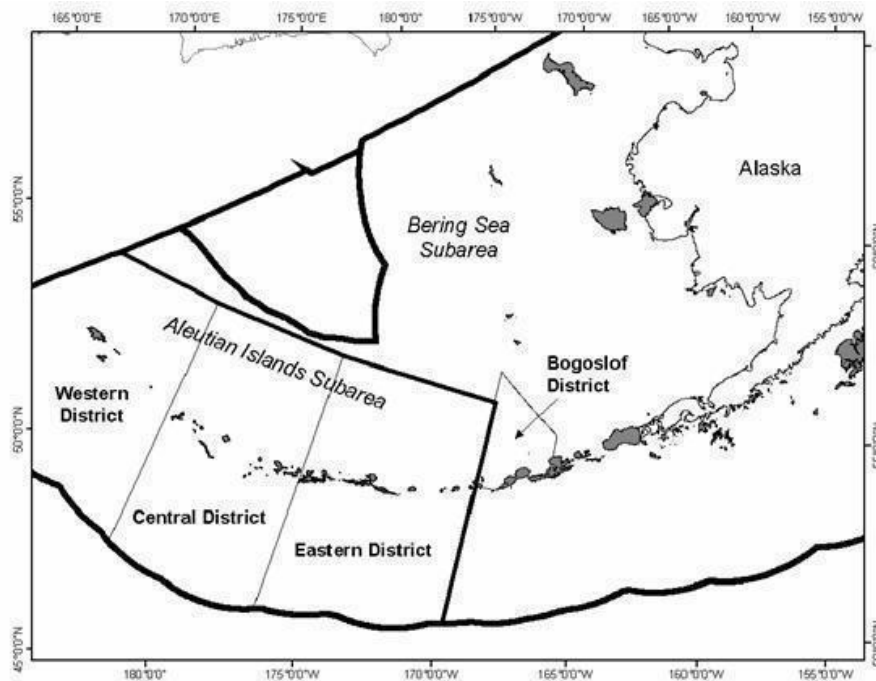


STOCK ASSESSMENT AND FISHERY EVALUATION REPORT
FOR THE GROUND FISH RESOURCES
OF THE BERING SEA/ALEUTIAN ISLANDS REGIONS

Compiled by:

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



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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	6
Definition of Acceptable Biological Catch and the Overfishing Level	6
Standard Harvest and Recruitment Scenarios and Projection Methodology	8
Overview of “Stock Assessment” Section	9
Summary and Use of Terms	10
Two-Year OFL and ABC Projections	10
Revised Stock Assessment Schedule	11
Economic Summary of the BSAI commercial groundfish fisheries in 2016-2017	12
Ecosystem Status Report for the EBS and AI	16
Stock Status Summaries	18
1. Walleye Pollock	18
19	
19	
19	
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	27
7. Kamchatka flounder	28
8. Northern rock sole	29
9. Flathead sole	30
10. Alaska plaice	31
11. Other Flatfish complex	32
12. Pacific ocean perch	33
13. Northern rockfish	34
14. Blackspotted and rougheye rockfish	35
15. Shortraker rockfish	37
16. Other Rockfish complex	38
17. Atka mackerel	39
18. Skates	40
19. Sculpins [from the 2017 partial assessment]	42
20. Sharks	42
21. Squid (moved to Ecosystem Component) See Appendix 1	43
22. Octopus	43
Appendix 1. Squids	45
Tables	46

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 12-15, 2019 to review the status of stocks of twenty-two 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: Grant Thompson (Co-chair), Steve Barbeaux (Co-chair), Steve A. MacLean (BSAI Groundfish FMP coordinator), Kirstin Holsman, Jane Sullivan, Andy Kingham, Allan Hicks, Mary Furuness, Cindy Tribuzio, Alan Haynie, Brenda Norcross, Kalei Shotwell, and Chris Siddon.

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.

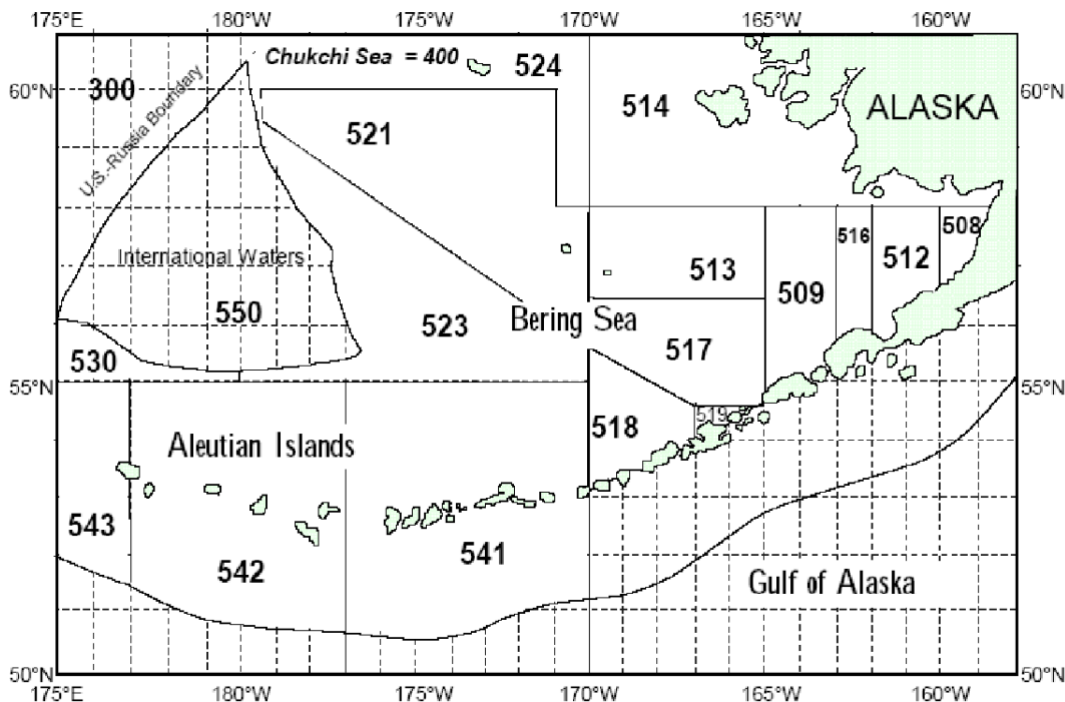


Figure 1. Bering Sea/Aleutian Islands statistical and reporting areas.

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 data base exists that allows each to be managed on its own biological merits. Accordingly, a specific TAC is established annually for each target species or species assemblage. Catch of each species must be recorded and reported. Stocks/assemblages in the target category are listed below.

Ecosystem Component:

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

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

In the fishery	Ecosystem component	
Target species¹	Prohibited species²	Forage fish species³
Walleye Pollock	Pacific halibut	Osmeridae family (eulachon, capelin, and other smelts)
Pacific cod	Pacific herring	Myctophidae family (lanternfishes)
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 (gunnels)
Kamchatka flounder		Stichaeidae family (pricklebacks warbonnets, eelblennys, cockscombs, shannys)
Northern rock sole		Gonostomatidae family (bristlemouths, lightfishes and anglemouths)
Flathead sole		Other euphausiacea (krill)
Alaska plaice		Squid
Other flatfish		
Pacific Ocean perch		
Northern rockfish		
Blackspotted/Rougheye		
Shortraker rockfish		
Other rockfish		
Atka mackerel		
Skates		
Sculpins		
Sharks		
Octopus		

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

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

³ Management measures for forage fish are established in regulations implementing the FMP.

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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. If Amendments 121/110 and their implementing regulations are approved by the Secretary of Commerce, Amendments 121/110 are anticipated to be effective by 2020. Until Amendment 121/110 is effective, NMFS will continue to publish OFLs, ABCs, and TACs for sculpins in the BSAI groundfish harvest specifications. In the future, 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 4. The initial target species in the BSAI commercial fisheries was yellowfin sole. During this period, total catches of groundfish peaked at 674,000 t in 1961. Following a decline in abundance of yellowfin sole, other species (principally walleye pollock) were targeted, and total catches peaked at 2.2 million t in 1972. Pollock is now the principal fishery, with catches peaking at approximately 1.4-1.5 million t due to years of high recruitment. After the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) was adopted in 1976, catch restrictions and other management measures were placed on the fishery and total groundfish catches have since varied from one to two million t. In 2005, Congress implemented a statutory cap on TACs for BSAI groundfish of 2 million t, which had previously been a policy adopted by the Council. Total groundfish catches in the EBS in 2018 totaled 1,823,944 t, Catches through November 2, 2019 totaled 1,791,471. For comparison catches in 2017 totaled 1,851,117 t. Pollock catches in the EBS totaled 1,356,445 t in 2017; catches through November 3, 2018 totaled 1,376,739 t.

Catches in the Aleutian Islands (AI) subarea always are much less than in the EBS (Table 5). Total AI catches peaked at 190,750 t in 1996. Total AI catches were 144,446 t in 2010, and dropped to 103,804 t in 2012. Total catch decreased again in 2015 to 99,916 t but rose in 2015 to 99,916 t and to 101,375 t in 2016 and 110,824 t in 2017, and 123,896 t in 2018. Total catch as of November 2, 2019 was 113,556 t. This increase from 2015 on is largely due to increased catch of cod and Atka mackerel.

The predominance of target species in the AI has changed over the years. Pacific ocean perch (POP) was the initial target species. As POP abundance declined, the fishery diversified to target different species. POP was the second largest fishery at 26,311 t in 2013; 26,944 t in 2014, 23,507 in 2015, 23,097 t in 2016, 23,240 t in 2017, and 25,114 t in 2019. Through November 2, 2019, POP catch was 28,476 t. Pacific ocean perch displaced Pacific cod as the second largest fishery beginning in 2011, as Pacific cod catch dropped from 29,001 t in 2010 to 9,064 in 2015 as a result of Steller sea lion protection measures; catch has increased since to 12,359 t in 2016, 12,286 in 2017, and 14,719 t in 2018. Through November 2, 2019, Pacific cod catch was 12,954 t. Atka mackerel was the largest fishery in the AI at 50,600 t in 2011 and 46,859 t in 2012 (down from 68,496 t in 2010); catch was 30,815 t in 2014 and increased to 53,003 in 2015, to 54,125 t in 2016, 63,401 t in 2017, and 69,248 t in 2018. Through November 2, 2019 Atka mackerel catch was 55,429 t. Catches since 2015 have been higher due to modifications in the Steller sea lion protection measures starting with the 2015 fishery.

Total catches since 1954 for the BSAI, combined, are shown in Table 6. Total BSAI catches were 1,354,662 t in 2010 (81 percent of the total TAC and 67 percent of the OY) and rose to 1,817,774 t in 2011 (92 percent of total TACs (which equaled the OY)), 1,914,585 t (96 percent of OY) in 2013 and 1,928,379 t in 2014 (96 percent of OY), 1,914,061 in 2015 (96 percent of OY), 1,952,492 t in 2016 (98 percent of OY), 1,909,033 t in 2017 (95% of OY) and 1,947,840 t (97% of OY). BSAI catches through November 2, 2019 were 1,905,027 t, which is 95% 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 percent 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 percent of the BS and AI pollock TACs, 20 percent of the fixed gear sablefish TAC, and 7.5 percent of the sablefish trawl gear allocation. It also receives 10.7 percent 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 2020 for each subarea are derived as 9% percent of the Bering Sea ABC (and an additional 45 t to the State jig fishery) and 35% of the Aleutian Islands subarea ABC. 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 percent 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 percent of each species or species group's TAC. 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 Tier (1), a pdf refers to a probability density function. For Tiers (1-2), if a reliable pdf of B_{MSY} is available, the preferred point estimate of B_{MSY} is the geometric mean of its pdf. For Tiers (1-5), if a reliable pdf of B is available, the preferred point estimate is the geometric mean of its pdf. For Tiers (1-3), the coefficient ' α ' is set at a default value of 0.05, with the understanding that the SSC may establish a different value for a specific stock or stock complex as merited by the best available scientific information. For Tiers (2-4), a designation of the form " $F_{X\%}$ " refers to the F associated with an equilibrium level of spawning per recruit (SPR) equal to X percent of the equilibrium level of spawning per recruit in the absence of any fishing. If reliable information sufficient to characterize the entire maturity schedule of a species is not available, the SSC may choose to view SPR calculations based on a knife-edge maturity assumption as reliable. For Tier (3), the term $B_{40\%}$ refers to the long-term average biomass that would be expected under average recruitment and $F=F_{40\%}$.

Tier	<p>1) Information available: <i>Reliable point estimates of B and B_{MSY} and reliable pdf of F_{MSY}.</i></p> <p>1a) Stock status: $B/B_{MSY} > 1$ $I_{OFL} = \mu_A$, the arithmetic mean of the pdf $F_{ABC} \leq \mu_H$, the harmonic mean of the pdf</p> <p>1b) Stock status: $\alpha < B/B_{MSY} \leq 1$ $I_{OFL} = \mu_A \times (B/B_{MSY} - \alpha)/(1 - \alpha)$ $F_{ABC} \leq \mu_H \times (B/B_{MSY} - \alpha)/(1 - \alpha)$</p> <p>1c) Stock status: $B/B_{MSY} \leq \alpha$ $I_{OFL} = 0$ $I_{ABC} = 0$</p> <p>2) Information available: <i>Reliable point estimates of B, B_{MSY}, F_{MSY}, F_{35%}, and F_{40%}.</i></p> <p>2a) Stock status: $B/B_{MSY} > 1$ $F_{OFL} = F_{MSY}$ $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%})$</p> <p>2b) Stock status: $\alpha < B/B_{MSY} \leq 1$ $I_{OFL} = I_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)$ $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)$</p> <p>2c) Stock status: $B/B_{MSY} < \alpha$ $F_{OFL} = 0$ $F_{ABC} = 0$</p> <p>3) Information available: <i>Reliable point estimates of B, B_{40%}, F_{35%}, and F_{40%}.</i></p> <p>3a) Stock status: $B/B_{40\%} > 1$ $F_{OFL} = F_{35\%}$ $F_{ABC} \leq F_{40\%}$</p> <p>3b) Stock status: $\alpha < B/B_{40\%} < 1$ $F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$ $F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$</p> <p>3c) Stock status: $B/B_{40\%} < \alpha$ $F_{OFL} = 0$ $F_{ABC} = 0$</p> <p>4) Information available: <i>Reliable point estimates of B, F_{35%}, and F_{40%}.</i> $I_{OFL} = F_{35\%}$ $I_{ABC} \leq F_{40\%}$</p> <p>5) Information available: <i>Reliable point estimates of B and natural mortality rate M.</i> $F_{OFL} = M$ $I_{ABC} < 0.75 \times M$</p> <p>6) Information available: <i>Reliable catch history from 1978 through 1995.</i> $OFL =$ the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information $ABC \leq 0.75 \times OFL$</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. 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 2019 and 2020, are as follow (“ $max F_{ABC}$ ” refers to the maximum permissible value of F_{ABC} under Amendment 56):

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

Scenario 2: In all future years, F is set equal to a constant fraction of $max F_{ABC}$, where this fraction is equal to the ratio of the F_{ABC} value for 2020 recommended in the assessment to the $max F_{ABC}$ for 2020, and where catches for 2020 and 2021 are estimated at their most likely values given the 2020 and 2021 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 2020 or 2) above 1/2 of its MSY level in 2020 and expected to be above its MSY level in 2029 under this scenario, then the stock is not overfished.)

Scenario 7: In 2019 and 2020, 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 2020 or 2) above 1/2 of its MSY level in 2020 and expected to be above its MSY level in 2030 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 2020 and 2021 ABCs and OFLs are summarized in Tables 1, 2, and 3.

The sum of the recommended ABCs for 2020 and 2021 are 3,273,825 t and 2,968,033 t, respectively. These compare with the sums of the 2019 (3,367,578) and 2018 (3,766,809 t). The primary decrease from previous years is due to declines in EBS pollock, and Pacific cod. The Team recommended maximum permissible ABCs for all stocks, except for EBS pollock and Sablefish (Table 2).

Overall, the status of the stocks continues to appear favorable. Nearly all stocks are above B_{MSY} or the B_{MSY} proxy of $B_{35\%}$ (Figure 2). The abundances of EBS pollock, EBS Pacific cod, all rockfishes managed under

Tier 3, and all flatfishes managed under Tiers 1 or 3 are projected to be above B_{MSY} or the B_{MSY} proxy of $B_{35\%}$ in 2020 while Blackspotted/Rougheye rockfish remain below this target level.

Bering Sea and Aleutian Islands

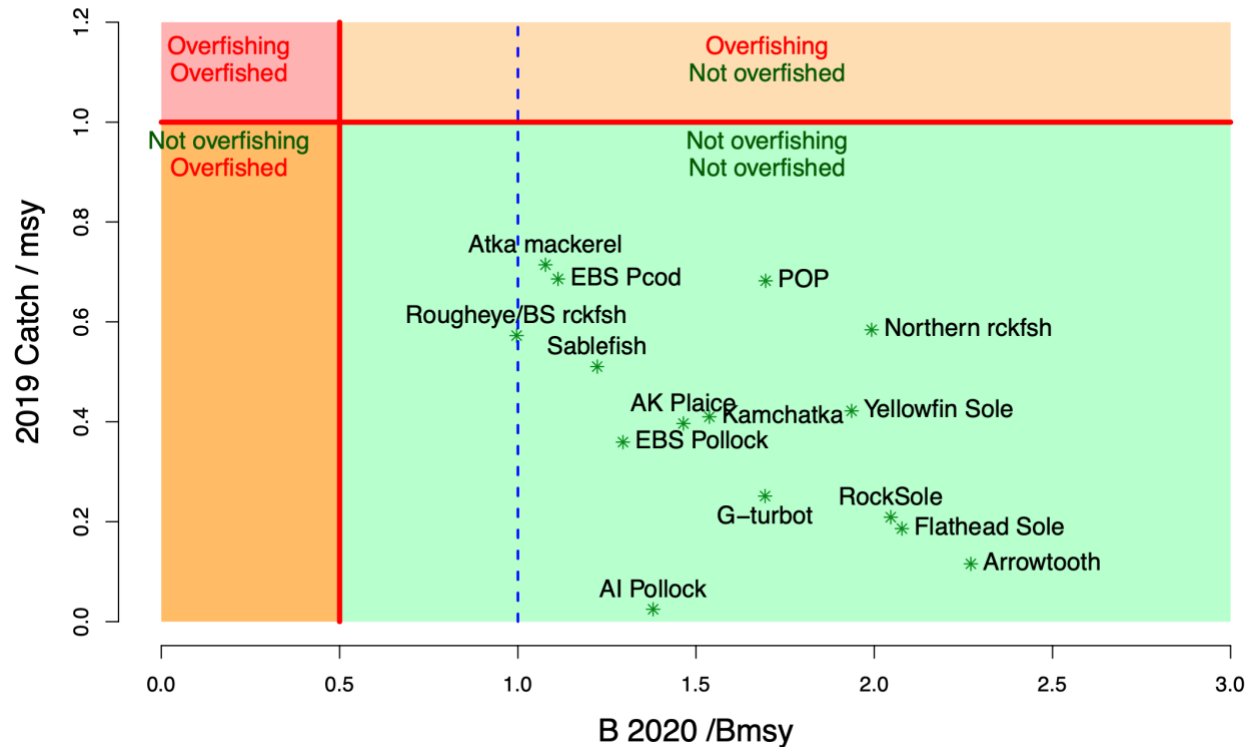


Figure 2. Summary of Bering Sea stock status next year (spawning biomass relative to B_{msy} ; horizontal axis) and current year catch relative to fishing at F_{msy} (vertical axis) where F_{OFL} is taken to equal F_{msy} .

The sum of the biomasses for 2020 listed in Table 3 (19,110,169 t) is a slight decline (1%) from 2019 (19,354,358 t). This is primarily due to declines in EBS pollock and Pacific cod balanced by increases in some flatfish and rockfish stocks. 2019 in turn was nearly identical (<0.01% decline) to 2018. The 2017 value represented an increase of 9% from 2016 after stable biomasses from 2013. This stability and current relative increases follow periods of declines since 2010.

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 3, 2018.

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 2020 harvest specifications (from Council recommendations in December 2018) are in place to start the fishery on January 1, 2020, but these will be replaced by final harvest specifications that will be recommended by the Council in December 2019. The final 2020 and 2021 harvest specifications will become effective when final rulemaking occurs in February or March 2020. 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 2021 ABC and OFL values recommended in next year's SAFE report are likely to differ from this year's projections for 2021 because of new information (e.g., survey) that is incorporated into the assessments. In the case of stocks managed under Tier 3, ABC and OFL projections for the second year in the cycle are typically based on the output for Scenario 2 from the standard projection model using assumed (best estimates) of actual catch levels. For stocks managed under Tiers 4-6, projections for the second year in the cycle are set equal to the Plan Team's recommended values for the first year in the cycle.

Revised Stock Assessment Schedule

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

Stock Assessment schedule for Bering Sea-Aleutian Islands

Stock	2019 SAFE Assessment status	Tier	Schedule (years)	Year of next full assessment
Eastern Bering Sea pollock	Full	1	1	2020
Bogoslof Island Pollock	None	5	2	2020
Aleutian Islands pollock	Partial	3	2	2020
Eastern Bering Sea Pacific Cod	Full	3	1	2020
Aleutian Islands Pacific cod	Full	5	1	2020
Sablefish	Full	3	1	2020
Yellowfin sole	Full	1	1	2020
Greenland Turbot	Partial	3	2	2020
Arrowtooth flounder	Partial	3	2	2020
Kamchatka flounder	Partial	3	2	2020
Northern Rock sole	Partial	1	2	2020
Flathead sole	Partial	3	2	2020
Alaska plaice	Full	3	2	2021
Other flatfish	None	5	4	2020
Pacific ocean perch	Partial	3	2	2020
Northern rockfish	Full	3	2	2021
Rougheye & blackspotted rockfish	Partial	3	2	2020
Shortraker rockfish	None	5	2	2020
Other rockfish	None	5	2	2020
Atka mackerel	Full	3	1	2020
Skates	Partial	3/5	2	2020
Sharks	None	5	2	2020
Octopus	None	6	2	2020
Sculpins	Partial	5	4	2020*
Forage Species (including Squids)	Report	Eco	2	2021
Grenadiers (BSAI/GOA)	None	Eco	4	2020

*Amendments 121/110 to the BSAI/GOA FMPs move sculpins to the ecosystem component. If approved and implemented for 2020, no sculpin assessment will be required in 2020.

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

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

Economic Summary of the BSAI commercial groundfish fisheries in 2017-2018

The ex-vessel value of all Alaska domestic fish and shellfish catch, which includes the amount paid to harvesters for fish caught, and the estimated value of pre-processed fish species that are caught by catcher/processors, decreased from \$ 2,039 million in 2017 to \$1,834 million in 2018. The first wholesale value of 2018 groundfish catch after primary processing was \$ 2,543 million. The 2018 total groundfish catch decreased by 2.5%, and the total first-wholesale value of groundfish catch decreased by 1%, relative to 2017.

The groundfish fisheries accounted for the largest share (54%) of the ex-vessel value of all commercial fisheries off Alaska, while the Pacific salmon (*Oncorhynchus spp.*) fishery was second with \$551 million or 30% of the total Alaska ex-vessel value. The value of the shellfish fishery amounted to \$182 million or 10% of the total for Alaska and exceeded the value of Pacific halibut (*Hippoglossus stenolepis*) with \$88 million or 5% of the total for Alaska.

The Economic SAFE report (appendix bound separately) contains detailed information about economic aspects of the groundfish fisheries, including figures and tables, economic performance indices, current year product price and ex-vessel price projections, an Amendment 80 fishery economic data report (EDR) summary, an Amendment 91 fishery economic data report (EDR), market profiles for the most commercially valuable species, a summary of the relevant research being undertaken by the Economic and Social Sciences Research Program (ESSRP) at the Alaska Fisheries Science Center (AFSC), and a list of recent publications by ESSRP analysts. The report will now also include a Gulf Trawl economic data report, but will exclude the previous community participation summaries and the catch share fishery indicators, which will be moved into a separate report due to a time lag in data availability. Data tables are organized into four relatively distinct sections: (1) All Alaska, (2) BSAI, (3) GOA, and (4) Pacific halibut. The figures and tables in the report provide estimates of total groundfish catch, groundfish discards and discard rates, prohibited species catch (PSC) and PSC rates, the ex-vessel value of the groundfish catch, the ex-vessel value of the catch in other Alaska fisheries, the gross product value of the resulting groundfish seafood products, the number and sizes of vessels that participated in the groundfish fisheries off Alaska, vessel activity, and employment on at-sea processors. Generally, the data presented in this report cover 2014-2018, but limited catch and ex-vessel value data are reported for earlier years to illustrate the rapid development of the domestic groundfish fishery in the 1980s and to provide a more complete historical perspective on catch. The data behind the tables from this and past Economic SAFE reports are available online at: <https://reports.psmfc.org/akfin> and <https://psesev.psmfc.org/PSESV-2/>.

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

According to data reported in the 2019 Economic SAFE report, the total ex-vessel value of BSAI groundfish increased 12 percent from \$738 million in 2017 to \$827 million in 2018 (Figure 3), and first-wholesale revenues from the processing and production of groundfish in the Bering Sea and Aleutian Islands (BSAI) increased by 2% between 2017 (\$2,199 million) and 2018 (\$2,246 million) (Figure 4). At the same time, the total quantity of groundfish products from the BSAI remained essential constant, decreasing by 0.1% from 824 thousand metric tons to 823 thousand metric tons. These changes in the BSAI differed from those in the GOA where wholesale revenue decreased by 21 percent; there was a 1% year-to-year decrease in first-wholesale revenues from Alaska groundfish fisheries overall.

Decomposition of the change in first-wholesale revenues from 2016-17 in the BSAI

The following brief analysis summarizes the overall *nominal* revenue changes that occurred between 2017-18 in the quantity produced and revenue generated from BSAI groundfish and how revenues have been impacted by changes in quantity or prices of each species and product group. These values are not adjusted for inflation, so enable a simple comparison of how changes in the price and quantity for each group combine to produce revenues.

By BSAI species group, small positive price effects and larger positive quantity effects resulted in a positive net effect of about \$45 million for pollock. For Pacific cod, a large positive price effect combined with a smaller but still substantial negative quantity effect, resulting in a \$24 million net increase in first-wholesale revenues for Pacific cod from the BSAI for 2017-18 (Figure 5). There was a small negative price effect and larger positive quantity effect for rockfish, resulting in a net positive effect of \$3 million. Atka mackerel had a small negative price effect and a larger positive quantity effect, combining for a net positive effect of \$3 million. Flatfish had a large positive price effect combined with a smaller negative quantity effect resulting in a net positive revenue increase of \$20 million. Sablefish had a negative price effect of \$4 million and a positive quantity effect of \$1 million, combining for a net positive effect of \$2.5 million. “Other” experienced a net revenue increase of \$4 million.

By product group, large positive price effects coupled with similar positive quantity effects in the fillets category resulted in a positive net effect of \$72 million in the BSAI first-wholesale revenue decomposition for 2017-18. For surimi, large negative price effects coupled with very small negative quantity effects resulted in a negative net effect of \$27 million. For roe, as in the previous year, small positive price effects coupled with larger positive quantity effects to result in a positive net effect of \$21 million. For whole fish and head & gut, a large positive price effect combined with a smaller put still large negative quantity effect to produce a net positive effect of \$26 million while for ‘other’ products a positive price effect combined with a smaller negative quantity effect for a net positive effect of \$2 million.

In summary, the changes in first-wholesale revenues from the BSAI groundfish fisheries increased from 2017-18 due in large part to positive price effects for flatfish and Pacific cod, and positive quantity effects for pollock. In comparison, first-wholesale revenues decreased from 2017-18 in the GOA. The main drivers of this GOA decline was a negative net revenue effect for flatfish, Pacific cod, and sablefish only being partially offset by positive net effects for pollock, Atka mackerel, and rockfish.

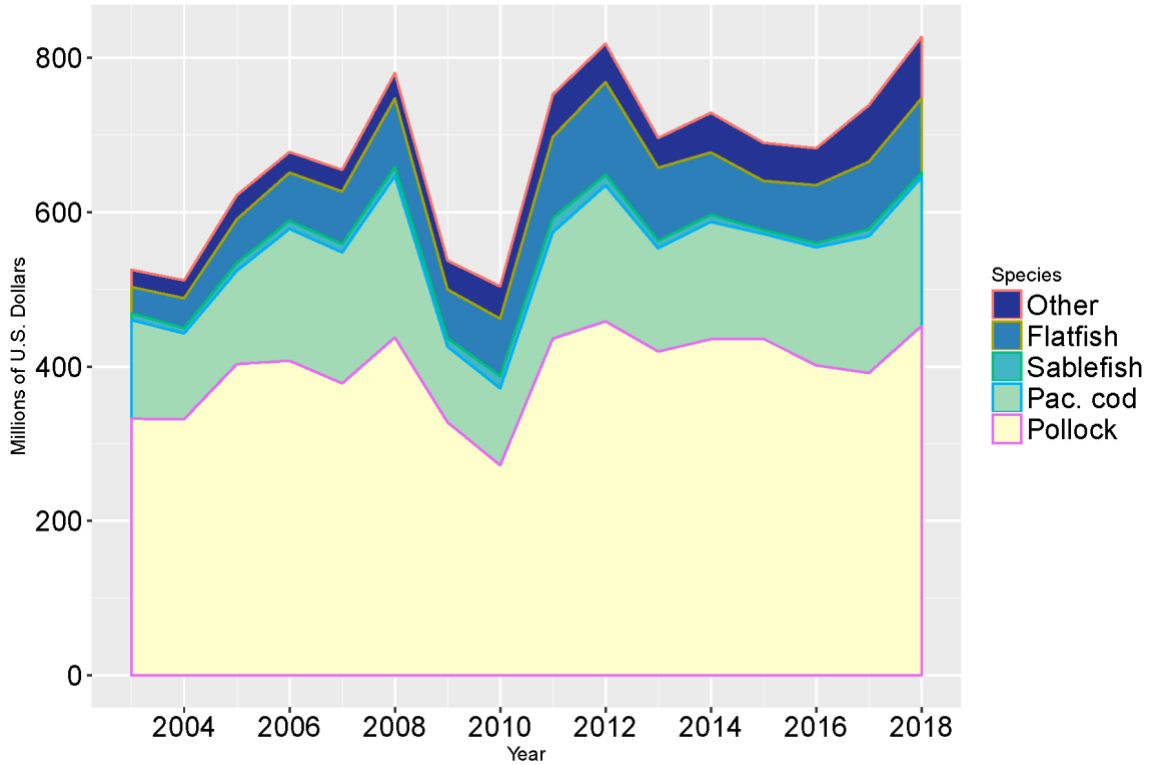


Figure 3. Real ex-vessel value of the groundfish catch in the domestic commercial fisheries in the BSAI area by species, 2003-2018 (base year = 2018).

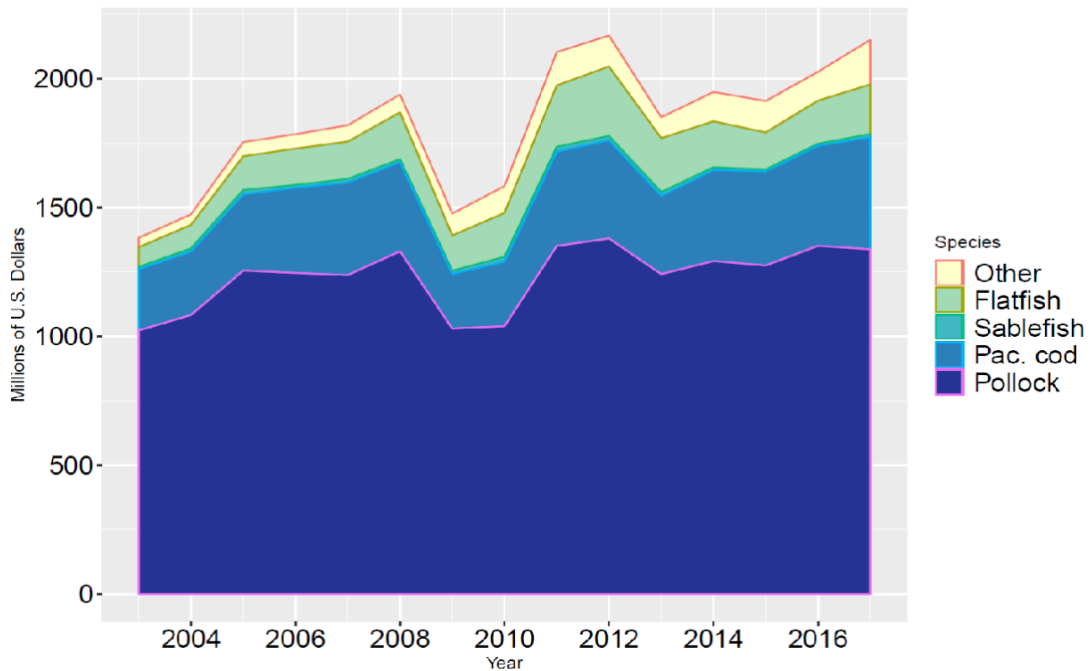


Figure 4. Real gross product value of the groundfish catch in the BSAI area by species, 2003-2018 (base year = 2018).

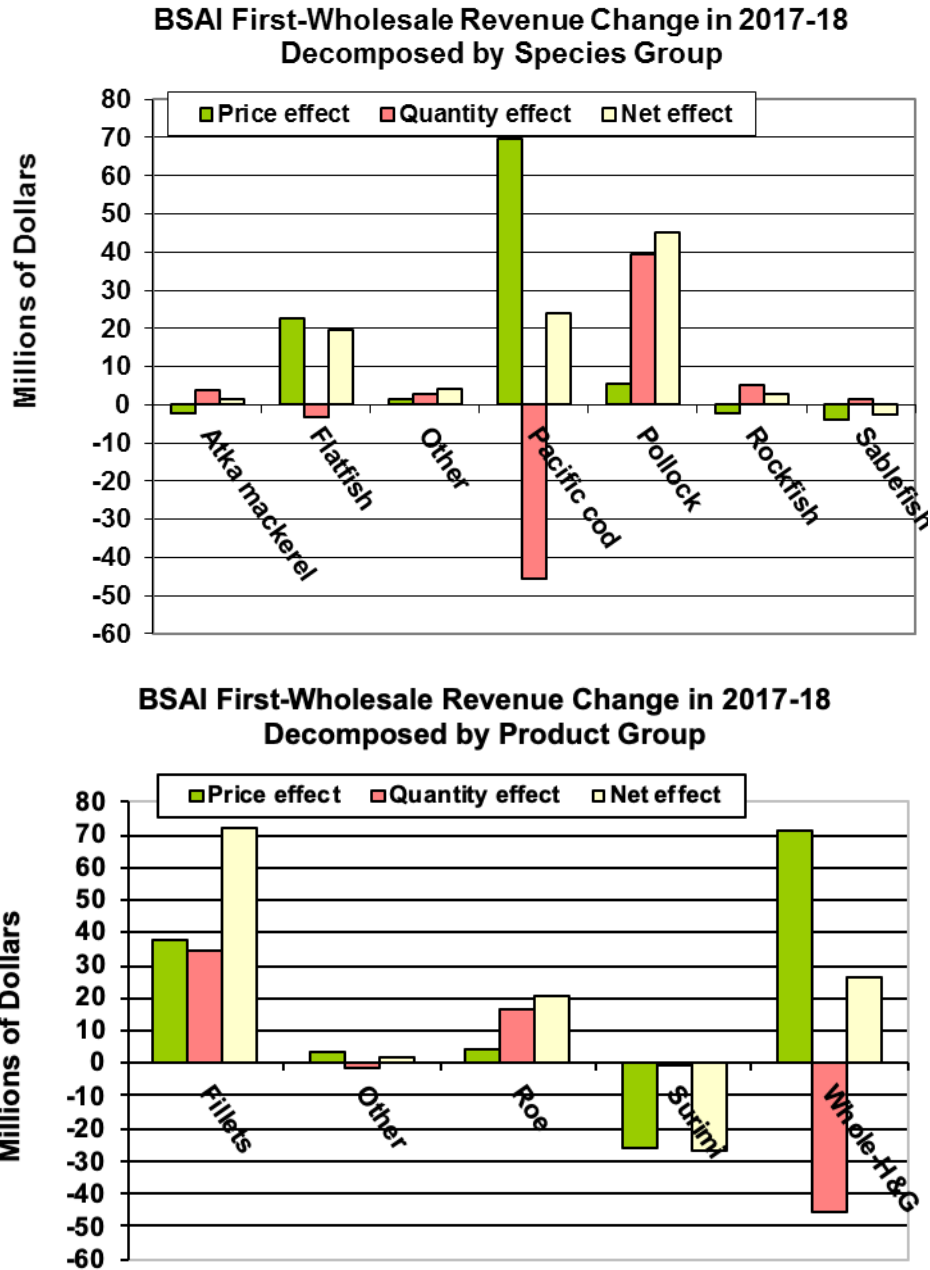


Figure 5. Decomposition of the change in first-wholesale revenues from 2017-18 in the BSAI area. The first decomposition is by the species groups used in the Economic SAFE report, and the second decomposition is by product group. The price effect refers to the change in revenues due to the change in the first-wholesale price index (current dollars per metric ton) for each group. The quantity effect refers to the change in revenues due to the change in production (in metric tons) for each group. The net effect is the sum of price and quantity effects. Year-to-year changes in the total quantity of first-wholesale groundfish products include changes in total catch and the mix of product types (e.g., fillet vs. surimi).

Ecosystem Status Report for the EBS and AI

2019 represents the warmest bottom temperatures on record for the EBS, including unprecedented warm conditions in the inner domain, it is also a second winter in a row of low sea ice in NBS, with “physics to fisheries” impacts on the cold pool through fish distributions (juveniles and adults). Sea ice extent was anomalously low in the winter of 2018/2019 (despite an early near-normal ice extent through Jan. that rapidly retreated in Feb. 2019). As a result, there was a small cold pool in the NBS (only slightly larger than 2018). The zooplankton prey base in 2019 was dominated by small, lipid poor copepods and there was a low abundance of lipid rich large copepods and euphausiids. This shift in prey base has potential impacts on the carrying capacity of the system, especially for newly recruited juvenile fish. In contrast to previous years, there were below average coccolithophore blooms in 2019. The spring bloom was ~9 d earlier than normal, and jellyfish abundance continued to increase.

Upper trophic level responses were mixed. There was declaration by NOAA of an Unusual Mortality Event (UME) due to 200+ emaciation-caused deaths of gray whales migrating back to the EBS. This reflects the poor 2018 foraging conditions; in the EBS gray whales feed on amphipods, mysids, crab larvae, and are in potential competition with groundfish in the NBS. Similarly, short-tailed shearwater die-offs were observed in 2019, reflective of 2018 foraging conditions (e.g., euphausiids) in the EBS before making migrations. Like previous years, ice seals continued to be impacted by lack of sea ice. A NOAA UME was also declared for Ice Seals in 2019. Like gray whales, many carcasses were young animals that were in poor condition or emaciated, and pups exhibited a decline in condition (blubber thickness), possibly reflecting competition with fish in the NBS and lack of ice.

In contrast, conditions likely improved in 2019 for other upper-trophic consumers like seabirds (except short-tailed shearwaters). Seabirds may have been successful at finding lipid rich copepods and euphausiids, even though abundances were low, competition for available prey may have been reduced as a result of shearwater mortality and/or poor recruitment events for fish species. Colonies at the Pribilof Islands may have benefited from northward shifts in fish populations. There remains a high level of concern regarding food security for local communities in Alaska that rely on subsistence resources including seabirds.

Similarly, fish condition in the SEBS survey in 2019 was above average. Multiple groundfish stocks like pollock appear to be persisting through warm conditions and/or are utilizing cold water refugia in the Northern Bering Sea. For example, the pollock 2018 year class appears strong, Pacific cod biomass continue to increase in the NBS, and groundfish condition across multiple species increased from 2018. Groundfish biomass in the NBS continued to increase (30% since 2017) as did abundance (52% increase relative to the 2017 survey). Abundance in the SEBS increase 112% from 2018 while biomass increased slightly (2% relative to 2018). There was indication of recruitment of some key fish species in both areas (e.g., Pacific cod). Juvenile Walleye pollock (age 0) pollock were captured in the NBS, and the SEBS saw a 75% increase in juvenile pollock biomass. Other species show mixed responses. Bristol Bay sockeye had the 4th largest return since 1963; crab biomass is down, likely reflecting multiple years of benthic productivity, difference in larval recruitment, and changes (increase) in predation. The OSCURS model based index of on-shore transport (key for flatfish recruitment) showed high on-shore transport, which is in contrast to previous years of offshore or little-onshore transport. For pollock, below average recruitment is projected from age 0 energy density, diet energy density, and surface silicic acid, while the temperature change index indicates increased recruitment. Combination of reduced predation and increased productivity may have led to increased survival (based on CEATTLE).

Warm conditions are projected to continue through winter 2019/2020.

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 2+ for the Aleutian Islands and the survey biomass for Bogoslof, as reported in the respective assessments. The OFL and ABC for 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019.

Area	Year	Biomass	OFL	ABC	TAC*	Catch
Eastern Bering Sea	2018	10,967,000	4,797,000	2,592,000	1,364,341	1,379,306
	2019	10,119,000	3,914,000	2,163,000	1,397,000	1,406,063
	2020	8,580,000	4,273,000	2,045,000	n/a	n/a
	2021	7,987,000	3,456,000	1,716,000	n/a	n/a
Aleutian Islands	2018	272,675	49,289	40,788	19,000	1,805
	2019	319,892	62,240	52,887	19,000	1,592
	2020	340,680	66,973	55,120	n/a	n/a
	2021	367,017	70,970	58,384	n/a	n/a
Bogoslof	2018	434,760	130,428	60,800	450	14
	2019	610,267	183,080	137,310	75	208
	2020	610,267	183,080	137,310	n/a	n/a
	2021	610,267	183,080	137,310	n/a	n/a

* In 2018, NMFS reallocated 14,100 t of pollock TAC from the Aleutian Islands to the Bering Sea, which increased the Bering Sea TAC to 1,378,441 t and decreased the Aleutian Islands TAC to 4,900 t. In 2019, NMFS reallocated 16,500 t of pollock TAC from the Aleutian Islands to the Bering Sea, which increased the Bering Sea TAC to 1,413,500 t and decreased the Aleutian Islands TAC to 2,500 t

Eastern Bering Sea pollock

Changes from previous assessment

New data in this year’s assessment include the following:

- The 2019 NMFS bottom-trawl survey (BTS) biomass and abundance at age estimates were included.
- The 2018 NMFS acoustic-trawl survey (ATS) biomass and abundance were updated (using an age-length key from that survey).
- The 2019 opportunistic acoustic data from vessels (AVO) conducting the bottom trawl survey was used as an added index of pollock biomass in mid-water.
- Observer data for catch-at-age and average weight-at-age from the 2018 fishery were finalized and included.
- Total catch as reported by NMFS Alaska Regional office was updated and included through 2019.

Model 16.1, which has been used for recommending harvest specifications since 2016, was used again this year.

Spawning biomass and stock trends

Spawning biomass in 2008 was at the lowest level since 1980 but had increased by a factor of 2.57 by 2017, and has since started 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, and 2013 year classes (above average by factors of 2.12, 2.28, and 2.16 for the post-1976 time series,

respectively), along with spawning exploitation rates below 20% since 2008. Spawning biomass is projected to be above B_{MSY} in 2020 by a factor of 1.30.

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 2.147 million t, 6% below last year's estimate of 2.280 million t. Projected spawning biomass for 2020 is 2.781 million t, placing EBS walleye pollock in sub-tier "a" of Tier 1. As has been the approach for many years, the maximum permissible ABC harvest rate was based on the ratio between MSY and the equilibrium biomass corresponding to MSY. The harmonic mean of this ratio from the present assessment is 0.442, 13% below last year's value of 0.510. The harvest ratio of 0.442 is multiplied by the geometric mean of the projected fishable biomass for 2020 (8.088 million t) to obtain the maximum permissible ABC for 2020, which is 3.578 million t, up 16% and 47% from the maximum permissible ABCs for 2019 and 2020 projected in last year's assessment, respectively. However, as with other recent EBS pollock assessments, the authors recommend setting ABCs well below the maximum permissible levels. Their reasons for doing so are listed in the "ABC Recommendation" section of the SAFE chapter, where assessment concerns are categorized as Level 1 ("normal"), and population dynamic, environmental/ecosystem, and fishery performance concerns are all categorized as Level 2 ("substantially increased concern"). The authors conclude that these levels of concern warrant setting the 2020 and 2021 ABCs at 2,045,000 t and 1,716,000 t (reductions of 43% and 41% from the corresponding maxABCs), which are the values associated with the Tier 3 maxABC harvest control rule. This is the same harvest policy that has been recommended by both the Team and SSC for the EBS pollock stock since the 2014 assessment cycle. The Team concurs with the authors' recommendation to continue this policy for the 2020 and 2021 fisheries.

The OFL harvest ratio under Tier 1a is 0.528, the arithmetic mean of the ratio between MSY and the equilibrium fishable biomass corresponding to MSY. The product of this ratio and the geometric mean of the projected fishable biomass for 2020 determines the OFL for 2020, which is 4.273 million t. The current projection for OFL in 2021 given a projected 2020 catch of 1.350 million t is 3.456 million t.

Status determination

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

Aleutian Islands pollock

Changes from previous assessment

No changes were made to the assessment model inputs since this was an off-cycle year. New data added to the project model included an updated 2018 catch estimate and new catch estimates for 2019-2020.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Updated estimates of 2020 spawning biomass at 98,172 t which is above the $B_{40\%}$ value of 81,312 t, placing the AI pollock stock in sub-tier "a" of Tier 3. The model estimated the values of $F_{40\%}$ as 0.331 and $F_{35\%}$ as 0.415. Under Tier 3a, the 2020 maximum permissible ABC and OFL are 55,120 t and 66,973 t, respectively. The Team recommends setting the 2020 ABC and OFL at these values. Projections assumed catches of 1,750 t for 2018 and 1,577 t for 2019, and 1,541 t for 2021 based on the three-year average (2013-2017). Following the Tier 3a formula, the 2020 maximum permissible ABC is 55,120 t and the 2020 OFL is 66,973 t. The Team recommends setting the 2020 ABC and OFL at these levels.

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, no assessment was conducted for Bogoslof pollock this year. However, a full stock assessment will be conducted in 2020. Until then, the values generated from the previous stock assessment (below) will be rolled over for 2020 specifications. Please refer to last year's stock assessment for details regarding the rolled over estimates. Additional information listed below summarizes the 2018 assessment.

Changes from previous assessment

Estimated catches for 2017 and 2018 were updated and the 2018 acoustic-trawl survey biomass estimate and preliminary 2018 survey age data were included. Two methods for computing the survey average are provided: one using the random effects and the other using a simple 3-survey average. Natural mortality was re-evaluated using the age-structured model presented in previous assessments (unchanged except for new survey, fishery, and age composition data from the survey).

Spawning biomass and stock trends

NMFS acoustic-trawl survey biomass estimates are the primary data source used in this assessment. Between 1997 and 2016, the values varied between 508,051 t and 67,063 t. The most recent acoustic-trawl survey of the Bogoslof spawning stock was conducted in March of 2018 and resulted in a biomass estimate of 663,070 t. The random-effects method of survey averaging resulted in 610,267 t, compared to the three-survey average of 427,730 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. The assessment authors and the Team recommend using the biomass estimate based on the random effects (610,267 t) for calculating the Tier 5 ABC.

The maximum permissible ABC value for 2019 is 137,310 t (assuming $M = 0.3$ and $F_{ABC} = 0.75 \times M = 0.225$ and the random effects survey estimate for biomass). The ABC for 2020 is the same (although a survey in that year is being planned).

The OFL was calculated using the random effects estimate for the survey biomass. Following the Tier 5 formula with $M=0.3$, OFL for 2019 is 183,080 t. The OFL for 2020 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 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019.

Area	Year	Age 0+ biomass	OFL	ABC	TAC*	Catch
Eastern Bering Sea	2018	918,000	238,000	201,000	188,136	186,702
	2019	824,000	216,000	181,000*	166,475	148,142
	2020	751,708	185,650	155,873*	n/a	n/a
	2021	716,581	123,331	102,975	n/a	n/a
Aleutian Islands	2018	79,600***	28,700	21,500	15,695	14,719
	2019	80,700***	27,400	20,600	14,214	12,954
	2020	80,700***	27,400	20,600	n/a	n/a
	2021	80,700***	27,400	20,600	n/a	n/a

*In 2018, the Council set the Federal TAC to account for the State of Alaska Aleutian Islands Guideline Harvest Level (GHL) fishery and the Bering Sea GHL fishery each of which was set equal to 6.4% of the Bering Sea ABC and 27% of the AI ABC for 2018. This proportion is increased in 2019 to 8% plus 45 mt for the Bering Sea and 31% for the AI. Catch includes only that which accrues to the Federal TAC.

**The ABC has been reduced by 20% from the maxABC for assessment, population, and environmental concerns.

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

Eastern Bering Sea Pacific cod

Changes from previous assessment

Changes to the input data have been made in the EBS Pacific cod assessment.

1. Catches for 1991-2018 were updated, and a preliminary catch estimate for 2019 were incorporated.
2. Commercial fishery size compositions for 1991-2018 were updated, and a preliminary size composition from the 2019 commercial fishery was incorporated.
3. Size composition from the 2019 EBS shelf bottom trawl survey was incorporated.
4. VAST estimates of the time series of numeric abundance and age composition from the respective survey or surveys (either EBS by itself, EBS and NBS combined into a single survey, or EBS and NBS modeled separately).

Many changes have been made or considered in the stock assessment model since the 2018 assessment. Seven models (including the current base model) were presented in this year's preliminary assessment. Following further explorations by the senior author, a set of nine models were included as an ensemble, with results presented as weighted averages. The nine models form a 3X3 factorial design. One axis of the design included three hypothesis about the spatial distribution of Pacific cod: 1) Pacific cod in the NBS are insignificant to the managed stock, so the assessment should include data from the EBS only; 2) Pacific cod in the EBS and NBS comprise a single stock, and the EBS and NBS surveys can be modeled in combination; and 3) Pacific cod in the EBS and NBS comprise a single stock, but the EBS and NBS surveys should be modeled separately. A second axis considered model complexity where 'basic' included the same model structure and assumptions as the 2018 base model (model 16.6i), 'simple' added to that model structure by changing the selectivity functions and a few other features, and 'complex' added a considerable amount of complexity including many time-varying parameters. The weighting of each model in the ensemble was determined by applying various emphasis factors to nine criteria. This weighting scheme gave more than 75% of the weight to model 19.12, and more than 99% of the weight to five models: three from hypothesis #2 along with the complex models from each other hypothesis.

Spawning biomass and stock trends

Three different survey abundance time-series were calculated with the vector autoregressive spatio-temporal model called VAST using two different areas: the EBS shelf survey area and the NBS area (including the datum for 2019, with the truncated survey design). One feature of VAST is that each year has a prediction, even when there are no observations in a particular area, because it uses information from nearby locations in years with observations. Comparing VAST estimates for 2019 to those for 2018, the EBS-only abundance index increased by 95%, the NBS-only abundance index decreased by 13%, and the combined EBS and NBS abundance index increased by 44%. Estimated spawning biomass from the ensemble increased from 2009 through 2018 to 307,608 t, and declined to 299,528 t in 2019 and is predicted to decrease to 259,509 t in 2020, which is slightly below $B_{40\%}$ (266,602 t). Recruitment is estimated to have been below average for the 2014-2017 year classes.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

This stock is assigned to Tier 3b for 2020. The maximum 2020 maxABC in this tier as calculated using the weighted average of the models in the ensemble is 155,873 t and the projected 2021 maxABC is 102,975 t. The 2020 OFL from the weighted ensemble is 185,650 t, which is greater than the projected OFL from the previous assessment. The 2021 projected OFL, given a 2020 catch of 155,873 t is 123,331 t. Even though a slightly elevated risk to the stock was identified due to environmental/ecosystem considerations, the 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. No changes were made to assessment methodology, but catch data from 1991-2018 were updated and preliminary catch data for 2019 were included. A random effects model using Aleutian Islands trawl survey biomass observations from 1991 to 2018 was used to estimate the biomass and provide management advice.

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).

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The author and Team recommend using the Tier 5 assessment again for 2020. The Team's recommended ABC is 20,600 t, and OFL is 27,400 t. The estimate of the natural mortality rate is 0.34, which was taken from the 2018 EBS Pacific cod assessment model (Model 16.6i).

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 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019. The combined BSAI OFL is based on a Joint Plan Team recommendation.

Area	Year	Age 4+ Biomass	OFL	ABC	TAC	Catch
Bering Sea	2018	94,000	2,887	1,464	1,464	1,598
	2019	52,000	3,221	1,489	1,489	2,994
Aleutian Islands	2018	65,000	3,917	1,988	1,988	660
	2019	98,000	4,350	2,008	2,008	490
BSAI	2020	270,000	11,758	4370	n/a	n/a
	2021	272,000	15,084	5,463	n/a	n/a
Bering Sea	2020	116,000	4,987	1,853	n/a	n/a
	2021	117,000	6,397	2,317	n/a	n/a
Aleutian Islands	2020	154,000	6,771	2,517	n/a	n/a
	2021	155,000	8,687	3,146	n/a	n/a

Changes from the previous assessment

New data included in the assessment model were relative abundance and length data from the 2019 longline survey, relative abundance and length data from the 2018 fixed gear fishery, length data from the 2018 trawl fisheries, age data from the 2018 longline survey and 2018 fixed gear fishery, updated catch for 2018, and projected 2019 - 2021 catches. Estimates of killer and sperm whale depredation in the fishery were updated and projected for 2019 - 2021. In 2019, there was a NMFS Gulf of Alaska trawl survey. Biomass estimates and length compositions from this survey were also added. Relative to the 2018 assessment there were no changes to the assessment methodology. This year the assessment included several apportionments including an updated Ecosystem and Socioeconomic Profile (ESP; Appendix 3C) and a document on simulation modeling to evaluate apportionment alternatives (Appendix 3D).

Spawning biomass and stock trends

Since projected female spawning biomass (combined areas) for 2020 is 113,368 t (7% higher than B_{40%}, or B_{43%}), sablefish is in sub-tier “a” of Tier 3. The longline survey abundance index increased 47% from 2018 to 2019 following a 14% increase in 2018 from 2017. The lowest point of the time series was 2015. The fishery catch-rate/abundance index stayed level from 2017 to 2018 and is at the time series low (the 2019 data are not available yet). Spawning biomass is projected to increase rapidly from 2020 to 2022, and then stabilize.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Sablefish are managed under Tier 3a of NPFMC harvest rules. Reference points were calculated using recruitments from 1977-2015. Instead of maximum permissible ABC, the authors recommended the 2020 ABC to be 25% higher than the 2019 ABC, **which translates to a 57% reduction from maximum ABC.**

The authors-recommended ABCs for 2020 and 2021 are lower than maximum permissible ABC for several important reasons that are examined in the risk-matrix approach for ABC reductions and supported by observations in the ESP. One reason for a more conservative ABC recommendation is the potential overestimation of the 2016 year class, which is estimated to be 2.5x times higher than any other year class observed in the current recruitment regime. The estimated recruitment for the 2014 year class, which was initially estimated to be very large, has decreased 56% since first estimated, and it is possible that the same will occur for the 2016 recruitment estimate. Fits to abundance indices are poor for recent years, particularly for fishery CPUE and the GOA trawl survey, and the model’s retrospective bias is slightly positive. While there are clearly positive signs of strong incoming recruitment, there are concerns regarding the lack of older fish contributing to spawning biomass. Mean age of spawners has decreased dramatically suggesting higher importance of the contribution of the incoming year classes to adult spawning biomass. The 2014 and 2016 year classes are expected to comprise about 33% and 14% of the 2020 spawning biomass, respectively. The 2014 year class is about 50% mature while the 2016 year class should be less than 15%

mature in 2020. Also, uncertainty about the environmental conditions and how they may affect these incoming year classes was highlighted.

The authors' examined the risk matrix approach and arrived at an overall score of level 3 indicating at least one "major concern" and suggests that setting the ABC below the maximum permissible is warranted. The Teams discussed the amount of reduction from maxABC (57%) and agreed the recommended 25% increase from the 2019 ABC not only represents the largest increase in ABC from 1996 to present, but also serves to keep fishery effort (fishing mortality rate) comparable to last year. The Teams concurred with this large adjustment and an additional (relatively minor) adjustment to account for the effects of whale depredation to arrive at the authors' recommended ABC.

Extensive discussion occurred regarding the determination of OFL by area and the relatively high bycatch of sablefish in the Bering Sea trawl fisheries in 2019. The authors provided a historical background of how the determination of OFL has evolved in sablefish and included OFL options requested by the SSC. Since 1996, sablefish have been managed Alaska-wide spanning both the BSAI and GOA FMPs with ABCs determined by sub-area. Also, for the Status Determination, the stock assessment uses the combined-areas, Alaska-wide OFL to determine whether the stock is subject to overfishing, currently overfished, or approaching an overfished condition. However, the sablefish OFL has been set separately for the BS, AI, and GOA since 1995 and does not necessarily reflect a biological or conservation concern for the stock. Three options were presented: 1) Status quo; 2) combine the BS and AI; 3) an Alaska-wide specification. Some options may provide management benefits or efficiencies, but the authors did not have the appropriate information or data to recommend a scientific basis or a conservation concern for one option over another. The Teams discussed potential biological concerns for the stock such as stock structure or productivity that could be considered to ensure specific areas are not depleted but had no specific conservation concerns to warrant an OFL recommendation. From a management perspective, sablefish are managed on an Alaska-wide stock basis and OFL should be set at the stock level. However, concerns were expressed that without management controls in place on a smaller scale there would be no incentive to regulate regional bycatch. Considerable uncertainty exists on whether this is a biological concern or allocation issue and the Teams suggested consulting the Council's spatial management policy for guidance.

The Teams recommend Option 2, combining the BS and AI OFLs. Combining these OFLs will make the sablefish OFLs more consistent with other stock assessments and consistent with FMP areas. NOAA General Council advised that National Standard 1 guidelines define "overfishing limit" at a stock or stock complex level but there is discretion under the National Standard guidelines that status determination criteria like OFL can be set to allow for operational feasibility, among other relevant criteria, and aligning OFL by FMP can be considered operationally feasible.

Status determination

Model projections indicate that this stock is not subject to overfishing, not overfished, nor approaching an overfished condition.

Area apportionment

Apportionments have been held constant since the 2013 fishery and the Teams concurred with the authors' recommendation to continue with the same formula for 2020-2021. OFLs in the BSAI for 2020 and 2021 have been combined based on the Plan Team recommendation. Apportionment values presented here include whale depredation adjustments:

Region	2019				2020		2021	
	OFL	ABC	TAC	Catch	OFL	ABC	OFL	ABC
W	--	1,518	1,581	1,139	--	1,942	--	2,427
C	--	5,178	5,178	4,374	--	6,445	--	8,055
*WYAK	--	1,828	1,828	1,614	--	2,343	--	2,687
*SEO	--	2,984	2,984	2,401	--	3,663	--	4,821
GOA	25,227	11,571	11,571	9,528	38,723	14,393	49,681	17,990
BS	3,221	1,489	1,489	2,994	--	1,853	--	2,317
AI	4,350	2,008	2,008	490	--	2,517	--	3,146
BSAI	--	--	--	--	11,758	4,370	15,084	5,463
Total	32,798	15,068	15,068	13,012	50,481	18,763	64,675	23,453

* 95:5 split in the EGOA following the trawl ban in SEO

4. Yellowfin sole

Status and catch specifications (t) of yellowfin sole in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019.

Area	Year	Age 6+				
		Biomass	OFL	ABC	TAC	Catch
BSAI	2018	2,553,100	306,700	277,500	154,000	131,544
	2019	2,462,400	290,000	263,200	154,000	122,309
	2020	2,461,850	287,307	260,918	n/a	n/a
	2021	2,467,300	287,943	261,497	n/a	n/a

The Flatfish Flexibility Exchange Program increased the 2018 TAC from 154,000 t to 155,947 t. Through November 2, 2019 the Flatfish Flexibility Exchange program has increased the TAC from 154,000 t to 156,450 t for 2019.

Changes from previous assessment

Changes to the input data include:

- 2018 fishery age composition
- 2018 survey age composition
- 2019 trawl survey biomass point estimate and standard error
- Estimate of the discarded and retained portions of the 2018 catch
- Estimate of total catch made through the end of 2019
- Updated weight at age for survey and fishery

The preferred model (18.1a) includes covariates on survey catchability based on survey start date and mean survey bottom temperature for stations < 100m depth. The relationship has been published by Nichol et al. (2018).

Spawning biomass and stock trends

The projected female spawning biomass estimate for 2020 is 857,187 t, which is $1.84 \times B_{MSY}$. This is a 3.5% increase from last year's 2019 estimate (827,900 t). A general slow decline in spawning biomass of approximately 6% per year has prevailed for the most part since 1985.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Although the authors presented a new model (Model 18.2) as their preferred alternative, the Team determined that Model 18.1a (the 2018 base model) was the preferred model. Model 18.2 was considered to be a major change over last year's base model and the Team resolved that it had not had adequate review as it had not been presented at the September Plan Team meeting. This should not be considered a reflection on the quality of the model, but rather the policy of the Plan Team that "for each assessment year, models introduced in that year should ideally be previewed in September or at least requested by the Team/SSC by September/October, and that the standard for acceptance of models that do not meet at least one of these criteria will be higher than for models that do."

The SSC has determined that reliable estimates of B_{MSY} and the probability density function for F_{MSY} exist for this stock. The estimate of B_{MSY} from the present assessment is 466,029 t, and projected spawning biomass for 2020 is 857,187 t, meaning that yellowfin sole qualify for management under Tier 1a. Corresponding to the approach used in recent years, the 1978-2013 age 1 recruitments (and corresponding spawning biomass estimates) were used this year to determine the Tier 1 harvest recommendations. This provided a maximum permissible ABC harvest ratio (the harmonic mean of the F_{MSY} harvest ratio) of 0.106. The current value of the OFL harvest ratio (the arithmetic mean of the F_{MSY} ratio) is 0.117. The product of the maximum permissible ABC harvest ratio and the geometric mean of the 2020 biomass estimate produced the 2020 ABC of 260,918 t recommended by the Team, and the corresponding product using the OFL harvest ratio produces the 2020 OFL of 287,307 t. For 2021, the corresponding quantities are 261,497 t and 287,943 t, respectively.

Status determination

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

5. Greenland turbot

Status and catch specifications (t) of Greenland turbot in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019.

Area	Year	Age 1+ Biomass	OFL	ABC	TAC	Catch
BSAI	2018	126,417	13,148	11,132	5,294	1,835
	2019	105,930	11,362	9,658	5,294	2,855
	2020	106,101	11,319	9,625	n/a	n/a
	2021	98,532	10,006	8,510	n/a	n/a
Eastern Bering Sea	2018	n/a	n/a	9,718	5,125	1,672
	2019	n/a	n/a	8,431	5,125	2,681
	2020	n/a	n/a	8,403	n/a	n/a
	2021	n/a	n/a	7,429	n/a	n/a
Aleutian Islands	2018	n/a	n/a	1,414	169	163
	2019	n/a	n/a	1,227	169	174
	2020	n/a	n/a	1,222	n/a	n/a
	2021	n/a	n/a	1,080	n/a	n/a

Changes from previous assessment

This chapter was presented in a partial assessment format because it was a scheduled “off-year” assessment under the stock assessment prioritization guidelines. Therefore, only the projection model was run, with updated catches. New catch data included a final 2018 catch estimate from the NMFS Alaska Regional Office Catch Accounting System and a preliminary catch estimate for 2019.

Spawning biomass and stock trends

The projected 2020 female spawning biomass is 57,094 t, which is an 8% increase from last year’s 2020 projection of 52,743 t. Female spawning biomass is projected to decrease slightly to 53,617 t in 2021. Last year’s assessment indicated that the effects of the incoming 2007-2009 year classes were creating increases in both the female spawning biomass and total biomass estimates. However this recruitment now appears to be fully integrated into the fishery, and no new recruitment has been observed. After peaking in 2018 and 2019, age 1+ and spawning biomass are once again trending downward and the survey biomass estimates are the lowest in the time series. There are concerns about the current warming trend and its impact on future recruitment.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The $B_{40\%}$ value, using the mean recruitment estimated for the period 1978-2014 is 36,213 t. The projected 2020 female spawning biomass of 57,094 t is well above the estimate of $B_{40\%}$. Because the projected spawning biomass in year 2020 is above $B_{40\%}$, Greenland turbot ABC and OFL levels will be determined under Tier 3a of Amendment 56. The OFLs for 2020 and 2021 are 11,319 t and 10,006 t, respectively, and the corresponding maximum permissible ABCs are 9,625 t and 8,510 t, respectively. The author recommended setting ABC at the maximum permissible values for 2020 and 2021, and the Team concurred.

Area apportionment

The authors and Team recommend that apportionment of ABC between the EBS and the Aleutian Islands be based on the assumption that 8% of the biomass is in the Aleutian Islands. This is documented in the 2018 assessment, and as in previous assessments, is based on unweighted averages of EBS slope and AI survey biomass estimates from the four most recent years in which both areas were surveyed. The Team’s recommended 2020 and 2021 ABCs in the EBS are 8,403 t and 7,429 t. The 2020 and 2021 ABCs for the AI are 1,222 t and 1,080 t. Area apportionment of the OFL is not recommended.

Status determination

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

6. Arrowtooth flounder

Status and catch specifications (t) of arrowtooth flounder in recent years are below. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019.

Area	Year	Age 1+ Bio	OFL	ABC	TAC	Catch
BSAI	2018	785,141	76,757	65,932	13,621	7,002
	2019	892,591	82,939	70,673	8,000	9,591
	2020	934,008	84,057	71,618	n/a	n/a
	2021	964,925	86,647	73,804	n/a	n/a

Changes from previous assessment

This chapter was presented in a partial assessment format because it was a scheduled “off-year” assessment under the stock assessment prioritization guidelines. Therefore, only the projection model was run, with

updated catches. New catch data included a final 2018 catch estimate from the NMFS Alaska Regional Office Catch Accounting System and a preliminary catch estimate for 2019.

Spawning biomass and stock trends

The projected age 1+ total biomass for 2020 is 934,008 t, which is a slight increase from the value of 932,024 t projected for 2020 in last year’s assessment. The projected female spawning biomass for 2020 is 478,260 t which is also a slight increase from last year’s 2020 estimate of 472,507 t. Overall stock trends remain fairly stable, with a slight upward trend in biomass estimates since 2017.

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 242,495 t and 0.136. The projected 2020 spawning biomass is above $B_{40\%}$, so ABC and OFL recommendations for 2020 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 2020 and 2021 ABCs of 71,618 t and 73,804 t, respectively. Projected harvesting at $F_{35\%}$ (0.161) gives 2020 and 2021 OFLs of 84,057 t and 86,647 t respectively. The Team agrees with these recommendations.

Status determination

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

7. Kamchatka flounder

Status and catch specifications (t) of Kamchatka flounder in recent years are below. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019.

Area	Year	Age 2+ Biomass	OFL	ABC	TAC	Catch
BSAI	2018	189,868	11,347	9,737	5,000	3,108
	2019	155,251	10,965	9,260	5,000	4,494
	2020	162,709	11,495	9,708	n/a	n/a
	2021	163,158	11,472	9,688	n/a	n/a

Changes from previous assessment

This chapter was presented in a “partial assessment” format because it was a scheduled “off-year” assessment under the Stock Assessment Prioritization guidelines. Therefore, only the projection model was run, with updated catches. New data in the 2019 assessment included updated 2018 catch, 2019 partial year catch and 2019 and 2020 estimated total catch. No changes were made to the assessment model.

New input data for the projection model included updating the 2018 catch and estimating the 2019 catch. The estimated total catch for 2019 was the product of the 2019 catch and an expansion factor based on the average proportion of catch occurring after October 11th between 2014 and 2018 (1.0475).

Spawning biomass and stock trends

The projected 2020 female spawning biomass is 57,948 t, above the $B_{40\%}$ level of 43,069 t, and spawning biomass is projected to remain above $B_{40\%}$ for the foreseeable future. The early shelf survey size composition data suggest that some significant recruitment events (assessed at age 2) occurred prior to 1991. Since 1991, the preferred assessment model (16.0a) estimates that the 2001, 2002, 2008, 2013, and 2014 year classes are all at least 80% above average. Female spawning biomass has been increasing since a drop in 2010 which coincided with the sharp peak of catch that same year.

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 2020 is above $B_{40\%}$, placing Kamchatka flounder in sub-tier “a” of Tier 3. For the 2020 fishery, the authors and Team recommend setting 2020 ABC at the maximum permissible value of 9,708 t from the projection model. This value is an increase of 5% from the 2019 ABC (9,260 t). The recommended 2020 OFL is 11,495 t, a 5% increase from 10,965 t for 2019.

Status Determination

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

8. Northern rock sole

Status and catch specifications (t) of northern rock sole in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019.

Area	Year	Age 6+ Biomass	OFL	ABC	TAC	Catch
BSAI	2018	923,200	147,300	143,100	47,100	28,275
	2019	828,000	122,000	118,900	47,100	25,497
	2020	1,068,000	157,300	153,300	n/a	n/a
	2021	1,608,000	236,800	230,700	n/a	n/a

Changes from previous assessment

This chapter was presented as a “partial assessment” format because it was a scheduled “off-year” assessment under the new Stock Assessment Prioritization guidelines. Therefore, only the projection model was run, with updated catches. No changes were made to the assessment model and no new data were included.

Spawning biomass and stock trends

Spawning biomass was at a low in 2008, but has increased continuously since then. The 2001-2005 year classes are all estimated to be above average; however, the spawning biomass has been in a slow decline since 2008 peaked and is now declining. The stock assessment model projects a 2020 spawning biomass of 380,600 t. This. The projected spawning biomass for 2021 is 356,000 t.

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 2020 is projected to be well above the B_{MSY} estimate of 186,000, placing northern rock sole in sub-tier “a” of Tier 1. The Tier 1 2020 ABC harvest recommendation is 153,300 t ($F_{ABC} = 0.144$) and the 2020 OFL is 157,300 t ($F_{OFL} = 0.147$). The 2021 ABC and OFL values are 230,700 t and 236,800 t, respectively. Recommended ABCs correspond to the maximum permissible levels.

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

Status determination

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

9. Flathead sole

Status and catch specifications (t) of flathead sole in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019.

Area	Year	Age 3+Biomass	OFL	ABC	TAC	Catch
BSAI	2018	762,513	79,862	66,773	14,500	11,061
	2019	673,718	80,918	66,625	14,500	15,062
	2020	684,768	82,810	68,134	n/a	n/a
	2021	692,915	86,432	71,079	n/a	n/a

The Flatfish Flexibility Exchange Program increased the TAC from 17,105 t to 14,076 t in 2018. The TAC was increased from 14,500 t to 20,150 t in 2019.

Changes from previous assessment

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

Changes to the input data in this analysis include:

- 2019 catch was estimated by adding the average catch between October 19 and December 31 over the years 2014-2018 to the current catch.
- The 2020 and 2021 catches were estimated as the average catch over the previous 5 years (2014-2018).

Changes to the assessment methodology:

- No changes were made.

Spawning biomass and stock trends

Spawning biomass is projected to increase slightly in 2020 and in 2021. Age 3+ biomass is also projected to have small increases in 2020 and 2021.

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 $B_{40\%}=84,824$ t, $F_{40\%}=0.38$, and $F_{35\%}=0.47$. Because projected spawning biomass for 2020 (154,195 t) is above $B_{40\%}$, flathead sole is in Tier 3a. The authors and Team recommend setting ABCs for 2020 and 2021 at the maximum permissible values under Tier 3a, which are 68,134 t and 71,079 t, respectively. The 2020 and 2021 OFLs under Tier 3a are 82,810 t and 86,432 t, respectively.

Status determination

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

10. Alaska plaice

Status and catch specifications (t) of Alaska plaice in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019.

Area	Year	Age 3 + Biomass	OFL	ABC	TAC	Catch
BSAI	2018	417,300	41,170	34,590	16,100	23,342
	2019	400,700	39,880	33,600	18,000	15,812
	2020	428,800	37,600	31,600	n/a	n/a
	2021	435,700	36,500	30,700	n/a	n/a

Changes from previous assessment

This assessment was changed to a biennial cycle beginning with the 2013 assessment. The last full assessment was in November 2017; only a projection model was run in November 2018. Changes to the input data in this full assessment include:

- Estimates of catch (t) and discards for 2018 and 2019
- 2018 and 2019 shelf trawl survey biomass estimates and standard errors
- 2019 survey length composition
- 2017 and 2018 survey age composition
- 2017 and 2018 fishery length composition

No modifications were made for this assessment methodology.

Spawning biomass and stock trends

Last year's assessment indicated that above average recruitment strength in 1998 and exceptionally strong recruitment in 2001 and 2002 have contributed to recent high level of female spawning biomass. The Alaska plaice spawning stock biomass is projected to decline through 2023 while remaining above $B_{35\%}$.

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 $B_{40\%} = 133,300$ t, $F_{40\%} = 0.125$, and $F_{35\%} = 0.15$. Given that the projected 2020 spawning biomass of 170,800 t exceeds $B_{40\%}$, the ABC and OFL recommendations for 2020 were calculated under sub-tier "a" of Tier 3. Projected harvesting at the $F_{40\%}$ level gives a 2020 ABC of 31,600 t and a 2021 ABC of 30,700 t. The recommended Tier 3a OFLs are 37,600 t and 36,500 t for 2020 and 2021, respectively.

Status determination

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

11. Other Flatfish Complex

In accordance with the approved schedule, no assessment was conducted for the Other Flatfish Complex this year. However, a full stock assessment will be conducted in 2020. Until then, the values generated from the previous stock assessment (below) will be rolled over for 2020 specifications. Please refer to last year's stock assessment for details regarding the rolled over estimates. Additional information listed below summarizes the 2018 assessment.

Changes from previous assessment

This chapter was presented in a partial assessment format because it was a scheduled "off-year" assessment under the stock assessment prioritization guidelines. Therefore, only the random effects model was run, with updated fishery catches from 2016, 2017 and 2018; and, because this stock complex is managed under Tier 5, updated survey biomass estimates as well. Surveys newly incorporated into the assessment include

the 2016, 2017, and 2018 Bering Sea shelf surveys; the 2016 Eastern Bering Sea slope survey; and the 2016 and 2018 Aleutian Island trawl surveys. There were no changes to the assessment methodology.

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. New survey estimates (and time-series) resulted in an ABC and OFL increase of 24% over 2018. The 2018 values were rolled-over from the previous year (i.e., the 2017 recommended ABC and OFL) and did not include a random effects model estimate of biomass. 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 2019 OFL and ABC are 21,824 t and 16,368 t respectively.

Status determination

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

12. Pacific ocean perch

Status and catch specifications (t) of Pacific ocean perch 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 2020 and 2021 are those recommended by the Team. Catch data are current through November 2, 2019.

Area	Year	Age 3+ Bio	OFL	ABC	TAC	Catch
BSAI	2018	749,925	51,675	42,509	37,361	34,749
	2019	934,293	61,067	50,594	44,069	41,653
	2020	908,529	58,956	48,846		n/a
	2021	885,439	56,589	46,885		n/a
Eastern Bering Sea	2018			11,861	11,861	9,635
	2019			14,675	14,675	13,178
	2020			14,168	n/a	n/a
	2021			13,600	n/a	n/a
Eastern Aleutian Islands	2018			10,021	9,000	8,946
	2019			11,459	11,009	10,324
	2020			11,063	n/a	n/a
	2021			10,619	n/a	n/a
Central Aleutian Islands	2018			7,787	7,500	7,312
	2019			8,435	8,385	8,263
	2020			8,144	n/a	n/a
	2021			7,817	n/a	n/a
Western Aleutian Islands	2018			12,840	9,000	8,856
	2019			16,025	10,000	9,888
	2020			15,471	n/a	n/a
	2021			14,849	n/a	n/a

Changes from previous assessment

This chapter was presented in a partial assessment format because it was a scheduled “off-year” assessment under the stock assessment prioritization guidelines. Therefore, only the projection model was run, with updated catches. New data in the 2019 assessment included updated 2018 catch and estimated 2019-2021 catches. No changes were made to the assessment model. Exploitation rates (i.e., catch/biomass) have averaged 0.024 from 2004-2019, which is below the exploitation rate associated with fishing at $F_{40\%}$.

Spawning biomass and stock trends

New projections were slightly lower than last year’s projections because estimated catch for 2019 is 17% larger than the value estimated in the 2018 projection model. Spawning biomass is projected to be 383,178 t in 2020 and to decline to 367,062 t in 2021. Exploitation rates from the BSAI subareas are similar to the overall BSAI exploitation rates, with the exception of low exploitation rates in the EBS area in the early 2000s and an increase in the exploitation rate in the central AI since 2016. The similarity in exploitation rates between areas is expected because BSAI POP are managed with subarea ABCs based on the spatial distribution of survey biomass.

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 258,295 t, 0.079, and 0.095, respectively. Spawning biomass for 2019 (383,178 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 0.079, which results in the author and Plan Team recommended 2020 ABC of 48,846 t and 2021 ABC of 46,885 t. The OFL fishing mortality rate is 0.095, which results in a 2020 OFL of 58,956 t and 2021 OFL of 56,589 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 2020): EBS = 14,168 t, Eastern Aleutians (Area 541) = 11,063 t, Central Aleutians (Area 542) = 8,144 t, and Western Aleutians (Area 543) = 15,471 t. The recommended OFLs for 2019 and 2020 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 2020 and 2021 are those recommended by the Team. Catch data are current through November 2, 2019.

Area	Year	Age 3+ Biomass	OFL	ABC	TAC	Catch
BSAI	2018	246,160	15,888	12,975	6,100	5,767
	2019	244,196	15,507	12,664	6,500	9,057
	2020	250,235	19,751	16,243	n/a	n/a
	2021	246,384	19,070	15,683	n/a	n/a

Changes from previous assessment

This chapter was presented as a full assessment. Changes to the input data included the following:

- Updated catch data through 2018
- Projected 2019-2021 catch estimates
- Fishery age data from 2015 and 2017

- Fishery length data from 2016 and 2018
- Biomass estimate and age data from the 2018 Aleutian Islands (AI) bottom trawl survey
- Age data from the 2016 AI and eastern Bering Sea (EBS) bottom trawl surveys

The fishery and survey age compositions were recomputed by applying subarea (i.e., not global) age-length keys to subarea length compositions, due to spatial differences in size at age. Separate weight-at-age curves were computed for the fishery and the population, and each were computed as an average of subarea weights-at-age (weighted by subarea fishery catch and survey abundance, respectively). The only change to the assessment methodology was that a constraint was placed on the asymptotic survey selectivity curve to ensure the selectivity at age 15 was close to 1. Updated data produces a larger weight-at-age for the fishery than was used in previous assessments, and the change in the survey selectivity curve scales the population higher than previous assessments.

Spawning biomass and stock trends

The survey biomass estimates in the AI decreased by 17% from 2016, with decreases in all AI sub-areas and a large increase in the southern Bering Sea area. The survey biomass has shown an increasing trend to a peak in 2014 and declining since. Estimated spawning and total biomass show a similar pattern, increasing until 2014 and 2013, respectively, and then decreasing until 2019. Spawning biomass is projected to be 111,476 t in 2020 and decline to 108,063 t in 2021. Spatial management of the stock is not consistent with the genetic spatial structure; however, stock abundance is high and exploitation rates are low.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, thereby qualifying northern rockfish for management under Tier 3. The current estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ are 63,940 t, 0.061, and 0.075, respectively. Spawning biomass for 2020 (111,476 t) is projected to exceed $B_{40\%}$, thereby placing northern rockfish in sub-tier “a” of Tier 3. The maximum permissible value of F_{ABC} under Tier 3a is 0.061, which results in the author and Plan Team recommended 2020 ABC of 16,243 t and 2021 ABC of 15,683 t. The OFL fishing mortality rate is 0.075 which results in a 2020 OFL of 19,751 t and 2021 OFL of 19,070 t.

Status determination

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

14. Blackspotted and rougheye rockfish

Status and catch specifications (t) of blackspotted and rougheye rockfish complex in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through November 2, 2019.

Area/subarea	Year	Total Biomass (t)*	OFL	ABC	TAC	Catch
BSAI	2018	37,453	749	613	225	238
	2019	47,853	676	555	279	387
	2020	50,376	861	708	n/a	n/a
	2021	52,822	1,090	899	n/a	n/a
Western/ Central Aleutian Islands	2018			374	75	173
	2019			204	204	305
	2020			264	n/a	n/a
	2021			339	n/a	n/a
Eastern AI/ Eastern Bering Sea	2018			239	150	66
	2019			351	75	82
	2020			444	n/a	n/a
	2021			560	n/a	n/a

*For 2018, the total biomass is from a BSAI age-structured model. For 2019-2021, the total biomass is from an AI age-structured models 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 partial assessment year.

Changes to the input data included catch data being updated for 2018 and estimated for 2019 -2021.

There were no changes in the assessment methodology.

Spawning biomass and stock trends

Spawning biomass for AI blackspotted/rougheye rockfish in 2020 is projected to be 10,213 t and is projected to increase slightly in 2021. Age 3+ biomass is also projected to increase slightly in 2020 and 2021.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The BSAI was separated into AI and BS components for this assessment last year, returning to the practice that had been used prior to the 2016 assessment. For the AI, this stock qualifies for management under Tier 3 due to the availability of estimates for $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$. Because the projected female spawning biomass for 2020 of 10,213 t is less than $B_{40\%}$, (11,715 t) the stock qualifies as Tier 3b and is projected to remain in Tier 3b, but very close to $B_{40\%}$ in 2021. For the BS, this stock qualifies for management under Tier 5 with a projected biomass for both 2020 and 2021 of 1,371 t.

The Team recommends an overall 2020 ABC of 708 t and a 2020 OFL of 861 t. The apportionment of the 2020 ABC to subareas is 264 t for the Western and Central Aleutian Islands and 444 t for the Eastern Aleutian Islands and Eastern Bering Sea.

Area apportionment

Given on-going concerns about fishing pressure relative to biomass in the Western Aleutians, the SSC requested that the apportionment by sub-area within the WAI and CAI be calculated and presented. The

maximum subarea species catch (MSSC) levels within the WAI/CAI, based on the random effects model, are as follow:

	WAI	CAI
2020 MSSCs	48	216
2021 MSSCs	61	278

Status determination

For the Aleutian Islands region, the blackspotted and rougheye rockfish complex is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition. For the Eastern Bering Sea region, the blackspotted and rougheye rockfish complex is not being subjected to overfishing. However, 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, no assessment was conducted for Shortraker rockfish this year. However, a full assessment will be conducted in 2020. Until then, the values generated from the previous stock assessment are rolled over for 2020 specifications. Please refer to last year's stock assessment for details regarding the rolled over estimates. Additional information listed below summarizes the 2018 assessment.

Changes from previous assessment

This chapter was presented as a full assessment. New data included updated catch data through 2018, and biomass and variance estimates from the 2018 Aleutian Islands (AI) bottom trawl survey. There were no changes in the assessment methodology since the last full assessment.

Spawning biomass and stock trends

Estimated shortraker rockfish biomass in the BSAI has been relatively stable since 2002. Increases in the 2018 AI survey biomass estimates occurred in the western and eastern AI with a decrease in the central AI. According to the random effects model, total biomass (AI and EBS slope combined) from 2002-2018 has been very stable, with a slight increase in the estimate of 2019 biomass since the 2016 assessment, from 22,191 t in the 2016 assessment to 24,055 t in the current assessment. The time series from the random effects model is much smoother than the time series for the raw data, due to large standard errors associated with the survey biomass estimates. Exploitation rates have generally been well below the ABC levels in all areas, except for the western area, where exploitation rates exceeded the ABC levels from 2011-2013.

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 541 t for 2019 and 2020 and the OFL is 722 t for 2019 and 2020.

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, no assessment was conducted for the Other rockfish complex this year. However, a full assessment will be conducted in 2020. Until then, the values generated from the previous stock assessment are rolled over for 2019 specifications. Additional information listed below summarizes the 2018 assessment.

Status and catch specifications (t) of other rockfish in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019.

Changes from previous assessment

A full stock assessment was conducted this year.

Changes in the input data:

- 1) Catch and fishery lengths updated through October 10, 2018.
- 2) Biomass estimates, catch per unit effort (CPUE), and length frequency compositions were reported from the 2018 Aleutian Islands trawl survey and the 2017 and 2018 Bering Sea shelf surveys. There has been no Bering Sea slope survey since 2016.

There were no changes in the assessment methodology.

Spawning biomass and stock trends

This is a Tier 5 complex, thus trends in spawning biomass *per se* are unknown. The random effects survey biomass estimates for short-spined thornyhead (SST) in the Aleutian Islands and EBS slope have been variable, with a slight decrease this year. The non-SST portion of the complex continues to vary dramatically, increasing this year. Biomass estimates are frequently zero or very small for the non-SST portion of the complex in both the EBS 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 2019 and 2020 ABCs of 956 t in the EBS and 388 t in the AI. 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, which yields an OFL of 1,793 t for 2019 and 2020.

Status determination

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

17. Atka mackerel

Status and catch specifications (t) of Atka mackerel in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019.

Area	Year	Age 1+ Biomass	OFL	ABC	TAC	Catch
BSAI	2018	599,000	108,600	92,000	71,000	70,394
	2019	498,320	79,200	68,500	57,951	56,563
	2020	515,890	81,200	70,100	n/a	n/a
	2021	534,220	74,800	64,400	n/a	n/a
E Aleutian Islands / EBS	2018	n/a	n/a	36,820	36,500	36,086
	2019	n/a	n/a	23,970	23,970	22,802
	2020	n/a	n/a	24,335	n/a	n/a
	2021	n/a	n/a	22,540	n/a	n/a
Central Aleutian Islands	2018	n/a	n/a	32,000	21,000	20,915
	2019	n/a	n/a	14,390	14,390	14,320
	2020	n/a	n/a	14,721	n/a	n/a
	2021	n/a	n/a	13,524	n/a	n/a
Western Aleutian Islands	2018	n/a	n/a	23,180	13,500	13,395
	2019	n/a	n/a	30,140	19,591	19,441
	2020	n/a	n/a	30,844	n/a	n/a
	2021	n/a	n/a	28,336	n/a	n/a

Changes from previous assessment

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

- The 2018 catch estimate was updated, and estimated total catch for 2019 was set equal to the TAC (57,951 t).
- Estimated 2020 and 2021 catches are 59,300 t and 54,700 t, respectively.
- The 2018 fishery age composition data were added.
- The 2018 Aleutian Islands survey age composition were added.
- The estimated average selectivity for 2014-2018 was used for projections.
- 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 2020 and 2021 maximum permissible ABCs, and those reduced amounts were assumed to be caught in order to estimate the 2020 and 2021 ABCs and OFL values.
- As in 2018, the sample sizes specified for fishery age composition data were rescaled to have the same means as in the original baseline model (100), but varied relative to the number of hauls for the fishery. The 2018 data were added.

No changes to the base model (Model 16.0b) were made this year.

Spawning biomass and stock trends

Spawning biomass reached an all-time high in 2005, then decreased almost continuously through 2019 (the estimated spawning biomass in 2020 is projected to be roughly 37% of what it was in 2005). It is projected to decrease further, at least through 2020. Total biomass follows the same decreasing trend. The 1998-2001 year classes were all very strong, and the 2007 and 2008 year classes 55% and 33% above average. The projected female spawning biomass for 2020 (109,900 t) is projected to be below $B_{40\%}$ (116,600 t), and the stock is projected to remain below $B_{40\%}$ through 2032.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The projected female spawning biomass under the recommended harvest strategy is estimated to be below $B_{40\%}$, thereby placing BSAI Atka mackerel in Tier 3b. The projected 2020 yield (ABC) at $F_{40\%adj} = 0.41$ is 70,100 t, up 2.3% from the 2019 ABC and up 11% from last year's projected ABC for 2020. The projected 2020 overfishing level at $F_{35\%} = 0.48$ is 81,200 t, up 2.5% from the 2019 OFL and up 11% from last year's projected OFL for 2020.

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

Area apportionment

The Tier 5 random effects model used since 2015 was not used to apportion the ABC among areas this year. This year, the four-survey weighted averaging method that had been used prior to 2015 was used to apportion ABC among areas. The recommended ABC apportionments by subarea for 2020 are 24,535 t for Area 541 and the Bering Sea region (a 1.5% increase from 2019), 14,721 t for Area 542 (a 2.3% increase from 2019), and 30,844 t for Area 543 (a 2.3% increase from 2019).

Status determination

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

18. Skates

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 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019.

Area	Year	Age 0+ Biomass	OFL	ABC	TAC	Catch
BSAI	2018	578,436	46,668	39,082	29,080	31,207
	2019	624,338	51,152	42,714	26,000	17,873
	2020	611,761	49,792	41,543	n/a	n/a
	2021	598,264	48,289	40,248	n/a	n/a

For 2018, NMFS increased the TAC to 29,080 t with a reallocation of 2,080 t from the non-specified reserves.

Changes from previous assessment

This chapter was presented in the partial assessment format, as a scheduled “off-year” assessment. The following new data were updated for the Alaska skate projection model in this year's assessment:

- updated 2018 and preliminary 2019 catch
- Estimated total catch for 2019 and 2020
- 2019 EBS shelf survey data

No changes were made to the assessment model. The projection model for Alaska skate was re-run with the most recent catch data. The 2017 EBS shelf survey data were presented in the chapter, but the Tier 5 random effects model was not re-run for the other skates component of the assemblage.

Spawning biomass and stock trends

Spawning biomass of Alaska skate increased continuously from 2006 (194,515 t) through 2018 (268,836 t), and is currently at an all-time high. Recruitment of Alaska skate was above average for all cohorts spawned between 2003 and 2010, but has been below average for all cohorts spawned since 2011. The remaining species of skates have relatively flat or increasing biomass, except for whiteblotched and leopard skates in the Aleutian Islands. Both of these species have been declining (since 2006 (whiteblotched) and 2010 (leopard)).

Tier determination/Plan Team discussion and resulting ABCs and OFLs

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

Because projected spawning biomass for 2020 (117,973 t) exceeds $B_{40\%}$ (71,105 t), Alaska skates are managed in sub-tier “a” of Tier 3. Other reference points are $maxF_{ABC} = F_{40\%} = 0.081$ and $F_{OFL} = F_{35\%} = 0.094$. The Alaska skate portions of the 2020 and 2021 ABCs are 32,559 t and 31,264 t, respectively, and the Alaska skate portions of the 2020 and 2021 OFLs are 37,813 t and 36,310 t. The “other skates” component is assessed under Tier 5, based on a natural mortality rate of 0.10 and a biomass estimated using the random effects model. The “other skates” portion of the 2020 and 2021 ABCs is 8,984 t for both years and the “other skates” portion of the 2020 and 2021 OFLs is 11,979 t for both years.

For the skate complex as a whole, ABCs for 2020 and 2021 total 41,543 t and 40,248 t, respectively, and OFLs for 2020 and 2021 total 49,792 t and 48,289 t, 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. Sculpins

Status and catch specifications (t) of sculpins 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 2020 and 2021 are those recommended by the Plan Team. Additional information listed below summarizes the 2019 partial assessment. The last full assessment was conducted in 2016. The OFL and ABC for 2020 and 2021 are those recommended by the Plan Team. Catch data are current through November 2, 2019.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2018	188,656	53,201	39,995	5,000	5,109
	2019	188,656	53,201	39,995	5,000	5,300
	2020	240,487	67,817	50,863	n/a	n/a
	2021	240,487	67,817	50,863	n/a	n/a

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. If Amendments 121/110 and their implementing regulations are approved by the Secretary of Commerce, Amendments 121/110 are anticipated to be effective by 2020. Until Amendment 121/110 is effective, NMFS will continue to publish OFLs, ABCs, and TACs for sculpins in the BSAI groundfish harvest specifications.

Changes from previous assessment

This chapter was presented in a “partial assessment” format because it was a scheduled “off-year” assessment under the new Stock Assessment Prioritization guidelines. The random effects model was re-run with new survey data. No changes were made to the assessment model. A new feature included in the “off-year” assessments was a time series of exploitation rate (i.e., catch/biomass).

Spawning biomass and stock trends

The Bering Sea shelf total 2019 biomass was 230,291 t compared to the total 2017 biomass estimate of 171,760 t). Bigmouth sculpin declined 11%, and Plain sculpin increased 67% and was responsible for the increase for the ABC and OFL. The random effects model was run using the updated 2019 shelf survey data and 2018 Aleutian Islands survey data. Catches appear stable, with 5,339 t in 2017, 5,109 t in 2018, and 5,315 t in 2019 (through November 2, 2019). Retention is low at about 2%. The catch to biomass ratio has been stable with catch to biomass at 3% in those years,

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The BSAI sculpin complex is managed as a Tier 5 stock. The recommended ABCs and OFLs for 2019 and 2020 are 50,863 t and 67,817 t, respectively.

Status determination

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

20. Sharks

In accordance with the approved schedule, no assessment was conducted for Sharks this year. However, a full assessment will be conducted in 2020. Until then, the values generated from the previous stock assessment are rolled over for 2019 specifications. Additional information listed below summarizes the 2018 assessment.

Changes from previous assessment

A full stock assessment was conducted for sharks in 2018. No assessment will be conducted in 2019, and the next full assessment will be in 2020.

Total catch was updated for 2003-2018 (as of Oct 9, 2018). The IPHC survey RPNs were updated through 2017. The biomass estimates were updated for the Aleutian Islands and EBS shelf surveys through 2018. There was no EBS slope survey in 2018.

Changes in assessment methodology

There were no changes in assessment methodology.

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. In 2017, the IPHC RPN showed a slight increase, which was the first increase in a decade. 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. 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.

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.

22. Octopus

In accordance with the approved schedule, no assessment was conducted for Octopus this year. However, a full assessment will be conducted in 2020. Until then, the values generated from the previous stock assessment are rolled over for 2019 specifications. Additional information listed below summarizes the 2018 assessment.

Changes from previous assessment

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

- Updated 2017 and preliminary 2018 incidental catch
- 2017 and 2018 EBS shelf survey and 2018 Aleutian Islands survey have been added. The planned 2018 EBS slope survey did not occur due to problems with vessel availability.

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

Spawning biomass and stock trends

Species composition and size frequencies from the surveys were similar to previous years. Survey biomass estimates increased in 2018 for the EBS shelf survey when compared to 2017 estimates and decreased in the AI survey when compared to the 2016 estimate.

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

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The ABC and OFL values were determined under Tier 6. Usually, Tier 6 specifications are based on average catch, but starting in 2011, the assessment authors recommended setting harvest specifications using an alternative mortality estimate based on species composition of Bering Sea Pacific cod diet from 1984-2008 survey data and weight-at-age data. This method was also recommended for 2017 and 2018 with additional years from 1984-2015 of Pacific cod diet data based on the requested five-year review of Pacific cod diet estimates. Data availability has not changed from the 2016 assessment, so harvest recommendations are the same as in 2016. The recommended ABCs and OFLs for 2019 and 2020 are 3,576 t and 4,769 t, respectively.

Status determination

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

Tables

Table 1. BSAI Groundfish Plan Team Recommended OFLs and ABSs for 2020 and 2021 (metric tons); OFL, ABS, TAC and catch through November 2, 2019.

Species	Area	2019				2020		2021	
		OFL	ABC	TAC	Catch	OFL	ABC	OFL	ABC
Pollock	EBS	3,914,000	2,163,000	1,397,000	1,406,063	4,273,000	2,045,000	3,456,000	1,716,000
	AI	64,240	52,887	19,000	1,592	66,973	55,120	70,970	58,384
	Bogoslof	183,080	137,310	75	208	183,080	137,310	183,080	137,310
Pacific cod	BS	216,000	181,000	166,475	148,142	185,650	155,873	123,331	102,975
	AI	27,400	20,600	14,214	12,954	27,400	20,600	27,400	20,600
Sablefish	BSAI					11,758	4,370	15,084	5,463
	BS	3,221	1,489	1,489	3,202	n/a	1,853	n/a	2,317
	AI	4,350	2,008	2,008	662	n/a	2,517	n/a	3,146
Yellowfin sole	BSAI	290,000	263,200	154,000	122,309	287,307	260,918	287,943	261,497
Greenland turbot	BSAI	11,362	9,658	5,294	2,855	11,319	9,625	10,006	8,510
	BS	n/a	8,431	5,125	2,681	n/a	8,403	n/a	7,429
	AI	n/a	1,227	169	174	n/a	1,222	n/a	1,080
Arrowtooth flounder	BSAI	82,939	70,673	8,000	9,591	84,057	71,618	86,647	73,804
Kamchatka flounder	BSAI	10,965	9,260	5,000	4,494	11,495	9,708	11,472	9,688
Northern rock sole	BSAI	122,000	118,900	47,100	25,497	157,300	153,300	236,800	230,700
Flathead sole	BSAI	80,918	66,625	14,500	15,062	82,810	68,134	86,432	71,079
Alaska plaice	BSAI	39,880	33,600	18,000	15,812	37,600	31,600	36,500	30,700
Other flatfish	BSAI	21,824	16,368	6,500	3,756	21,824	16,368	21,824	16,368
Pacific Ocean perch	BSAI	61,067	50,594	44,069	41,653	58,956	48,846	56,589	46,885
	BS	n/a	14,675	14,675	13,178	n/a	14,168	n/a	13,600
	EAI	n/a	11,459	11,009	10,324	n/a	11,063	n/a	10,619
	CAI	n/a	8,435	8,385	8,263	n/a	8,144	n/a	7,817
	WAI	n/a	16,025	10,000	9,888	n/a	15,471	n/a	14,849
Northern rockfish	BSAI	15,507	12,664	6,500	9,057	19,751	16,243	19,070	15,683
Blackspotted/Rougheye Rockfish	BSAI	676	555	279	387	861	708	1,090	899
	EBS/EAI	n/a	351	75	82	n/a	444	n/a	560
	CAI/WAI	n/a	204	204	305	n/a	264	n/a	339
Shortraker rockfish	BSAI	722	541	358	355	722	541	722	541
Other rockfish	BSAI	1,793	1,344	663	1,254	1,793	1,344	1,793	1,344
	BS	n/a	956	275	685	n/a	956	n/a	956
	AI	n/a	388	388	569	n/a	388	n/a	388
Atka mackerel	BSAI	79,200	68,500	57,951	56,563	81,200	70,100	74,800	64,400
	EAI/BS	n/a	23,970	23,970	22,802	n/a	24,535	n/a	22,540
	CAI	n/a	14,390	14,390	14,320	n/a	14,721	n/a	13,524
	WAI	n/a	30,140	19,591	19,441	n/a	30,844	n/a	28,336
Skates	BSAI	51,152	42,714	26,000	17,873	49,792	41,543	48,289	40,248
Sculpins	BSAI	53,201	39,995	5,000	5,300	67,817	50,863	67,817	50,863
Sharks	BSAI	689	517	125	141	689	517	689	517
Octopuses	BSAI	4,769	3,576	400	244	4,769	3,576	4,769	3,576
Total	BSAI	5,340,955	3,367,578	2,000,000	1,905,026	5,727,923	3,273,825	4,929,117	2,968,033

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 2020-2021. 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	2020					
		Tier	$\max F_{ABC}$	F_{ABC}	$\max ABC$	ABC	% Red.
Pollock Sablefish	EBS	1a	0.442	0.253	3,578,000	2,045,000	32%
	BSAI	3a	0.102	0.043	10,116	4,369	57%
		2021					
		Tier	$\max F_{ABC}$	F_{ABC}	$\max ABC$	ABC	% Red.
Pollock Sablefish	EBS	1a	0.442	0.262	2,894,000	1,716,000	41%
	BSAI	3a	0.102	0.043	12,991	5,463	58%

Table 3. Summary of stock abundance (biomass), overfishing level (OFL), acceptable biological catch (ABC), the fishing mortality rate corresponding to ABC (F_{ABC}), and the fishing mortality rate corresponding to OFL (F_{OFL}) for the eastern Bering Sea (EBS), Aleutian Islands (AI), and Bogoslof district as projected for 2020 and 2021. “Biomass” corresponds to projected January abundance for the age+ range reported in the summary. Stock-specific biomass, OFL, and ABC are in metric tons.

Species or Complex	Tier	Area	2020					2021			
			Biomass	OFL	ABC	F _{OFL}	F _{ABC}	OFL	ABC	F _{OFL}	F _{ABC}
Pollock	1a	EBS	8,580,000	427,300	2,045,000	0.528	0.356	3,456,000	1,716,000	0.528	0.253
	3a	AI	319,892	66,973	55,120	0.415	0.331	70,970	58,384	0.415	0.331
	5	Bogoslof	610,267	183,080	137,310	0.300	0.225	183,080	137,310	0.300	0.225
Pacific cod	3a	BS	751,708	185,650	155,873	0.410	0.340	123,331	102,975	0.340	0.280
	5	AI	80,700	27,400	20,600	0.340	0.255	27,400	20,600	0.340	0.255
Sablefish	3b	BS	52,000	3,221	1,489	0.096	0.044	4,441	1,994	0.117	0.051
	3b	AI	98,000	4,350	2,008	0.096	0.044	5,997	2,688	0.117	0.051
Yellowfin sole	1a	BSAI	2,726,370	321,794	296,060	0.118	0.109	322,591	296,793	0.118	0.109
Greenland turbot	3a	BSAI	100,420	10,654	9,059	0.210	0.180	9,430	8,020	0.210	0.180
Arrowtooth flounder	3a	BSAI	891,959	82,860	70,606	0.161	0.136	84,057	71,618	0.161	0.136
Kamchatka flounder	3a	BSAI	162,708	11,495	9,708	0.108	0.090	11,472	9,688	0.108	0.090
Northern rock sole	1a	BSAI	828,000	157,300	153,300	0.147	0.144	236,800	230,700	0.147	0.144
Flathead sole	3a	BSAI	684,768	82,810	68,134	0.470	0.380	86,432	71,079	0.470	0.380
Alaska plaice	3a	BSAI	428,800	37,600	31,600	.150	0.125	36,500	30,700	0.150	0.125
Other flatfish	5	BSAI	141,325	21,824	16,368	0.17 / 0.09 / 0.15	0.13 / 0.06 / 0.11	21,824	16,368	0.17 / 0.09 / 0.15	0.13 / 0.06 / 0.11
Pacific ocean perch	3a	BSAI	908,529	58,956	48,846	0.095	0.079	56,589	46,885	0.095	0.079
Northern rockfish	3a	BSAI	250,235	19,751	16,243	0.075	0.061	19,070	15,683	0.075	0.061
Shortraker rockfish	5	BSAI	24,055	722	541	0.030	0.023	722	541	0.030	0.024
Blackspotted/Rougheye	3b	BSAI	49,005	817	675	0.042	0.034	1046	866	0.047	0.039
Other rockfish	5	BSAI	53,290	1,793	1,344	0.03 / 0.09	0.023 / 0.068	1,793	1,344	0.03 / 0.09	0.023 / 0.068
Atka mackerel	3b	BSAI	515,890	81,200	70,100	0.480	0.410	74,800	64,400	0.460	0.390
Skate	3a/5	BSAI	611,761	49,792	41,543	0.094 / 0.10	0.081 / 0.075	48,289	40,248	0.094 / / 0.10	0.081 / 0.075
Sculpin	5	BSAI	240,487	67,817	50,863	0.282	0.212	67,817	50,863	0.282	0.212
Shark	6	BSAI	n/a	689	517	n/a	n/a	689	517	n/a	n/a
Octopus	6	BSAI	n/a	4,769	3,576	n/a	n/a	4,769	3,576	n/a	n/a
Total		BSAI	19,110,169	5,756,317	3,306,483			4,955,909	2,999,840		

Table 4. Groundfish catches (metric tons) in the eastern Bering Sea, 1954-2018.

Year	Pollock	Pacific Cod	Sablefish	Yellowfin Sole	Greenland Turbot	Arrowtooth Flounder/a	Kamchatka Flounder/b	Rock Sole	Flathead Sole	Alaska Plaice	Other Flatfish/c
1954				12,562							
1955				14,690							
1956				24,697							
1957				24,145							
1958	6,924	171	6	44,153							
1959	32,793	2,864	289	185,321							
1960			1,861	456,103	36,843						
1961			15,627	553,742	57,348						
1962			25,989	420,703	58,226						
1963			13,706	85,810	31,565						
1964	174,792	13,408	3,545	111,177	33,729						
1965	230,551	14,719	4,838	53,810	9,747						
1966	261,678	18,200	9,505	102,353	13,042						
1967	550,362	32,064	11,698	162,228	23,869						
1968	702,181	57,902	4,374	84,189	35,232						
1969	862,789	50,351	16,009	167,134	36,029						
1970	1,256,565	70,094	11,737	133,079	19,691	12,598					
1971	1,743,763	43,054	15,106	160,399	40,464	18,792					
1972	1,874,534	42,905	12,758	47,856	64,510	13,123					
1973	1,758,919	53,386	5,957	78,240	55,280	9,217					
1974	1,588,390	62,462	4,258	42,235	69,654	21,473					
1975	1,356,736	51,551	2,766	64,690	64,819	20,832					
1976	1,177,822	50,481	2,923	56,221	60,523	17,806					
1977	978,370	33,335	2,718	58,373	27,708	9,454					
1978	979,431	42,543	1,192	138,433	37,423	8,358					
1979	913,881	33,761	1,376	99,017	34,998	7,921					
1980	958,279	45,861	2,206	87,391	48,856	13,761					
1981	973,505	51,996	2,604	97,301	52,921	13,473					
1982	955,964	55,040	3,184	95,712	45,805	9,103					
1983	982,363	83,212	2,695	108,385	43,443	10,216					
1984	1,098,783	110,944	2,329	159,526	21,317	7,980					
1985	1,179,759	132,736	2,348	227,107	14,698	7,288					
1986	1,188,449	130,555	3,518	208,597	7,710	6,761					
1987	1,237,597	144,539	4,178	181,429	6,533	4,380					
1988	1,228,000	192,726	3,193	223,156	6,064	5,477					
1989	1,230,000	164,800	1,252	153,165	4,061	3,024					
1990	1,353,000	162,927	2,329	80,584	7,267	2,773					
1991	1,268,360	165,444	1,128	94,755	3,704	12,748		46,681			
1992	1,384,376	163,240	558	146,942	1,875	11,080		51,720			
1993	1,301,574	133,156	669	105,809	6,330	7,950		63,942			
1994	1,362,694	174,151	699	144,544	7,211	13,043		60,276			
1995	1,264,578	228,496	929	124,746	5,855	8,282		54,672	14,699		
1996	1,189,296	209,201	629	129,509	4,699	13,280		46,775	17,334		
1997	1,115,268	209,475	547	166,681	6,589	8,580		67,249	20,656		
1998	1,101,428	160,681	586	101,310	8,303	14,985		33,221	24,550		
1999	988,703	146,738	678	69,275	5,401	10,585		40,505	18,534		
2000	1,132,736	151,372	742	84,057	5,888	12,071		49,186	20,342		
2001	1,387,452	142,452	863	63,563	4,252	12,836		28,949	17,757		
2002	1,481,815	166,552	1,143	74,956	3,150	10,821		40,700	15,464		
2003	1,492,039	174,687	1,039	81,050	2,565	13,667		36,375	14,132	10,118	
2004	1,480,552	183,745	1,041	75,502	1,825	17,367		47,862	17,361	7,888	
2005	1,483,022	182,936	1,070	94,383	2,140	13,409		36,814	16,074	11,194	
2006	1,488,031	168,814	1,079	99,156	1,453	11,966		35,878	17,942	17,318	
2007	1,354,502	140,129	1,182	120,962	1,481	11,082		36,364	18,929	19,522	
2008	990,587	139,802	1,141	148,893	2,089	18,897		50,934	24,521	17,377	
2009	810,857	147,174	916	107,512	2,252	19,212		48,145	19,535	13,944	
2010	810,390	142,868	755	118,624	2,273	14,782		52,644	20,097	16,165	
2011	1,199,216	209,222	705	151,166	3,136	16,864	4,478	60,353	13,546	23,655	
2012	1,205,276	232,674	743	147,186	3,058	18,978	2,510	75,777	11,355	16,612	
2013	1,270,823	236,700	634	164,944	1,449	14,056	2,110	59,590	17,344	23,522	
2014	1,297,846	238,735	315	156,772	1,479	14,928	3,268	51,569	16,505	19,447	
2015	1,322,312	232,832	210	126,937	2,090	10,330	3,386	45,347	11,293	14,614	
2016	1,353,711	231,511	532	135,350	2,117	9,777	3,165	44,860	10,358	13,385	
2017	1,356,445	196,761	1,150	125,620	2,691	5,680	3,166	34,877	8,859	15,549	
2018	1,379,320	148,142	1,598	131,539	1,672	6,182	1,373	28,059	11,045	23,342	
2019/f	1,406,271	148,142	3,202	122,303	2,681	8,956	2,924	25,200	15,036	15,812	

Note: Numbers don't include fish taken for research.
a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69.
b/ Kamchatka flounder included in Arrowtooth flounder prior to 2011.
c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in other flatfish catch statistics.
d/ Includes POP, northern, rougheye, shortraker, and sharpchin rockfish until 2004.
e/ Octopus, sculpin, sharks, skates included in Other species prior to 2011.
f/ Data through November 2, 2019.

Table 4 (continued). Groundfish catches (metric tons) in the eastern Bering Sea, 1954-2018.

Year	POP Complex/d	POP	N. Rockfish	RE Rockfish	BS/SR Rockfish	Other Rockfish	Atka Mack.	Other Species/e	Skate	Sculpin	Shark	Squid	Octopus	Total (All Species)
1954														12,562
1955														14,690
1956														24,697
1957														24,145
1958								147						51,401
1959								380						221,647
1960	6,100													500,907
1961	47,000													673,717
1962	19,900													524,818
1963	24,500													191,224
1964	25,900							736						393,891
1965	16,800							2,218						344,369
1966	20,200							2,239						452,081
1967	19,600							4,378						836,308
1968	31,500							22,058						967,083
1969	14,500							10,459						1,192,020
1970	9,900							15,295						1,593,649
1971	9,800							13,496						2,137,326
1972	5,700							10,893						2,149,092
1973	3,700							55,826						2,064,444
1974	14,000							60,263						1,900,092
1975	8,600							54,845						1,645,232
1976	14,900							26,143						1,428,565
1977	2,654					311		35,902				4,926		1,168,144
1978	2,221					2,614	831	61,537				6,886		1,302,509
1979	1,723					2,108	1,985	38,767				4,286		1,159,547
1980	1,097					459	4,955	34,633				4,040		1,221,944
1981	1,222					356	3,027	35,651				4,182		1,259,666
1982	224					276	328	18,200				3,838		1,211,483
1983	221					220	141	15,465				3,470		1,280,285
1984	1,569					176	57	8,508				2,824		1,458,299
1985	784					92	4	11,503				1,611		1,649,109
1986	560					102	12	10,471				848		1,633,911
1987	930					474	12	8,569				108		1,639,121
1988	1,047					341	428	12,206				414		1,810,470
1989	2,017					192	3,126	4,993				300		1,630,382
1990	5,639					384	480	5,698				460		1,644,109
1991	4,744					396	2,265	16,285				544		1,647,455
1992	3,309					675	2,610	29,993				819		1,831,954
1993	3,763					190	201	21,413				597		1,674,406
1994	1,907					261	190	23,430				502		1,818,628
1995	1,210					629	340	20,928				364		1,745,893
1996	2,635					364	780	19,717				1,080		1,653,828
1997	1,060					161	171	20,997				1,438		1,641,829
1998	1,134					203	901	23,156				891		1,486,704
1999	654					141	2,267	18,916				392		1,318,304
2000	704					239	239	23,098				375		1,497,502
2001	1,148					296	264	23,148				1,761		1,694,671
2002	858					401	572	26,639				1,334		1,826,993
2003	1,391					336	6,362	26,986				1,246		1,864,915
2004		731	116	24	119	318	7,159	27,588				1,000		1,874,953
2005		879	112	12	108	178	3,540	28,066				1,170		1,879,673
2006		1,041	246	7	47	157	3,176	25,077				1,403		1,875,914
2007		870	70	10	114	220	3,005	24,746				1,175		1,740,061
2008		513	22	22	41	222	392	27,152				1,494		1,427,678
2009		623	48	13	69	208	244	25,369				269		1,198,523
2010		3,547	299	30	161	268	151	20,697				305		1,206,215
2011		5,601	196	36	106	328	1,217		22,422	4,872	103	237	576	1,721,158
2012		5,589	91	17	117	211	966		23,740	4,991	94	560	126	1,754,172
2013		5,051	137	26	104	191	147		25,972	5,222	99	158	185	1,829,966
2014		7,437	147	23	96	323	136		26,326	4,487	134	1,568	410	1,846,290
2015		7,918	199	31	75	185	267		26,871	4,055	103	2,281	423	1,814,145
2016		8,221	208	41	51	280	360		27,952	4,381	117	1,328	585	1,851,117
2017		8,904	218	32	89	252	255		27,002	4,152	174	2,057	187	1,798,209
2018		9,635	188	15	170	212	1,146		29,475	4,397	96	1,701	132	1,823,944
2019/f		13,178	466	52	273	685	1,134		16,648	4,508	138	0	152	1,791,471

Note: Numbers don't include fish taken for research.
a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69.
b/ Kamchatka flounder included in Arrowtooth flounder prior to 2011.
c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in other flatfish catch statistics.
d/ Includes POP, northern, rougheye, shortraker, and sharpchin rockfish until 2004.
e/ Octopus, sculpin, sharks, skates included in Other species prior to 2011.
f/ Data through November 2, 2019.

Table 5. Groundfish catches (metric tons) in the Aleutian Islands, 1954-2018.

Year	Pollock	Pacific Cod	Sable fish	Yellowfin Sole	Greenland Turbot	Arrowtooth Flounder/a	Kamchatka Flounder/b	Rock Sole	Flathead Sole	Alaska Plaice	Other Flatfish/c
1954											
1955											
1956											
1957											
1958											
1959											
1960											
1961											
1962											
1963			664		7						
1964		241	1,541		504						
1965		451	1,249		300						
1966		154	1,341		63						
1967		293	1,652		394						
1968		289	1,673		213						
1969		220	1,673		228						
1970		283	1,248		285	274					
1971		2,078	2,936		1,750	581					
1972		435	3,531		12,874	1,323					
1973		977	2,902		8,666	3,705					
1974		1,379	2,477		8,788	3,195					
1975		2,838	1,747		2,970	784					
1976		4,190	1,659		2,067	1,370					
1977	7,625	3,262	1,897		2,453	2,035					
1978	6,282	3,295	821		4,766	1,782					
1979	9,504	5,593	782		6,411	6,436					
1980	58,156	5,788	274		3,697	4,603					
1981	55,516	10,462	533		4,400	3,640					
1982	57,978	1,526	955		6,317	2,415					
1983	59,026	9,955	673		4,115	3,753					
1984	81,834	22,216	999		1,803	1,472					
1985	58,730	12,690	1,448		33	87					
1986	46,641	10,332	3,028		2,154	142					
1987	28,720	13,207	3,834		3,066	159					
1988	43,000	5,165	3,415		1,044	406					
1989	156,000	4,118	3,248		4,761	198					
1990	73,000	8,081	2,116		2,353	1,459					
1991	78,104	6,714	2,071	1,380	3,174	938					88
1992	54,036	42,889	1,546	4	895	900	236				68
1993	57,184	34,234	2,078	0	2,138	1,348	318				59
1994	58,708	22,421	1,771	0	3,168	1,334	308				55
1995	64,925	16,534	1,119	6	2,338	1,001	356	16			31
1996	28,933	31,389	720	654	1,677	1,330	371	10			51
1997	26,872	25,166	779	234	1,077	1,071	271	32			7
1998	23,821	34,964	595	5	821	694	446	19			35
1999	981	28,117	671	13	460	774	580	34			20
2000	1,244	39,684	1,070	13	1,086	1,157	480	80			32
2001	824	34,207	1,074	15	1,060	1,220	526	54			43
2002	1,177	30,801	1,118	29	485	1,032	1,165	111			39
2003	1,653	32,459	1,009	0	965	913	964	49			32
2004	1,158	28,873	955	9	434	818	818	38	0		33
2005	1,621	22,699	1,481	2	468	834	549	34	0		26
2006	1,745	24,211	1,151	4	537	1,476	578	39	0		36
2007	2,519	34,356	1,168	2	523	834	762	29	0		25
2008	1,278	31,229	899	0	822	2,473	342	18	0		46
2009	1,662	28,582	1,100	1	2,263	10,688	570	23	0		45
2010	1,235	29,001	1,097	0	1,873	24,098	577	29			41
2011	1,208	10,858	1,024	1	532	3,269	5,493	279	7		56
2012	975	18,220	1,205	1	1,658	3,400	6,995	322	12	0	42
2013	2,964	13,607	1,062	0	296	6,485	5,656	210	10	0	35
2014	2,375	10,595	818	0	177	4,181	3,190	155	9	0	51
2015	915	9,225	430	0	114	937	1,608	120	14	0	29
2016	1,257	12,359	349	0	121	1,328	1,685	241	26	0	21
2017	1,492	12,286	588	1	122	509	1,296	246	19	0	32
2018	1,860	14,719	660	4	161	820	1,735	216	17	0	39
2019/f	1,592	12,954	662	5	174	636	1,570	297	26	0	46

Note: Numbers don't include fish taken for research.
a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69.
b/ Kamchatka flounder included in Arrowtooth flounder prior to 2011.
c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in other flatfish catch statistics.
d/ Includes POP, northern, rougheye, shortraker, and sharpchin rockfish until 2004.
e/ Octopus, sculpin, sharks, skates included in Other species prior to 2011.
f/ Data through November 2, 2019.

Table 5 (continued). Groundfish catches (metric tons) in the Aleutian Islands, 1954-2018.

Year	POP Complex/d	POP	N. Rockfish	RE Rockfish	BS/SR Rockfish	Other Rockfish	Atka Mack.	Other Species/e	Skate	Sculpin	Shark	Squid	Octopus	Total (All Species)
1954														0
1955														0
1956														0
1957														0
1958														0
1959														0
1960														0
1961														0
1962		200												200
1963		20,800												21,471
1964		90,300												92,652
1965		109,100												111,868
1966		85,900												87,589
1967		55,900												66,781
1968		44,900												56,023
1969		38,800												44,009
1970		66,900					949	10,671						80,610
1971		21,800						2,973						32,118
1972		33,200					5,907	22,447						79,717
1973		11,800					1,712	4,244						34,006
1974		22,400					1,377	9,724						49,340
1975		16,600					13,326	8,288						46,553
1976		14,000					13,126	7,053						43,465
1977		8,080				3,043	20,975	16,170				1,808		67,348
1978		5,286				921	23,418	12,436				2,085		61,092
1979		5,487				4,517	21,279	12,934				2,252		75,195
1980		4,700				420	15,533	13,028				2,332		108,531
1981		3,622				328	16,661	7,274				1,763		104,199
1982		1,014				2,114	19,546	5,167				1,201		98,233
1983		280				1,045	11,585	3,675				510		94,617
1984		631				56	35,998	1,670				343		147,022
1985		308				99	37,856	2,050				9		113,310
1986		286				169	31,978	1,509				20		96,259
1987		1,004				147	30,049	1,155				23		81,364
1988		1,979				278	21,656	437				3		77,383
1989		2,706				481	14,868	108				6		186,494
1990		14,650				864	21,725	627				11		124,886
1991		2,545				549	22,258	91				30		117,942
1992		10,277				3,689	46,831	3,081				61		164,513
1993		13,375				495	65,805	2,540				85		179,659
1994		16,959				301	69,401	1,102				86		175,614
1995		14,734				220	81,214	1,273				95		183,862
1996		20,443				278	103,087	1,720				87		190,750
1997		15,687				307	65,668	1,555				323		139,049
1998		13,729				385	56,195	2,448				25		134,182
1999		18,501				657	53,966	1,670				9		106,453
2000		14,893				601	46,990	3,010				8		110,348
2001		15,587				610	61,296	4,029				5		120,550
2002		14,996				551	44,722	1,980				10		98,216
2003		18,765				401	52,988	1,326				36		111,560
2004		11,165	4,567	185	123	337	53,405	1,866				14		104,798
2005		9,548	3,852	78	62	286	58,474	1,417				17		101,446
2006		11,826	3,582	196	165	426	58,719	1,943				15		106,650
2007		17,581	3,946	157	210	435	55,742	2,053				13		120,357
2008		16,923	3,265	171	91	390	57,690	2,322				49		118,010
2009		14,725	3,064	184	116	403	72,563	2,514				91		138,594
2010		14,304	4,033	202	139	503	68,496	2,713				105		148,446
2011		18,403	2,566	129	227	616	50,600		732	502	4	99	11	96,616
2012		18,554	2,388	174	227	736	46,863		1,083	808	2	128	11	103,804
2013		26,311	1,900	296	267	623	23,034		1,058	606	17	141	39	84,619
2014		24,944	2,195	173	101	621	30,815		1,185	373	3	110	18	82,089
2015		23,507	6,998	150	78	501	53,003		1,252	925	4	83	23	99,916
2016		23,097	4,333	117	54	506	54,125		1,174	511	11	50	10	101,375
2017		23,240	4,461	165	62	568	63,401		1,387	882	4	42	21	110,824
2018		25,114	5,579	223	80	775	69,248		1,733	712	8	35	158	123,896
2019		28,476	8,591	335	82	569	55,429		1,225	791	3	0	93	113,556

Note: Numbers don't include fish taken for research.
a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69.
b/ Kamchatka flounder included in Arrowtooth flounder prior to 2011.
c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in other flatfish catch statistics.
d/ Includes POP, northern, roughey, shortraker, and sharpchin rockfish until 2004.
e/ Octopus, sculpin, sharks, skates included in Other species prior to 2011.
f/ Data through November 2, 2019.

Table 6. Groundfish catches (metric tons) in the Bering Sea and Aleutian Islands, 1954-2018.

Year	Pollock	Pacific Cod	Sablefish	Yellowfin Sole	Greenland Turbot	Arrowtooth Flounder/a	Kamchatka Flounder/b	Rock Sole	Flathead Sole	Alaska Plaice	Other Flatfish/c
1954				12,562							
1955				14,690							
1956				24,697							
1957				24,145							
1958	6,924	171	6	44,153							
1959	32,793	2,864	289	185,321							
1960			1,861	456,103	36,843						
1961			15,627	553,742	57,348						
1962			25,989	420,703	58,226						
1963			14,370	85,810	31,572						
1964	174,792	13,649	5,086	111,177	34,233						
1965	230,551	15,170	6,087	53,810	10,047						
1966	261,678	18,354	10,846	102,353	13,105						
1967	550,362	32,357	13,350	162,228	24,263						
1968	702,181	58,191	6,047	84,189	35,445						
1969	862,789	50,571	17,682	167,134	36,257						
1970	1,256,565	70,377	12,985	133,079	19,976	12,872					
1971	1,743,763	45,132	18,042	160,399	42,214	19,373					
1972	1,874,534	43,340	16,289	47,856	77,384	14,446					
1973	1,758,919	54,363	8,859	78,240	63,946	12,922					
1974	1,588,390	63,841	6,735	42,235	78,442	24,668					
1975	1,356,736	54,389	4,513	64,690	67,789	21,616					
1976	1,177,822	54,671	4,582	56,221	62,590	19,176					
1977	985,995	36,597	4,615	58,373	30,161	11,489					
1978	985,713	45,838	2,013	138,433	42,189	10,140					
1979	923,385	39,354	2,158	99,017	41,409	14,357					
1980	1,016,435	51,649	2,480	87,391	52,553	18,364					
1981	1,029,021	62,458	3,137	97,301	57,321	17,113					
1982	1,013,942	56,566	4,139	95,712	52,122	11,518					
1983	1,041,389	93,167	3,368	108,385	47,558	13,969					
1984	1,180,617	133,160	3,328	159,526	23,120	9,452					
1985	1,238,489	145,426	3,796	227,107	14,731	7,375					
1986	1,235,090	140,887	6,546	208,597	9,864	6,903					
1987	1,266,317	157,746	8,012	181,429	9,599	4,539					
1988	1,271,000	197,891	6,608	223,156	7,108	5,883					
1989	1,386,000	168,918	4,500	153,165	8,822	3,222					
1990	1,426,000	171,008	4,445	80,584	9,620	4,232					
1991	1,346,464	172,158	3,199	96,135	6,878	13,686	46,681				
1992	1,438,412	206,129	2,104	146,946	2,770	11,980	51,956				
1993	1,358,758	167,390	2,747	105,809	8,468	9,298	64,260				
1994	1,421,402	196,572	2,470	144,544	10,379	14,377	60,584				
1995	1,329,503	245,030	2,048	124,752	8,193	9,283	55,028	14,715			
1996	1,218,229	240,590	1,349	130,163	6,376	14,610	47,146	17,344			
1997	1,142,140	234,641	1,326	166,915	7,666	9,651	67,520	20,688			
1998	1,125,249	195,645	1,181	101,315	9,124	15,679	33,667	24,569			
1999	989,684	174,855	1,349	69,288	5,861	11,359	41,085	18,568			
2000	1,133,980	191,056	1,812	84,070	6,974	13,228	49,666	20,422			
2001	1,388,276	176,659	1,937	63,578	5,312	14,056	29,475	17,811			
2002	1,482,992	197,353	2,261	74,985	3,635	11,853	41,865	15,575			
2003	1,493,692	207,146	2,048	81,050	3,530	14,580	37,339	14,181	10,118		
2004	1,481,710	212,618	1,996	75,511	2,259	18,185	48,681	17,398	7,888		
2005	1,484,643	205,635	2,551	94,385	2,608	14,243	37,362	16,108	11,194		
2006	1,489,776	193,025	2,229	99,160	1,989	13,442	36,456	17,981	17,318		
2007	1,357,021	174,485	2,350	120,964	2,004	11,916	37,126	18,958	19,522		
2008	991,865	171,030	2,040	148,894	2,911	21,370	51,276	24,540	17,377		
2009	812,520	175,756	2,016	107,513	4,515	29,900	48,716	19,558	13,944		
2010	811,625	171,869	1,852	118,624	4,146	38,880	53,221	20,127	16,165		
2011	1,200,424	220,080	1,730	151,168	3,668	20,133	60,632	13,553	23,655		
2012	1,206,252	250,894	1,948	147,187	4,716	22,378	9,505	76,099	11,366	16,612	
2013	1,273,787	250,307	1,697	164,944	1,745	20,541	7,766	59,800	17,354	23,522	
2014	1,300,221	249,330	1,133	156,772	1,656	19,109	6,458	51,724	16,514	19,447	
2015	1,323,227	242,057	640	126,937	2,204	11,267	4,994	45,467	11,307	14,614	
2016	1,354,968	243,870	881	135,350	2,238	11,105	4,850	45,101	10,384	13,385	
2017	1,357,937	209,047	1,738	125,621	2,813	6,189	4,462	35,123	8,878	15,549	
2018	1,381,180	201,421	2,258	131,543	1,833	7,002	3,108	28,275	11,062	23,342	
2019/f	1,407,863	16,196	3,864	122,308	2,855	9,592	4,494	25,497	15,062	15,815	

Note: Numbers don't include fish taken for research.
a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69.
b/ Kamchatka flounder included in Arrowtooth flounder prior to 2011.
c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in other flatfish catch statistics.
d/ Includes POP, northern, rougheye, shortraker, and sharpchin rockfish until 2004.
e/ Octopus, sculpin, sharks, skates included in Other species prior to 2011.
f/ Data through November 2, 2019.

Table 6 (continued). Groundfish catches (metric tons) in the Bering Sea and Aleutian Islands, 1954-2018.

Year	POP Complex/d	POP	N. Rockfish	RE Rockfish	BS/SR Rockfish	Other Rockfish	Atka Mack.	Other Species/e	Skate	Sculpin	Shark	Squid	Octopus	Total (All Species)		
1954														12,562		
1955														14,690		
1956														24,697		
1957														24,145		
1958								147						51,401		
1959								380						221,647		
1960	6,100													500,907		
1961	47,000													673,717		
1962	20,100													525,018		
1963	45,300													212,695		
1964	116,200							802						486,543		
1965	125,900							2,986						456,237		
1966	106,100							2,370						539,670		
1967	75,500							12,920						903,089		
1968	76,400							31,006						1,023,106		
1969	53,300							13,547						1,236,029		
1970	76,800						949	25,966						1,674,259		
1971	31,600							16,469						2,169,444		
1972	38,900						5,907	33,340						2,228,809		
1973	15,500						1,712	60,070						2,098,450		
1974	36,400						1,377	69,987						1,949,432		
1975	25,200						13,326	63,133						1,691,785		
1976	28,900						13,126	33,196						1,472,030		
1977	10,734						3,354	20,975				6,734		1,235,492		
1978	7,507						3,535	24,249				8,971		1,363,601		
1979	7,210						6,625	23,264				5,538		1,234,742		
1980	5,797						879	20,488				6,372		1,330,475		
1981	4,844						684	19,688				5,945		1,363,865		
1982	1,238						2,390	19,874				5,039		1,309,716		
1983	501						1,265	11,726				3,980		1,374,902		
1984	2,200						232	36,055				3,167		1,605,321		
1985	1,092						191	37,860				1,620		1,762,419		
1986	846						271	31,990				868		1,730,170		
1987	1,934						621	30,061				131		1,720,485		
1988	3,026						619	22,084				417		1,887,853		
1989	4,723						673	17,994				306		1,816,876		
1990	20,289						1,248	22,205				471		1,768,995		
1991	7,289						945	24,523				574		1,765,397		
1992	13,586						4,364	49,441				880		1,996,467		
1993	17,138						685	66,006				682		1,854,065		
1994	18,866						562	69,591				588		1,994,242		
1995	15,944						849	81,554				459		1,929,755		
1996	23,078						642	103,867				1,167		1,844,578		
1997	16,747						468	65,839				1,761		1,780,878		
1998	14,863						588	57,096				916		1,620,886		
1999	19,155						798	56,233				401		1,424,757		
2000	15,597						840	47,229				383		1,607,850		
2001	16,735						906	61,560				1,766		1,815,221		
2002	15,854						952	45,294				1,344		1,925,209		
2003	20,156						737	59,350				1,282		1,976,475		
2004		11,896	4,684	209	242		656	60,564				29,454	1,014	1,979,752		
2005		10,427	3,964	90	170		465	62,014				29,482	1,186	1,981,119		
2006		12,867	3,828	203	212		583	61,895				27,021	1,418	1,982,564		
2007		18,451	4,016	168	323		655	58,747				26,799	1,188	1,860,418		
2008		17,436	3,287	193	133		612	58,082				29,474	1,542	1,545,687		
2009		15,347	3,111	197	184		611	72,807				27,883	360	1,337,116		
2010		17,852	4,332	232	300		771	68,647				23,410	410	1,354,662		
2011		24,004	2,762	165	333		944	51,817			23,154	5,374	107	336	587	1,817,774
2012	0	24,143	2,479	191	344		947	47,829			24,823	5,799	96	688	137	1,857,977
2013	0	31,362	2,038	322	371		815	23,181			27,030	5,828	116	300	224	1,914,585
2014	0	32,381	2,342	196	197		944	30,951			27,511	4,860	137	1,678	428	1,928,379
2015	0	31,425	7,197	181	153		686	53,270			28,123	4,980	107	2,364	446	1,914,061
2016	0	31,318	4,541	158	105		786	54,485			29,126	4,892	128	1,378	595	1,952,492
2017	0	32,144	4,679	197	151		820	63,656			28,389	5,034	178	2,099	208	1,909,033
2018	0	34,749	5,767	238	250		987	70,394			31,208	5,109	104	1,736	290	1,947,840
2019/f	0	41,654	9,057	387	355	1,254	56,563				17,873	5,299	141		245	1,905,027