ ). However, the lack of sablefish greater than 10 years of age (i.e. the age when sablefish are more than 90% mature), especially compared to historic levels of older and larger fish, remains concerning for a long-lived species, and should continue to be monitored. Survival of recent cohorts to fully mature age classes will be essential to ensure the long-term productivity of the resource and fishery, given that the 2014 through 2020 cohorts currently comprise more than 75% of the SSB. However, catch has been well below acceptable biological catch (ABC) with the proportion of the quota utilized averaging ~70% over the last three years. The declining ABC utilization, corresponding reductions in market value, and recent rapid fishery changes (i.e., transition from predominantly hook-and-line gear to pot gear), represent the only source of elevated risk table concern. The ‘fishery performance’ category was rated ‘level 2 – major concern’, while all other risk table scores were ‘level 1 – no concern’.

### *Tier determination/Plan Team discussion and resulting ABCs and OFLs*

Sablefish are managed under Tier 3 of the NPFMC harvest control rule, which aims to maintain the population at  $B_{40\%}$ . Since projected female spawning biomass (combined areas) for 2024 is equivalent to  $B_{62\%}$ , 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  $F_{ABC}$  under Tier 3a is 0.086, which translates into a Tier 3a maximum permissible 2024 ABC (combined areas) of 47,367 t. After adjusting for whale depredation, the



final author recommended ABC is 47,146 t. The OFL fishing mortality rate is 0.101, which translates into a 2024 OFL (combined areas) of 55,385 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*

Based on biological rationale, the SSC adopted a five-year average survey apportionment method in 2020. A five-year moving average of the longline survey proportions of biomass in each region are used to apportion catch to management area. The apportionment values are updated yearly as new survey data is collected. This gives the following area-specific ABCs (including deductions for estimated whale depredation):

Region	2023			2024		2025	
	OFL <sub>w</sub>	ABC <sub>w</sub>	TAC	OFL <sub>w</sub>	ABC <sub>w</sub>	OFL <sub>w</sub>	ABC <sub>w</sub>
BS	--	8,417	7,996	--	11,450	--	11,499
AI	--	8,884	8,440	--	13,100	--	13,156
BSAI	--	17,301	16,436	--	24,550	--	24,655
GOA <sup>1</sup>	--	23,201	23,201	--	22,596	--	22,695
Alaska-wide	47,390	40,502		55,084	47,146	55,317	47,350

<sup>1</sup>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 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 2024 and 2025 are those recommended by the Team. Catch data are current through -November 5, 2023

Area	Year	Age-6+ Biomass	OFL	ABC	TAC	Catch
BSAI	2022	2,479,370	377,071	354,014	250,000	154,253
	2023	3,321,640	404,882	378,499	230,000	105,682
	2024	2,512,810	305,298	265,913		
	2025	2,616,800	317,932	276,917		

### *Changes from previous assessment*

Changes to the input data include:

1. The 2022 fishery age compositions were added.
2. The 2022 VAST survey age compositions were added.
3. The estimate of the total catch made through the end of 2022 was updated as reported by the NMFS Alaska Regional office. The catch through the end of 2023 was estimated based on available data to be 79,688 t. Catch for the 2024 and 2025 projections were assumed to be the mean of the past 5 years, 2019 - 2023, 121,103 t.
4. The 2023 NMFS survey biomass estimate and standard error were included. Model-based (VAST) estimate of the EBS and NBS biomass and standard error were used in all models presented.

Changes to the model include:

Two models were presented in this assessment. Model 22.1 was the accepted model in 2022 and was presented with updated data. Model 23.0 is based on Model 22.1, except that a single sex time-varying fishery selectivity was used rather than separate time-varying fishery selectivities for males and females. Further details are described below.

1. Model 22.1 was accepted by the BSAI Plan Team and the SSC in 2022. Survey biomass index data (1982-2023) and age compositions consisted of VAST estimates for the combined eastern Bering Sea and northern Bering Sea.
2. Model 23.0 is the same as Model 22.1 except a single-sex fishery selectivity was used rather than a separate fishery selectivity for males and females. Survey index data (1982-2023) and age compositions were based on VAST model-based indices for the combined eastern Bering Sea and northern Bering Sea. This is the authors' preferred model.

The authors and Team recommend using Model 23.0 for use in setting 2024 and 2025 harvest specifications.

#### *Spawning biomass and stock trends*

The projected estimate of total biomass for 2024 was 38% lower than that of the 2022 assessment. The model projection of spawning biomass for 2024 was 2% higher than the projected 2024 spawning biomass from the 2022 assessment. The 2024 and 2025 ABCs using  $F_{ABC}$  from this assessment model were lower than last year's 2024 ABC.

#### *Tier determination/Plan Team discussion and resulting ABCs and OFLs*

The 2023 eastern Bering Sea (EBS) bottom trawl survey model-based biomass estimate for yellowfin sole was 32% lower than estimated by the 2022 EBS bottom trawl survey. Spawning biomass estimated by Model 23.0 was  $1.63 * B_{MSY}$ . Therefore, yellowfin sole continues to qualify for management under Tier 1a. The 1978-2017 age-1 recruitments and the corresponding spawning biomass estimates were used to fit the stock recruitment curve and determine the Tier 1 harvest recommendations. Tier 3 estimates were also calculated, which is typical for this assessment. This assessment updates last year's model with total and spawning biomass estimates for 2023 that are lower than the 2022 estimates for 2023. This year's recommended ABC and OFL are lower than the 2022 assessment, coincident with a decrease in the 2023 survey biomass estimate.

#### *Status determination*

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

### **5. Greenland turbot**

Greenland turbot are assessed biennially according to the stock assessment prioritization schedule. A statistical catch-at-age model configured in Stock Synthesis 3 (Methot and Wetzel, 2013) is used as the primary assessment tool for BSAI Greenland turbot, which qualifies as a Tier 3 stock. The assessment model is not run during an off-cycle year. During odd years, a harvest projection is presented with recommendations of harvest levels for the next two years for this species, using updated catch information in the projection model. The last full stock assessment was conducted in 2022. A full stock assessment document with updated assessment and projection model results will be presented in November, 2024.

Status and catch specifications (t) of Greenland turbot in recent years. The grayed-out text below the following table summarizes the 2022 assessment and the 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 Team. Catch data for 2023 are current through November 5, 2023.

Area	Year	Age-1+ Biomass	OFL	ABC	TAC	Catch
BSAI	2022	84,341	7,687	6,572	6,572	1,478
	2023	53,907	4,645	3,960	3,960	1,272
	2024	50,278	3,705	3,188		
	2025	47,854	3,185	2,740		
Eastern Bering Sea	2022			5,540	5,540	1,038
	2023			3,338	3,338	793
	2024			2,687		
	2025			2,310		
Aleutian Islands	2022			1,032	1,032	440
	2023			622	622	479
	2024			501		
	2025			430		

#### *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**

Arrowtooth flounder are assessed quadrennially according to the stock assessment prioritization schedule. A forward projecting age structured model is the primary assessment tool for arrowtooth flounder, which qualifies as a Tier 3 stock. The assessment model is not run during an off-cycle year. During odd years, a harvest projection is presented with recommendations of harvest levels for the next two years for this species, using updated catch information in the projection model. The most recent full assessment was conducted in 2022 (Shotwell et. al, 2022). A full stock assessment document with updated assessment and projection model results is scheduled for November, 2026

Status and catch specifications (t) of arrowtooth flounder in recent years are below. The grayed-out text below the following table summarizes the 2022 assessment and the status and catch specifications (t) of arrowtooth flounder 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 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

Area	Year	Age-1+ Biomass	OFL	ABC	TAC	Catch
BSAI	2022	921,690	94,445	80,389	20,000	7,857
	2023	929,274	98,787	83,852	15,000	6,948
	2024	921,062	103,280	87,690		
	2025	907,809	104,270	88,548		

### *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**

Kamchatka flounder are assessed biennially according to the stock assessment prioritization schedule. A forward projecting age structured model is the primary assessment tool for BSAI Kamchatka flounder, which qualifies as a Tier 3 stock. The assessment model is not run during an off-cycle year. During odd years, a harvest projection is presented with recommendations of harvest levels for the next two years for this species, using updated catch information in the projection model. The most recent full assessment was conducted in 2022 (Bryan et. al, 2022). A full stock assessment document with updated assessment and projection model results is scheduled for November, 2024

Status and catch specifications (t) of Kamchatka flounder in recent years are below. The grayed-out text below the following table summarizes the 2022 assessment and the status and catch specifications (t) of Kamchatka flounder 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 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

<b>Area</b>	<b>Year</b>	<b>Age-2+ Biomass</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
BSAI	2022	143,983	10,903	9,214	9,214	8,369
	2023	121,977	8,946	7,579	7,579	6,926
	2024	119,565	8,850	7,498		
	2025	116,651	8,687	7,360		

### *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  $B_{ms}$  level of 37,748 t, and spawning biomass is projected to remain above  $B_{ms}$  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  $B_{msy}$ , 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

Northern rock sole (*Lepidopsetta polyxystra*) are assessed on a biennial stock assessment schedule according to the stock assessment prioritization schedule. The most recent full assessment was conducted in 2022 (McGilliard et. al, 2022). A full stock assessment document with updated assessment and projection model results is scheduled for November 2024.

A statistical age-structured model is used as the primary assessment tool for the Bering Sea/Aleutian Islands northern rock sole assessment, a Tier 1 stock. This assessment consists of a population model, which uses survey and fishery data to generate a historical time series of population estimates, and a projection model, which uses results from the population model to predict future population estimates and recommended harvest levels. The data sets used in this assessment include total catch biomass, fishery age compositions, trawl survey abundance estimates and trawl survey age compositions. In a partial assessment year, the full assessment model is not rerun but instead a Tier 1 projection model with an assumed future catch is used to estimate the stock level in the next two years. This incorporates the most current catch information for ABC and OFL recommendations without re-estimating model parameters and biological reference points.

The Tier 1 projection operates within the full assessment model by projecting estimates of the female spawning biomass, age 6+ total biomass, ABC and OFL ahead two years. Since the full assessment model is not rerun in this assessment, the projected values from the 2022 assessment are used to provide ABC and OFL.

The 2022 BSAI Northern rock sole assessment reduced the ABC from maxABC due to concerns about diagnostics and retrospective patterns in the assessment. The reduced ABC was set equal to the OFL from an alternative model that showed improved diagnostics and retrospective patterns. This year, the 2024 and 2025 projected ABC is reduced in the same manner, by setting it equal to the OFL from the updated alternative projections. This is a risk table reduction from maxABC using the same concerns that were identified in the 2022 assessment. The grayed-out text below the following table summarizes the 2022 assessment and the status and catch specifications (t) of northern rock sole in recent years.

Area	Year	Age-6+ Biomass	OFL	ABC	TAC	Catch
BSAI	2022	1,361,360	214,084	206,896	66,000	18,399
	2023	941,359	166,034	121,719	66,400	26,907
	2024	1,121,670	197,828	122,091		
	2025	1,501,330	264,789	122,535		

Under the flatfish exchange the northern rock sole TAC was increased by 400 t in 2023.

### *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**

“Flathead sole” as currently managed by the North Pacific Fishery Management Council (NPFMC) in the Bering Sea and Aleutian Islands (BSAI) and represents a two-species complex consisting of true Flathead

sole (*Hippoglossoides elassodon*) and its morphologically-similar congener Bering flounder (*Hippoglossoides spp.*). This species is currently assessed on a four-year cycle; the most recent full assessment was conducted in 2020 (Monnahan and Haehn, 2020) and will be updated in 2024. In years without a full assessment, we present an executive summary to recommend harvest levels for the next two years.

Status and catch specifications (t) of flathead sole in recent years. The grayed-out text below the following table summarizes the 2022 assessment and the 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 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

Area	Year	Age-3+ Biomass	OFL	ABC	TAC	Catch
BSAI	2022	608,631	77,967	64,288	35,500	14,690
	2023	606,522	79,256	65,344	35,100	8,759
	2024	609,488	81,605	67,289		
	2025	608,230	82,699	68,203		

Under the flatfish exchange the flathead sole TAC was reduced by 400 t in 2023

#### *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**

Alaska plaice are assessed quadrennially according to the stock assessment prioritization schedule and a harvest projection is done on the off years. A harvest projection involves projecting the model, established in the last full assessment, forward to predict future population estimates and recommended harvest levels for the next two years. The primary assessment tool for Alaska plaice assessment, a Tier 3 stock, is a statistical age-structured model that uses survey and fishery data to generate a historical time series of population estimates. For the 2023 Alaska plaice stock assessment, a harvest projection was conducted. In a harvest projection year, the full assessment model is not rerun but instead a Tier 3 projection model with updated catch estimates is run to estimate the stock level in future years. This incorporates the most current harvest information without re-estimating model parameters and biological reference points. The Tier 3 projection operates outside the full assessment model by projecting estimates of future female spawning biomass, age 3+ total biomass, ABC and OFL from the full model estimates of 2021 numbers-at-age, weight-at-age, maturity, and selectivity. Please refer to the last full stock assessment report for further information regarding the stock assessment model (Ormseth 2021). A full



stock assessment document with updated assessment and projection model results is scheduled for November, 2025

Status and catch specifications (t) of Alaska plaice in recent years. The grayed-out text below the following table summarizes the 2022 assessment and the 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 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

Area	Year	Age-3+ Biomass	OFL	ABC	TAC	Catch
BSAI	2022	442,946	39,305	32,697	24,500	11,253
	2023	461,992	40,823	33,946	17,875	15,018
	2024	473,125	42,695	35,494		
	2025	481,959	45,182	37,560		

The Alaska Plaice TAC was increased in NMFS in-season management by 375 t to 17,875 in 2023

#### *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, a catch report was provided 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-over estimates.

Status and catch specifications (t) of other flatfish in recent years. The grayed-out text below the following table summarizes the 2020 assessment. 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	2022	146,679	22,919	17,189	10,000	2,559
	2023	146,679	22,919	17,189	4,500	2,994
	2024	146,679	22,919	17,189		
	2025	146,679	22,919	17,189		

### *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

In 2005, BSAI rockfish were moved to a biennial assessment schedule, with full assessments in even years to coincide with the occurrence of trawl surveys in the Aleutian Islands and the eastern Bering Sea slope. In 2017, the scheduled frequency for some stock assessments was changed in response to the National Stock Assessment Prioritization effort, with BSAI Pacific ocean perch maintaining its existing schedule. In 2022, a full assessment was conducted (Spencer and Ianelli 2022). The grayed-out text following the table below summarizes the 2022 assessment. A harvest projection assessment is conducted this year by revising the recent catch data and re-running the projection model using the results from the previous full assessment as a starting point. The harvest projection assessment includes estimates of catch/biomass (i.e., exploitation rates), using estimated total biomass from the 2022 assessment and updated projection model. A full stock assessment document with updated assessment and projection model results is scheduled for November, 2024.

Status and catch specifications (t) of Pacific ocean perch in recent years. The grayed-out text below the following table summarizes the 2022 assessment and the status and catch specifications (t) of Pacific ocean perch 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 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

Area	Year	Age-3+ Biomass	OFL	ABC	TAC	Catch
BSAI	2022	738,710	42,605	35,688	35,385	34,782
	2023	888,722	50,133	42,038	37,703	34,720
	2024	871,892	49,010	41,096		
	2025	858,751	48,139	40,366		
Eastern Bering Sea	2022			10,352	10,352	10,066
	2023			11,903	11,903	10,196
	2024			11,636		
	2025			11,430		
Eastern Aleutian Islands	2022			8,083	8,083	7,996
	2023			8,152	8,152	7,255
	2024			7,969		
	2025			7,828		
Central Aleutian Islands	2022			5,950	5,950	5,837
	2023			5,648	5,648	5,461
	2024			5,521		
	2025			5,423		
Western Aleutian Islands	2022			11,303	11,000	10,882
	2023			16,335	12,000	11,807
	2024			15,970		
	2025			15,685		

### *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 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

<b>Area</b>	<b>Year</b>	<b>Age-3+ Biomass</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
BSAI	2022	279,584	23,420	19,217	17,000	7,898
	2023	277,133	22,776	18,687	11,000	10,308
	2024	297,189	23,556	19,274		
	2025	292,686	22,838	18,685		

### *Changes from previous assessment*

Changes in the input data:

1. Catch data was updated through 2022, and total catch for 2023 was projected.
2. The 2022 Aleutian Island survey age composition, the 2021 fishery age composition data, and the 2022 fishery length composition data were included in the assessment.
3. The 2022 Aleutian Island survey biomass estimate was included in the assessment.
4. The ageing error matrix was updated.

Changes in the Assessment Methodology:

1. There were no changes to the assessment methodology.

### *Spawning biomass and stock trends*

The estimated survey biomass for Northern rockfish shows an increasing trend, starting at 91,159 t in 1977 and increasing to a peak of 256,819 t in 2014, and declining to 236,604 t in 2023. The estimated total biomass shows a similar trend, increasing to a peak value of 343,230 t in 2014, and the estimated spawning biomass increases from 55,180 in 1977 to its highest value of 151,130 in 2015.

A relatively high fishing mortality rate in 1977 is estimated to account for the relatively high catch in this year, followed by very low levels of fishing mortality during the 1980s when catch was small. Fishing mortality rates began to increase during the early 1990s, and declined from the late 1990s to 2014.

Fishing mortality rates have increased since 2014, and the 2023 estimate of 0.034 is the largest F in the estimated time series beginning in 1977. The stock is currently below F35% and above B40%.

For recruitment, relatively strong year classes are observed in 1984-1985, 1989, 1993, 1995-1998, and 2005, reflecting several of the strong year classes observed in the age composition input data. Most of these estimated strong year classes are larger than their estimates in the 2021 assessment, and years adjacent to the strong year classes are often smaller than estimated in the 2021 assessment (for example, the 1985, 1989, and 2005 year classes). This reflects the influence of the updated aging error matrix; the greater uncertainty in the observed ages allows stronger recruitments which will be distributed to a greater degree to adjacent observed ages. There is substantial variability in the relationship between recruitment and spawning stock size.

### *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 author recommended Model 21 with no reductions from maximum permissible ABC and the Team agreed with the author's recommendation.

### *Status determination*

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

## **14. Blackspotted and roughey rockfish**

In 2022 a full assessment was conducted for the BSAI blackspotted and roughey rockfish complex (Spencer, Ianelli, and Laman 2022). This year, a harvest projection assessment is conducted by revising the recent catch data and re-running the projection model using the results from the previous full assessment as a starting point for the Aleutian Islands portion of the stock, with the eastern Bering Sea portion assessed with Tier 5 methods applied to survey biomass estimates. Therefore, this update does not incorporate any changes to the 2022 assessment methodology, but does update the catch estimates for 2022 and provides an estimated catch for 2023. This assessment also includes estimates of catch/biomass (i.e., exploitation rates), using estimated total biomass from the 2022 assessment and updated projection model. A full stock assessment document with updated assessment and projection model results is scheduled for November, 2024

Status and catch specifications (t) of blackspotted and roughey rockfish complex in recent years. The grayed-out text below the following table summarizes the 2022 assessment and the status and catch specifications (t) of blackspotted and roughey rockfish 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, 2023.

Area	Year	Total Biomass*	OFL	ABC	TAC	Catch
BSAI	2022	19,145	598	503	503	455
	2023	25,400	703	525	525	523
	2024	25,859	761	569		
	2025	26,287	813	607		
Western/Central Aleutian Islands	2022			177	177	250
	2023			166	166	316
	2024			181		
	2025			195		
Eastern AI/ Eastern Bering Sea	2022			326	326	204
	2023			359	359	207
	2024			388		
	2025			412		

\*The total biomass is from an AI age-structured model and survey biomass estimates from the EBS.

### *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.

- 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
2024 MSSCs	67	114
2025 MSSCs	71	124

#### *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**

In accordance with the approved schedule, a catch report was provided for BSAI shortraker rockfish 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 used for 2024-2025 specifications. Please refer to the previous stock assessment for details regarding the assessment model and trends. The grayed-out text below the following table summarizes the 2022 assessment and the status and catch specifications (t) of shortraker rockfish in recent years. The OFL and ABC for 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

Area	Year	Survey Biomass	OFL	ABC	TAC	Catch
BSAI	2022	24,055	722	541	541	284
	2023	23,547	706	530	530	224
	2024	23,547	706	530		
	2025	23,547	706	530		

### *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**

In accordance with the approved schedule, a catch report was provided for the BSAI other rockfish 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 used for 2024-2025 specifications. Please refer to the previous stock assessment for details regarding the assessment model and trends. The grayed-out text below the following table summarizes the 2022 assessment and the status and catch specifications

(t) of the other rockfish complex in recent years. The OFL and ABC for 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

Area	Year	Survey Biomass	OFL	ABC	TAC	Catch
BSAI	2022	53,248	1,751	1,313	1,144	1,308
	2023	52,733	1,680	1,260	1,260	1,179
	2024	52,733	1,680	1,260		
	2025	52,733	1,680	1,260		
Eastern Bering Sea	2022			919	750	651
	2023			880	880	618
	2024			880		
	2025			880		
Aleutian Islands	2022			394	394	657
	2023			380	380	560
	2024			380		
	2025			380		

#### *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**

In 2023, BSAI Atka mackerel changed from an annual to a biennial assessment frequency based on recent groundfish stock prioritization efforts. Under this new frequency, full assessments will be conducted in even years coinciding with the Aleutian Islands (AI) bottom trawl survey, and harvest projections (formerly called “partial” assessments) will be conducted in odd years. A harvest projection was conducted in 2023, and the next full assessment is scheduled for 2024.

BSAI Atka mackerel are managed as a Tier 3 stock (Lowe and Ianelli 2022). During full assessment years, a statistical catch-at-age model is used to generate historical time series of population estimates. Results from this model are input to the standard Alaska Fisheries Science Center (AFSC) projection model, which produces future population estimates, biological reference points, and recommended harvest levels. For 2024, only the projection model is run based on the last full assessment model results with updated catch assumptions. A full stock assessment document with updated assessment and projection model results is scheduled for November, 2024

Status and catch specifications (t) of Atka mackerel in recent years. The grayed-out text below the following table summarizes the 2022 assessment and the 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 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

Area	Year	Age 1+ Biomass	OFL	ABC	TAC	Catch
BSAI	2022	554,490	91,870	78,510	66,481	58,107
	2023	615,027	118,787	98,588	69,282	65,527
	2024	625,578	111,684	95,358		
	2025	631,261	99,723	84,676		
E Aleutian Islands/EBS	2022			27,260	27,260	19,138
	2023			43,281	27,260	23,776
	2024			41,723		
	2025			37,049		
Central Aleutian Islands	2022			16,880	16,880	16,761
	2023			17,351	17,351	17,210
	2024			16,754		
	2025			14,877		
Western Aleutian Islands	2022			34,370	22,341	22,208
	2023			37,956	24,671	24,541
	2024			36,882		
	2025			32,750		

*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  $B_{msy}$  (112,182 t), and the stock is projected to drop slightly below  $B_{msy}$  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  $B_{msy}$ , 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**

The Bering Sea and Aleutian Islands (BSAI) skate stock complex is managed in aggregate, with a single set of harvest specifications applied to the entire complex. However, to generate the harvest recommendations the stock is divided into two units. Harvest recommendations for Alaska skate *Bathyraja parmifera*, the most abundant skate species in the BSAI, are made using the results of an age-structured model and are managed under Tier 3. The remaining species (Other skates) are managed under Tier 5 due to a lack of data. The Tier 3 and Tier 5 recommendations are combined to generate recommendations for the complex as a whole.

BSAI skates are assessed on a biennial stock assessment schedule. An operational assessment is conducted in even years, and in odd years a harvest projection is produced.

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 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

Area	Year	Age-0+ Biomass	OFL	ABC	TAC	Catch
BSAI	2022	597,042	47,790	39,958	30,000	29,236
	2023	580,701	46,220	38,605	27,441	24,605
	2024	584,499	45,574	37,808		
	2025	569,197	44,203	36,625		

### *Changes from previous assessment*

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

1. Catch data have been updated through October 1, 2023. Total catch for 2023 was estimated by the mean proportion of catch occurring after October 1 over the last 5 years.
2. The time series of eastern Bering Sea (EBS) shelf bottom trawl survey biomass estimates from 2000 – 2019 were updated to reflect updates to the design-based estimator.
3. 2022 Aleutian Islands (AI) and 2021 – 2023 EBS bottom trawl survey data were included.
4. Survey length compositions from the 2021-2023 EBS shelf bottom trawl survey were included.
- 5.

There were no substantive changes to the assessment methodology. For the Tier 5 Other Skate component, the total biomass was estimated using the *rema* framework, but since the previous assessment also used a random effects model to estimate biomass, this is not considered a change to the methodology, as only the framework changed. For the Tier 3 Alaska Skate, there were 2 minor changes introduced in addition to the new data. However, as noted these were not considered a change to the methodology:

1. Modeling framework was updated to SS3 v3.
2. Updated historical data including changes to EBS shelf survey biomass (2000 – 2019), and minor changes to catch time series.

### *Spawning biomass and stock trends*

*Other skates (Tier 5 component):* Biomass estimates in the EBS shelf have been trending upward since 2013 and are at a historic high for 2024, mostly driven by Big skates. In the AI, biomass has trended down since at least 2010. There is concern for the population of Leopard skates in the AI, as this rare, endemic species appears to be in decline. Biomass estimates in the EBS slope appear stable but are uncertain due to the lack of a slope survey in recent years.

*Alaska skates (Tier 3 component):* 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. The accepted model (14.2d) indicates a change to a decreasing trend since 2021, but estimates are still well above the long-term average. With lower recruitment in recent years as indicated in the assessment, spawning biomass is expected to decrease in the future. However, there is some indication that another new cohort may be beginning to recruit into the population.

### *Tier determination/Plan Team discussion and resulting ABCs and OFLs*

The biomass estimates of the Tier 5 “other skates” component of the stock are based on a natural mortality rate of 0.10 and derived using the random effects model. The Team discussed the possibility of deriving different values of *M* for the various species within this component of the stock in the future but accepted the Tier 5 harvest specifications as presented noting this is an area for future work. The resulting ABCs for this portion of the stock is 9,858 t for both 2024 and 2025, and the resulting OFLs for this portion of the stock is 13,145 t for both 2024 and 2025.

For the Alaska skate portion, projected spawning biomass for 2024 (106,549 t) exceeds  $B_{40\%}$  (69,152 t), so Alaska skates are managed in sub-tier “a” of Tier 3. The Alaska skate portions of the 2024 and 2025 ABCs are 27,950 t and 26,767 t, respectively, and the Alaska skate portions of the 2024 and 2025 OFLs

are 32,429 t and 31,058 t. Other reference points for Alaska skates are  $\max F_{ABC} = F_{40\%} = 0.080$  and  $F_{OFL} = F_{35\%} = 0.093$ .

In aggregate, the harvest recommendations for the BSAI skate stock complex are ABCs of 37,808 t and 36,625 t for 2024 and 2025, and OFLs of 45,574 t and 44,203 t for 2024 and 2025 respectively.

### *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**

In accordance with the approved schedule, a catch report was provided for the BSAI shark complex this year. However, a full stock assessment will be conducted in 2026. Until then, the values generated from the previous stock assessment (below) will be used for 2024-2025 specifications. Please refer to the previous stock assessment for details regarding the assessment model and trends. The grayed-out text below the following table summarizes the 2022 assessment and the status and catch specifications (t) of the BSAI shark complex in recent years. The OFL and ABC for 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2022	n/a	689	517	500	127
	2023	n/a	689	450	333	320
	2024	n/a	689	450		
	2025	n/a	689	450		

The Sharks TAC was increased by 83 t to 333 t by NMFS in-season management in 2023

### *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

Through 2010, octopuses were managed as part of the Bering Sea/Aleutian Islands (BSAI) “other species” complex, along with sharks, skates, and sculpins. Historically, catches of the other species complexes were well below TAC. Due to increasing market values, retention of species within the other species complex increased. Beginning in 2011, an amendment to the BSAI fisheries management plan provided separate management for sharks, skates, sculpins, and octopus and set catch limits for each species group. Initially, catch limits for octopus were set using Tier 6 methods based on the maximum historical incidental catch rate. Since 2012, a methodology based on consumption of octopus by Pacific cod (*Gadus macrocephalus*) has been used to set catch limits (see Conners et al. (2016) for methodological details).

This year’s assessment is an operational update, meaning new consumption data was provided through 2023 to determine catch limits using the previous assessment’s model/methodology. Alternative models/methodologies were not considered. At least eight species of octopus are found in the BSAI though in this update assessment, all octopus species are grouped into a single assemblage. The species composition of the octopus community is not well documented, but data indicate that the giant Pacific octopus (*Enteroctopus dofleini*) is the most common. Octopuses are taken as incidental catch in trawl, longline, and pot fisheries with a portion retained and sold for human consumption or bait. The BSAI trawl surveys produce highly variable biomass estimates for octopus

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 2024 and 2025 are those recommended by the Team. Catch data are current through November 5, 2023.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2022	n/a	4,769	3,576	700	251
	2023	n/a	4,769	3,576	400	151
	2024	n/a	6,080	4,560		
	2025	n/a	6,080	4,560		

### *Changes from previous assessment*

Changes in data input:

1. The calculation of annual and long-term average consumption rates has been updated using 13,614 additional Pacific cod stomach samples collected from 2012-2013 and 2016-2023.

Changes in Assessment Methodology:

There have been no changes to the assessment methodology

### *Spawning biomass and stock trends*

Species composition and size frequencies from the surveys were similar to previous years. Survey biomass estimates decreased substantially from 2019 through 2023 (-54%) for the EBS shelf survey. A similar decline from 2018 to 2022 was observed in the AI survey (-32%). However, trawl surveys sample octopus poorly, and biomass estimates from trawl surveys are not considered reliable as they are highly variable between years.

At least eight species of octopus are found in the BSAI though in this update assessment, all octopus species are grouped into a single assemblage. The species composition of the octopus community is not well documented, but data indicate that the giant Pacific octopus (*Enteroctopus dofleini*) is the most common. Octopuses are taken as incidental catch in trawl, longline, and pot fisheries with a portion retained and sold for human consumption or bait. The highest catch occurring in the Pacific cod fishery.

### *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. This year's assessment is an operational update, meaning new consumption data was provided through 2023 to determine catch limits using the previous assessment's model/methodology.

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.

## **Appendix 1. Forage Species**

The forage species report for the Bering Sea and Aleutian Islands (BSAI) region is prepared and presented to the BSAI Plan Team and the North Pacific Fishery Management Council (NPFMC) in odd years. The report is not a formal stock assessment; it is a presentation of the available data on trends in abundance and distribution of forage populations and a description of their interactions with federal fisheries through bycatch.

Forage species are a fundamental component of the BSAI ecosystem, so there is overlap between the information presented here and in the Ecosystem Considerations report (<https://access.afsc.noaa.gov/reem/ecoweb/index.php>). The forage report primarily displays data from the BSAI bottom trawl surveys and BASIS surface water surveys. The Ecosystem Considerations report contains euphausiid abundances from acoustic surveys and indirect indicators of forage species abundance such as seabird breeding success and groundfish predator diets.

Estimated capelin and eulachon density and prevalence from the NMFS bottom trawl surveys were near all time lows in 2023. Pacific herring density and prevalence has been above average for the last several years. Shrimp densities have been trending upward since the mid-1990s; prevalence peaked in 2010. Magistrate armhook squid density in the Aleutian Islands was near average in 2022. The Bering Arctic Subarctic Integrated Survey (BASIS) forage index was near all-time lows in 2023.

Total incidental catches of the FMP forage group were low in 2022 and 2023 compared to historical values. Total shrimp catches decreased in 2022, but were near all time highs in 2023. Prohibited species catch of herring has been higher than average since 2020, with the third highest catches ever observed in 2023.

## **Appendix 2. Sculpins**

Sculpins are managed as non-target species in the BSAI and GOA, and are taken only as bycatch during directed fishing for other species. In 2020, a final rule was issued which reclassified sculpins as Ecosystem Component category, non-target species in the Bering Sea/Aleutian Islands (BSAI) (Amendment 121) and Gulf of Alaska (Amendment 110) Groundfish Fishery Management Plans (85 FR 06310, March 23, 2020 for the proposed rule, and 85 FR 41427, July 10, 2020 for the final rule). Prior to this rule the sculpin complexes were not in the FMPs (i.e. "nonspecified"). Under this rule, sculpins are not allowed to be targeted, and there is a Maximum Retainable Allowance (MRA) of 20% in the BSAI and GOA (Federal Register, Proposed Rules, Vol. 79, No. 93). This rule applies to all vessels processing groundfish harvested in the BSAI or GOA (50 CFR 679) and it prohibits directed fishing. Stock assessments are not required for Ecosystem Component species. There are no ABC or OFL catch limits adopted in the annual groundfish harvest specifications. The Ecosystem Report for the combined BSAI and GOA is presented for tracking trends in abundance and catch. For the first year of this Ecosystem Component sculpin report, unofficial OFL and ABC values based on the former Tier 5 assessment methods, are provided for comparison as an appendix. Because overfishing is not defined for an Ecosystem Component, the values provided are not used for management or for determining if overfishing is occurring. Through the stock assessment prioritization process, the sculpin report is now on a 4-year cycle. Prior to the shift of sculpins to the Ecosystem Component category, the last full BSAI

SAFE assessment was presented in 2016 and a partial assessment in 2019. New data in the sculpin report include: 1) updated catch data through October 16, 2023; 2) survey biomass estimates from the 2022 Aleutian Islands survey, the 2020-2023 Eastern Bering Sea surveys, the 2021 and 2023 Gulf of Alaska surveys and 3) updated GOA and BSAI trawl survey biomass time series estimates through 2023 using a random effects multivariate assessment (REMA) model.

## Tables

Table 1. BSAI Groundfish Plan Team Recommended OFLs and ABCs for 2024 and 2025 (metric tons); OFL, ABC, TAC and catch through November 5, 2023.

Species	Area	2023		TAC	Catch as of 11/5/2023	2024		2025	
		OFL	ABC			OFL	ABC	OFL	ABC
Pollock	EBS	3,381,000	1,910,000	1,314,500	1,307,997	3,162,000	2,313,000	3,449,000	2,401,000
	AI	52,383	43,413	4,500	3,665	51,516	42,654	53,030	43,863
	Bogoslof	115,146	86,360	300	118	115,146	86,360	115,146	86,360
Pacific cod	BS	172,495	144,834	127,409	112,963	200,995	167,952	180,798	150,876
	AI	18,416	13,812	8,425	3,750	18,416	12,732	18,416	12,732
Sablefish	BSAI/GOA	47,390				55,084	47,146	55,317	47,350
	BS		8,417	7,996	5,164		11,450		11,499
	AI		8,884	8,440	2,319		13,100		13,156
Yellowfin sole	BSAI	404,882	378,499	230,000	105,682	305,298	265,913	317,932	276,917
Greenland turbot	BSAI	4,645	3,960	3,722	1,272	3,705	3,188	3,185	2,740
	BS		3,338	3,180	793		2,687		2,310
	AI		622	592	479		501		430
Arrowtooth flounder	BSAI	98,787	83,852	15,000	6,948	103,280	87,690	104,270	88,548
Kamchatka flounder	BSAI	8,946	7,579	7,579	6,926	8,850	7,498	8,687	7,360
Northern rock sole	BSAI	166,034	121,719	66,400	26,907	197,828	122,091	264,789	122,535
Flathead sole	BSAI	79,256	65,344	35,100	8,759	81,605	67,289	82,699	68,203
Alaska plaice	BSAI	40,823	33,946	17,875	15,018	42,695	35,494	45,182	37,560
Other flatfish	BSAI	22,919	17,189	4,500	2,994	22,919	17,189	22,919	17,189
Pacific Ocean perch	BSAI	50,133	42,038	37,703	34,720	49,010	41,096	48,139	40,366
	BS		11,903	11,903	10,196		11,636		11,430
	EAI		8,152	8,152	7,255		7,969		7,828
	CAI		5,648	5,648	5,461		5,521		5,423
	WAI		16,335	12,000	11,807		15,970		15,685
Northern rockfish	BSAI	22,776	18,687	11,000	10,308	23,556	19,274	22,838	18,685
Blackspotted/Rougheye Rockfish	BSAI	703	525	525	523	761	569	813	607
	EBS/EAI		359	359	207		388		412
	CAI/WAI		166	166	316		181		195
Shortraker rockfish	BSAI	706	530	530	224	706	530	706	530
Other rockfish	BSAI	1,680	1,260	1,260	1,179	1,680	1,260	1,680	1,260
	BS		880	880	618		880		880
	AI		380	380	560		380		380
Atka mackerel	BSAI	118,787	98,588	69,282	65,527	111,684	95,358	99,723	84,676
	EAI/BS		43,281	27,260	23,776		41,723		37,049
	CAI		17,351	17,351	17,210		16,754		14,877
	WAI		37,956	24,671	24,541		36,882		32,750
Skates	BSAI	46,220	38,605	27,441	24,605	45,574	37,808	44,203	36,625
Sharks	BSAI	689	450	333	320	689	450	689	450
Octopuses	BSAI	4,769	3,576	400	151	6,080	4,560	6,080	4,560
<b>Total</b>	BSAI	<b>4,859,585</b>	<b>3,132,067</b>	<b>2,000,270</b>	<b>1,748,036</b>	<b>4,609,077</b>	<b>3,454,506</b>	<b>4,946,241</b>	<b>3,528,297</b>

Sources: 2023 OFLs, ABCs, and TACs are from harvest specifications adopted by the Council in December 2022 as well as in season actions; 2023 catches through November 5, 2023 from AKR Catch Accounting. NMFS increased TACs for Sharks and Alaska Plaice in 2023 from the in-season reserve above those initially set in 2022 however total catch remained < 2,000,000 t



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	2024					
		Tier	$\max F_{ABC}$	$F_{ABC}$	$\max ABC$	ABC	% Red.
Pollock	EBS	1a	0.379	0.33	2,837,000	2,313,000	18%
Pacific cod	AI	5	0.255	0.255	13,812	12,732	8%
Northern rock sole	BSAI	1a	0.169	0.129	189,360	122,091	36%
Blackspotted Roughey rockfish	AI	3b	0.034	0.034	583	511	12%
Sharks	BSAI	6	n/a	n/a	517	450	13%
		2025					
		Tier	$\max F_{ABC}$	$F_{ABC}$	$\max ABC$	ABC	% Red.
Pollock	EBS	1a	0.379	0.33	3,449,000	2,401,000	30%
Pacific cod	AI	5	0.255	0.255	13,812	12,732	8%
Northern rock sole	BSAI	1a	0.169	0.108	253,455	122,535	52%
Blackspotted Roughey rockfish	AI	3b	0.034	0.034	627	549	12%
Sharks	BSAI	6	n/a	n/a	517	450	13%

Table 3. Final 2024 and 2025 Pacific halibut Discard Mortality Rates (DMR) for the BSAI

<b>Gear</b>	<b>Sector</b>	<b>Halibut discard mortality rate (percent)</b>
Pelagic trawl	All	100
Non-pelagic trawl	Mothership and catcher/processor	85
Non-pelagic trawl	Catcher vessel	63
Hook-and-line	Catcher vessel	7
Hook-and-line	Catcher/processor	7
Pot	All	26