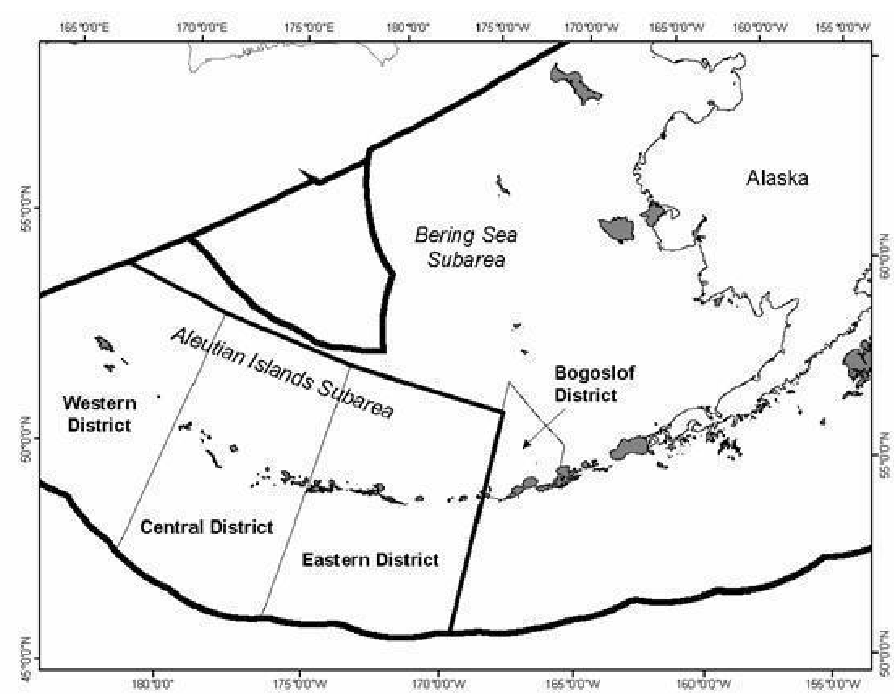
STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

FOR THE GROUNDFISH RESOURCES

OF THE BERING SEA/ALEUTIAN ISLANDS REGIONS

Compiled by:

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



With contributions by

K. Aydin, S.J. Barbeaux, M. Bryan, C. Conrath, M. Dalton, K. Echave, B. Fissel, M. Furuness, D. Hanselman, A. Haynie, A. Hicks, J. Hoff, K. Holsman, T. Honkalehto, P-J Hulson, J.N. Ianelli, A. Kingham, S. Kotwicki, R. Lauth, S. Lowe, C.R. Lunsford, C.R. McGilliard, D. McKelvey, D.G. Nichol, B. Norcross, O.A. Ormseth, W.A. Palsson, , C.J. Rodgveller, C.N. Rooper, C. Siddon, K. Shotwell, P.D. Spencer, I.B. Spies, D. Stram, T.T. TenBrink, G.G. Thompson, C.A. Tribuzio, and T.K. Wilderbuer.

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North Pacific Fishery Management Council
605 West 4th Ave., Suite 306
Anchorage, AK 99501

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Summary

By

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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 Ecosystems Ecosystem Status Report and the Economic SAFE report.

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

The BSAI Groundfish Plan Team met in Seattle on November 13-16, 2018 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 (Chair), Diana Stram (BSAI Groundfish FMP coordinator), Kirstin Holsman, Jane Sullivan, Andy Kingham, Allan Hicks, Mary Furuness, Cindy Tribuzio, Alan Haynie, Brenda Norcross, Kalei Shotwell, Steve Barbeaux, 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.

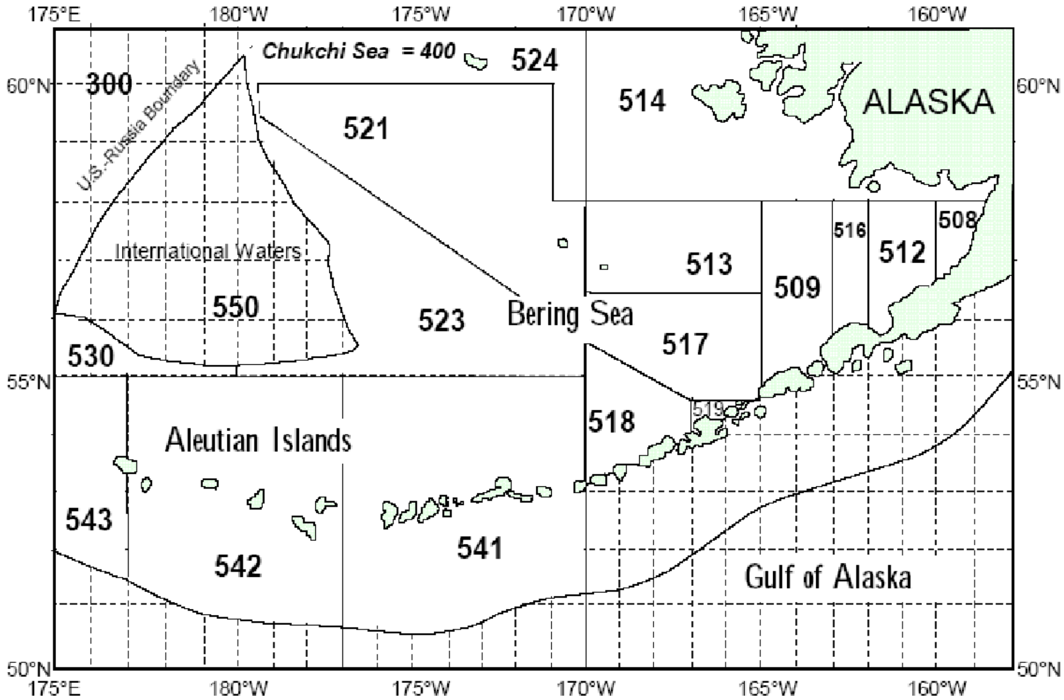


Figure 1. Bering Sea/Aleutian Islands statistical and reporting areas.

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 species[1]	**Prohibited species**[2]	**Forage fish species**[3]
Walleye Pollock	Pacific halibut	Osmeridae family (eulachon, capelin,and other smelts)
Pacific cod	Pacific herring	Myctophidae family (laternfishes)
Sablefish	Pacific salmon	Bathylagidae (deep-sea smelts)
Yellowfin sole	Steelhead trout	Ammodytidae family (Pacific sandlance)
Greenland turbot	King crab	Trichodontidae family (Pacific sand fish)
Arrowtooth flounder	Tanner crab	Pholidae family (gunnels)
Kamchatka flounder		Stichaeidae family (pricklebacks warbonnets, eelblennys, cockscombs, shannys)
Northern rock sole		Gonostomatidae family (bristlemouths, lightfishes and anglemouths)
Flathead sole		Other euphausiacea (krill)
Alaska plaice		Squid
Other flatfish		
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.

On July 6, 2018, NMFS published the final rule to implement Amendment 117 to the FMP (83 FR 31460). This rule reclassified squids in the FMP as an "Ecosystem Component" species. Starting in 2019, NMFS will no longer set an Overfishing Level (OFL), ABC, and TAC for squids in the BSAI groundfish harvest specifications. Amendment 117 prohibits directed fishing for squids, while maintaining recordkeeping and reporting requirements for squid. Appendix 1 to this report provides additional assessment and catch information for squid species. In the future, information on squids will be contained in the 'Forage Fish' report produced on a biennial cycle.

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 2017 totaled 1,798,209 t, Catches through November 3, 2018 totaled 1,791,237. For comparison catches in 2016 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. Total catch as of November 3, 2018 rose to 120,201 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 has increased to 24,235 through November 3, 2018. 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 has increased to 14,549 t through November 3, 2018. 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 with catch as of November 3, 2018 at 66,813 t. Catches since 2015 have been higher due to modifications in the Steller sea lion protections 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). BSAI catches through November 3,2018 totaled 1,911,438 t, which equaled 96% 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 2019 for each subarea are derived as 8% percent of the Bering Sea ABC (and an additional 45 t to the State jig fishery) and 31% 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

1) Information available: *Reliable point estimates of B and B_{MSY} and reliable pdf of F_{MSY}.*
   - 1a) Stock status: $B/B_{MSY} > 1$
     - $F_{OFL} = \mu_A$, *the arithmetic mean of the pdf*
     - $F_{ABC} \leq \mu_H$, *the harmonic mean of the pdf*
   - 1b) Stock status: $\alpha < B/B_{MSY} \leq 1$
     - $F_{OFL} = \mu_A \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
     - $F_{ABC} \leq \mu_H \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
   - 1c) Stock status: $B/B_{MSY} \leq \alpha$
     - $F_{OFL} = 0$
     - $F_{ABC} = 0$
2) Information available: *Reliable point estimates of B, B_{MSY}, F_{MSY}, $F_{35\%}$, and $F_{40\%}$.*
   - 2a) Stock status: $B/B_{MSY} > 1$
     - $F_{OFL} = F_{MSY}$
     - $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%})$
   - 2b) Stock status: $\alpha < B/B_{MSY} \leq 1$
     - $F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
     - $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
   - 2c) Stock status: $B/B_{MSY} \leq \alpha$
     - $F_{OFL} = 0$
     - $F_{ABC} = 0$
3) Information available: *Reliable point estimates of B, $B_{40\%}$, $F_{35\%}$, and $F_{40\%}$.*
   - *3a) Stock status:* $B/B_{40\%} > 1$
     - $F_{OFL} = F_{35\%}$
     - $F_{ABC} \leq F_{40\%}$
   - *3b) Stock status:* $\alpha < B/B_{40\%} \leq 1$
     - $F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$
     - $F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$
   - *3c) Stock status:* $B/B_{40\%} \leq \alpha$
     - $F_{OFL} = 0$
     - $F_{ABC} = 0$
4) Information available: *Reliable point estimates of B, $F_{35\%}$, and $F_{40\%}$.*
   - $F_{OFL} = F_{35\%}$
   - $F_{ABC} \leq F_{40\%}$
5) Information available: *Reliable point estimates of B and natural mortality rate M.*
   - $F_{OFL} = M$
   - $F_{ABC} \leq 0.75 \times M$
6) Information available: *Reliable catch history from 1978 through 1995.*
   - *OFL = the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information*
   - $ABC \leq 0.75 \times OFL$

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

Standard Harvest and Recruitment Scenarios and Projection Methodology

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

For each scenario, the projections begin with an estimated vector of 2019 or 2020 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. In each year, recruitment 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 2019 recommended in the assessment to the *max* F_{ABC} for 2019, and where catches for 2019 and 2020 are estimated at their most likely values given the 2019 and 2020 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 2019 and 2020 ABCs and OFLs are summarized in Tables 1, 2, and 3.

The sum of the recommended ABCs for 2019 and 2020 are 3,331,274 t and 2,953,299 t, respectively. These compare with the sums of the 2018 (3,766,809 t) and 2017 ABCs (4,013,993t). 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, EBS Pacific cod 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 2019 while Sablefish and Blackspotted/Rougheye rockfish remain below this target level.

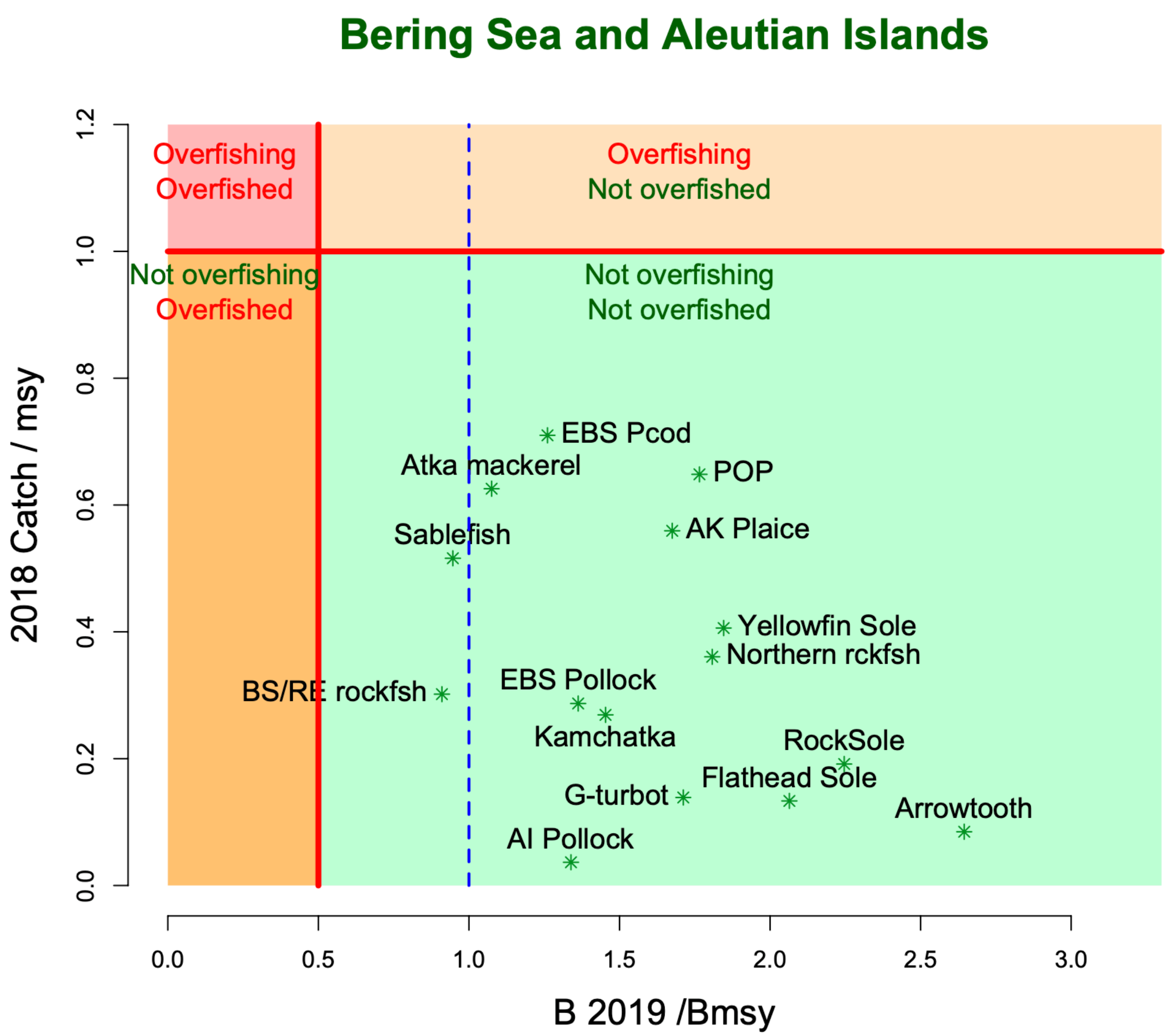


Figure 2. Summary of Bering Sea stock status next year (spawning biomass relative to B_{msy}; horizontal axis) and current year catch relative to fishing at F_{msy} (vertical axis) where F_{OFL} is taken to equal F_{msy}.

The sum of the biomasses for 2019 listed in Table 3 represents a nearly stable (<0.01 % decrease) trend since 2018. This is primarily due to declines in EBS pollock and Pacific cod balanced by increases in some flatfish and rockfish stocks. 2018 in turn was a 16% decrease from 2017. 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 2019 harvest specifications (from Council recommendations in December 2017) are in place to start the fishery on January 1, 2019, but these will be replaced by final harvest specifications that will be recommended by the Council in December 2018. The final 2019 and 2020 harvest specifications will become effective when final rulemaking occurs in February or March 2019. 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 2020 ABC and OFL values recommended in next year's SAFE report are likely to differ from this year's projections for 2020 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	2018 SAFE Assessment status	Tier	Schedule (years)	Year of next full assessment
Eastern Bering Sea pollock	Full	1	1	2019
Bogoslof Island Pollock	Full	5	2	2020
Aleutian Islands pollock	Full	3	2	2020
Eastern Bering Sea Pacific Cod	Full	3	1	2019
Aleutian Islands Pacific cod	Full	5	1	2019
Sablefish	Full	3	1	2019
Yellowfin sole	Full	1	1	2019
Greenland Turbot	Full	3	2	2020
Arrowtooth flounder	Full	3	2	2020
Kamchatka flounder	Full	3	2	2020
Northern Rock sole	Full	1	2	2020
Flathead sole	Full	3	2	2020
Alaska plaice	Partial	3	2	2019
Other flatfish	Partial	5	4	2020
Pacific ocean perch	Full	3	2	2020
Northern rockfish	Partial	3	2	2019
Rougheye & blackspotted rockfish	Full	3	2	2020
Shortraker rockfish	Full	5	2	2020
Other rockfish	Full	5	2	2020
Atka mackerel	Full	3	1	2019
Squids	Report	Eco	2	n/a
Skates	Full	3/5	2	2020
Sharks	Full	5	2	2020
Octopus	Full	6	2	2020
Sculpins	None	5	4	2019
Forage Species (including Squids)	None	Eco	2	2019
Grenadiers (BSAI/GOA)	None	Eco	4	2020

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

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

Economic Summary of the BSAI commercial groundfish fisheries in 2016-2017

The ex-vessel value of all Alaska domestic fish and shellfish catch, which includes the amount paid to harvesters for fish caught, and the estimated value of pre-processed fish species that are caught by catcher/processors, increased from $1,752 million in 2016 to $2,007 million in 2017. The first wholesale value of 2017 groundfish catch after primary processing was $2,518 million. The 2017 total groundfish catch decreased by 0.2%, and the total first-wholesale value of groundfish catch increased by 3%, relative to 2016.

The groundfish fisheries accounted for the largest share (47%) of the ex-vessel value of all commercial fisheries off Alaska with a total value of $947 million, while the Pacific salmon (*Oncorhynchus spp*.) fishery was second with $744 million or 37% of the total Alaska ex-vessel value. The value of the shellfish fishery amounted to $183 million or 9% of the total for Alaska and exceeded the value of Pacific halibut (*Hippoglossus stenolepis*) with $117 million or 6% 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, catch share fishery indicators, product price projections and ex-vessel price projections, a summary of the Alaskan community participation in fisheries, an Amendment 80 fishery economic data report (EDR) summary, an updated Amendment 91 fishery economic data report (EDR) and vessel master survey summary, 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. Data tables are organized into four relatively distinct sections: (1) All Alaska, (2) BSAI, (3) GOA, and (4) Pacific halibut. Additionally, flatfish and rockfish data are incorporated into the main data tables (rather than in the appendices as was done prior to 2017). 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. Appendices contain fisheries export data from the Census Bureau, and employment data from the Alaska Dept. of Labor. Generally, the data presented in this report cover 2013 - 2017, 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: www.afsc.noaa.gov/refm/Socioeconomics/SAFE.

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

According to data reported in the 2018 Economic SAFE report, the total ex-vessel value of BSAI groundfish increased 6 percent from $695 million in 2016 to $738 million in 2017 (Figure 3), and first-wholesale revenues from the processing and production of groundfish in the Bering Sea and Aleutian Islands (BSAI) increased by 5% between 2016 ($2,066 million) and 2017 ($2,151 million) (Figure 4). At the same time, the total quantity of groundfish products from the BSAI decreased from 838 thousand metric tons to 824 thousand metric tons, a 2%

decrease. These changes in the BSAI differed from those in the GOA where wholesale revenue was constant; there was a 4% year-to-year increase 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 2016-17 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, negative price effects and smaller positive quantity effects resulted in a negative net effect of about $13 million for pollock. For Pacific cod, a large positive price effect combined with a smaller negative quantity effect, resulting in a $46 million net increase in first-wholesale revenues for Pacific cod from the BSAI for 2016-17 (Figure 5). There was a positive price effect and small negative quantity effect for rockfish, resulting in a net positive effect of $7 million. Atka mackerel had a positive price effect of $29 million and a positive quantity effect of $24 million, combining for a net positive effect of $53 million. Sablefish had a negative price effect of $1 million and a positive quantity effect of $6 million, combining for a net positive effect of $5 million. “Other” experienced a net revenue increase of $2 million.

By product group, large negative price effects coupled with smaller negative quantity effects in the fillets category resulted in a negative net effect of $50 million in the BSAI first-wholesale revenue decomposition for 2016-17. For surimi, large positive price effects coupled with smaller positive quantity effects resulted in a large positive net effect of $75 million. For roe, small positive price effects coupled with larger positive quantity effects to result in a positive net effect of $28 million. For whole fish and head & gut, a large positive price effect combined with a much smaller negative quantity effect to produce a net positive effect of $124 million while for ‘other’ products a negative price effect combined with a negative quantity effect for a net negative effect of $35 million.

In summary, the changes in first-wholesale revenues from the BSAI groundfish fisheries increased from 2016-17 due in large part to positive price effects for flatfish and pollock, and positive quantity effects for Pacific cod. In comparison, first-wholesale revenues decreased from 2016-17 in the GOA. The main drivers of this GOA decline was a negative net revenue effect for pollock and Pacific cod being offset by positive net effects for sablefish and flatfish.

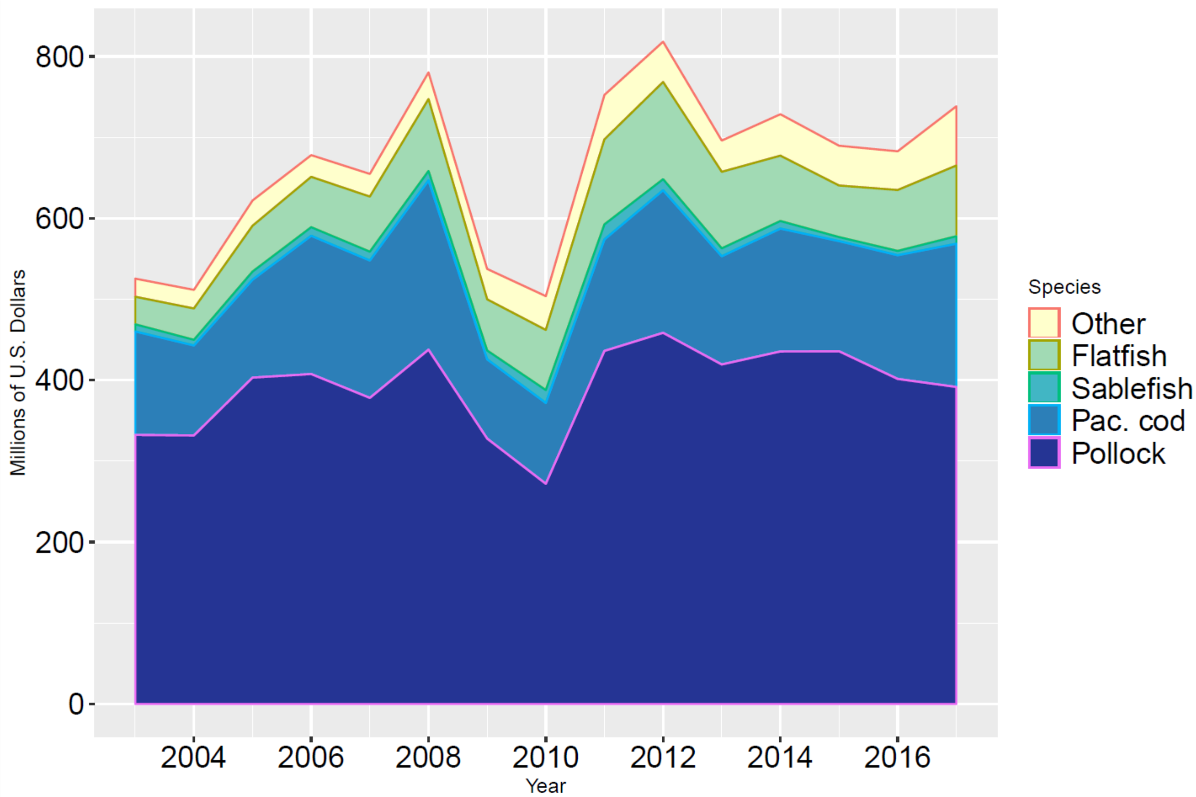


Figure 3. Real ex-vessel value of the groundfish catch in the domestic commercial fisheries in the BSAI area by species, 2003-2017 (base year = 2017).

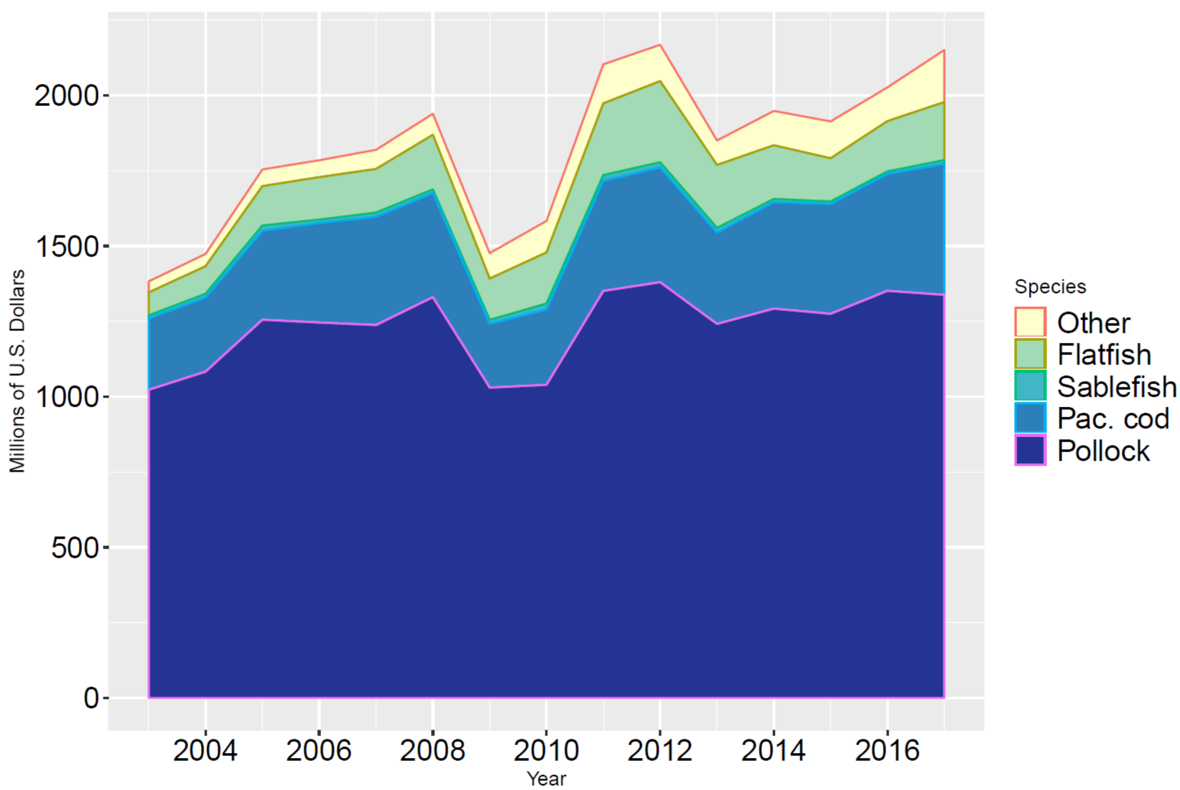
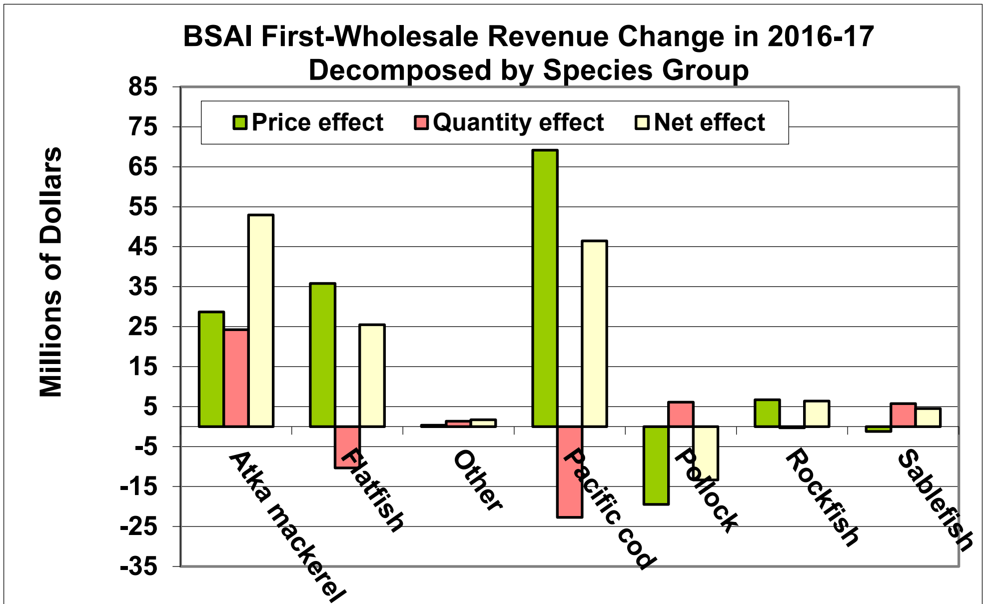


Figure 4. Real gross product value of the groundfish catch in the BSAI area by species, 2003-2017 (base year = 2017).



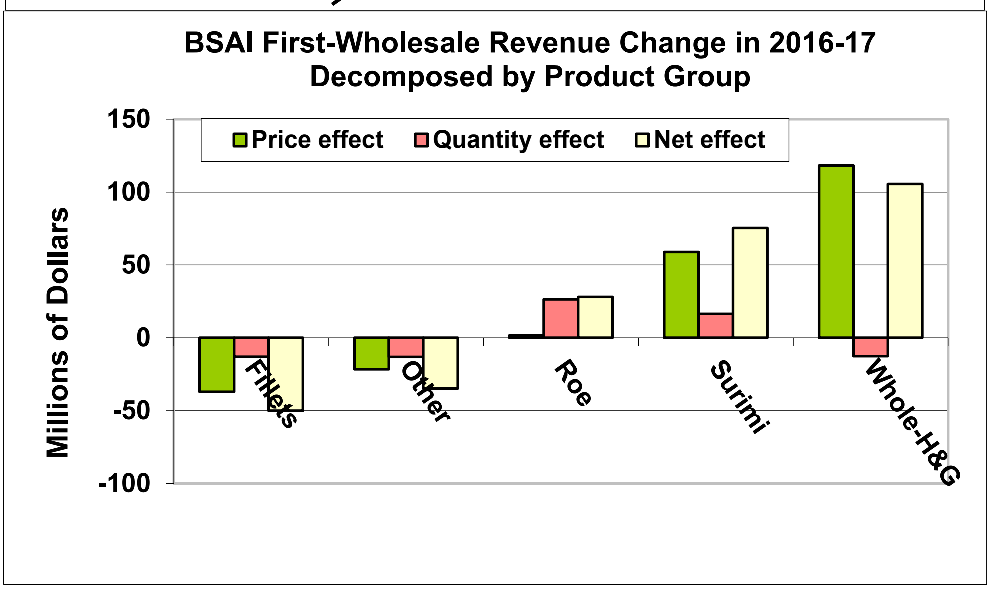


Figure 5. Decomposition of the change in first-wholesale revenues from 2016-17 in the BSAI area. The first decomposition is by the species groups used in the Economic SAFE report, and the second decomposition is by product group. The price effect refers to the change in revenues due to the change in 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

The Bering Sea experienced an unprecedented marine heatwave in 2018 resulting in an exceptionally low amount of winter sea ice during the 2017/2018. The Chukchi experienced the warmest year on record; there was little to no salinity stratification (no >32 ppm salinities), which led to more water column mixing. The northern Bering Sea had >+5ºC anomalies in January–April 2018 and anomalously warm conditions persisted in summer 2018 with both the SE Bering Sea (SEBS) and NE Bering Sea (NEBS) experiencing water temperatures that were well above the long-term expected range. Sea ice formation in 2018 reached an unprecedented minimum extent, with a near-complete lack of sea ice in the northern Bering Sea due to: (i) residual heat that delayed freeze-up, (ii) a large high-pressure system that shifted the position of the Aleutian Low Pressure System (ALPS) northwest, and (iii) winds from the southwest that brought warm air over the Bering Sea. The cold pool for summer 2018 was nearly non-existent. The response of the Bering Sea ecosystem to highly anomalously warm conditions in the SEBS 2016, near average conditions in 2017, and a return to highly anomalously warm conditions in 2018 was evident across multiple trophic levels, with some lags and divergent responses that are species- and sub-region specific. In the NEBS, 2018 was extraordinarily different than in the past experience of scientists visiting the region or in the oral histories of local residents. Notable patterns are listed below:

- There were positive sea surface temperature anomalies in the northern Bering Sea during summer and winter for the last several years, including the warmest summer of the time series in 2018.
- In the SEBS an unprecedented lack of winter sea ice resulted in a near absent cold pool, which has never been observed in the 37 year timeseries. The cold pool was the lowest areal coverage in the 37-year time-series and 2018 was the first time that bottom temperatures <0ºC were not observed in any location within the standard bottom trawl survey area.
- Both global model forecasts and a regional 9-month forecast predict continued heatwave conditions in the NEBS and warm conditions in the SEBS. The forecasts for summer 2019 predict a lack of a cold pool based on the ≤0ºC or ≤1ºC definitions, and a small ≤2ºC cold pool (similar to 2003). There is a 70% change of El Niño conditions in 2019.
- Multiple indices point to SEBS conditions that are unfavorable for cod and pollock recruitment of the 2018 year class relative to slightly favorable conditions in for 2017 year classes.
- The lack of sea ice led to a delayed and weak spring bloom and reduced large copepod and juvenile euphausiid abundances across the Bering Sea from spring through late summer 2018, with some potential productivity 'hot spots' located near Unimak Pass and in the northwest region. In contrast small copepods were abundant throughout the survey area, except at the most northern stations.
- Widespread and prolonged seabird die-offs were reported for the NEBS, likely due to starvation especially in species that consume large zooplankton.
- There are continued declines or continued below average fish conditions (defined as Length-Weight residuals) observed for multiple species in the SEBS. Notably, there has been a negative trend in Pacific cod condition since a peak in 2003. Condition of age-1+ pollock in 2018 was the second lowest on record and continued a decreasing trend. While cod and pollock in the SEBS were in poor condition, NEBS cod and pollock north of St. Lawrence were "fat and healthy".
- The 2018 catch of Canadian-origin juvenile Chinook salmon in the northern Bering Sea was among the lowest observed since 2003. It is likely that the 2018 estimate will be below average, marking the 2nd consecutive year of below average abundance.
- The 2018 Bristol Bay salmon inshore run of adult sockeye was the largest on record since 1963. Multiple indicators suggest these stocks may have experienced positive conditions at juvenile entry into the southeastern Bering Sea in summer of 2015 and 2016 and winter of 2016 and 2017.
- The abundance of Northern and southern rock sole in larval surveys were near zero in 2018, and rockfish larvae were lowest observed in the 2012-2018 timeseries. Capelin were below average, age 0

pollock near average, and non-chinook juvenile salmonids and herring above average in 2018. Jellyfish CPUE in the bottom trawl survey increased >200% from 2017 to 2018 and were similar to mid 1990s catch. CPUE of eelpouts, poachers and seastars decreased relative to 2017

- Cod diet analyses in the NEBS indicate that cod were consuming snow crab, which have increased by 60% relative to 2017. Non-snow crab biomass and abundance decreased for multiple species and stocks in 2018 including Bristol Bay red king crab (males and females), St. Matthew Island blue king crab males, and Tanner crab (males and females); Pribilof Island blue king crab (males and females) stocks remain depressed.
- Fur seal pup production on St. Paul continues to decline while the St. George population shows no significant trend since 1998. In the NEBS, ice seals (especially ribbon seals) were scarce, and population location and abundance is presently unknown.
- In the Northern Bering Sea, walruses were harvested at times when they are not typically accessible and they were reported to be fat and in good condition. There were multiple reports of high numbers of dead seals on beaches of St. Lawrence and appeared to be of poor body condition and with empty stomachs.

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 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Biomass	OFL	ABC	TAC*	Catch
Eastern Bering Sea	2017	13,000,000	3,640,000	2,800,000	1,345,000	1,359,274
	2018	10,967,000	4,797,000	2,592,000	1,364,341	1,376,730
	2019	10,119,000	3,914,000	2,163,000	n/a	n/a
	2020	8,156,000	3,082,000	1,792,000	n/a	n/a
Aleutian Islands	2017	250,221	43,650	36,061	19,000	1,507
	2018	272,675	49,289	40,788	19,000	1,805
	2019	319,892	62,240	52,887	n/a	n/a
	2020	340,680	66,981	55,125	n/a	n/a
Bogoslof	2017	434,760	130,428	51,300	500	186
	2018	434,760	130,428	51,300	450	9
	2019	610,267	183,080	137,310	n/a	n/a
	2020	610,267	183,080	137,310	n/a	n/a

* In 2017, NMFS reallocated 14,900 t of pollock TAC from the Aleutian Islands to the Bering Sea, which increased the Bering Sea TAC to 1,354,900 t and decreased the Aleutian Islands TAC to 4,100 t.

Eastern Bering Sea pollock

Changes from previous assessment

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

- The 2018 NMFS bottom-trawl survey (BTS) biomass and abundance at age estimates were included.
- The 2018 NMFS acoustic-trawl survey (ATS) biomass and abundance were included (using mainly samples from the BTS survey for age-length keys)
- The 2018 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 2016 fishery were finalized and included.
- Total catch as reported by NMFS Alaska Regional office was updated and included through 2018.

There were no changes to assessment methodology this year.

Spawning biomass and stock trends

Spawning biomass in 2008 was at the lowest level since 1981 but had increased by a factor of 2.52 by 2017, and has now 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 2.19, 2.43, and 1.80 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 2019 by a factor of 1.36.

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 2.280 million t, 12% above last year's estimate of 2.043 million t. Projected spawning biomass for 2019 is 3.107 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 0.510, 9% above last year's value of 0.466. The harvest ratio of 0.510 is multiplied by the geometric mean of the projected fishable biomass for 2019 (6.073 million t) to obtain the maximum permissible ABC for 2019, which is 3.096 million t, down 14% and 10% from the maximum permissible ABCs for 2018 and 2019 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 "risk matrix" contained in the SAFE chapter, where assessment concerns are categorized as Level 1 ("normal"), and population dynamic and environmental/ecosystem concerns are both categorized as Level 2 ("substantially increased concern"). The authors conclude that these levels of concern warrant setting the 2019 and 2020 ABCs at 2,163,000 t and 1,792,000 t (reductions of 30% and 26% 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 2019 and 2020 fisheries.

The OFL harvest ratio under Tier 1a is 0.645, 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 2019 determines the OFL for 2019, which is 3.914 million t. The current projection for OFL in 2020 given a projected 2019 catch of 1.350 million t is 3.082 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.

Ecosystem considerations

In addition to the ecosystem considerations listed in the SAFE chapter, an appendix to the SAFE chapter describes a multi-species model ("CEATTLE") involving walleye pollock, Pacific cod, and arrowtooth flounder. The authors view this as a "strategic" model rather than a model that would be used for setting annual harvest specifications. Nevertheless, when CEATTLE is run in single-species mode, the 2019 "target" ABC value is within 5% of the authors' and Team's recommended 2019 ABC value. When CEATTLE is run in multi-species mode, the 2019 "target" ABC is 37% higher than the author's and Team's 2019 ABC value. The CEATTLE estimates of age 1 natural mortality are trending towards average after a peak in 2016. The climate-enhanced recruitment projections from CEATTLE model indicates the increase in 2018 age 1 recruitment may have been due to favorable environmental conditions in 2017. The model projects a decrease in 2019 age 1 recruitment to levels below 2017 age 1 recruitment due to poor environmental conditions in the spring-fall of 2018.

Aleutian Islands pollock

Changes from previous assessment

Last year this chapter was a "partial assessment" for the AI Pollock as it was an "off" year under the Stock Assessment Prioritization guidelines. Model 15.1 (same as the 2015 accepted model) is presented for ABC/OFL advice. For the first time in eight years there was a directed pollock fishery, albeit a small one (188 t). As of October 3, 2018, there had been only 1,590 t of incidental catch, primarily in the Atka mackerel and rockfish fisheries.

New data in this year's assessment included the following:

- Catches for 1978 to 2018 were updated to the latest estimates from the catch accounting system (CAS). There were no significant changes except the addition of the 2018 estimate at 1,750 t.
- 2018 AI bottom trawl survey biomass estimated of 165,747 t was added.
- 2016 AI bottom trawl survey age composition data were added.

Spawning biomass and stock trends

This year's assessment estimates that spawning biomass reached a minimum level of about $B_{35\%}$ in 2003 and then generally increased during the period with no directed fishery (1999-2017), with a projected value of $B_{47\%}$ for 2019. The increase in spawning biomass since 1999 has resulted more from a dramatic decrease in harvest than from good recruitment, as the 2015 year class is the first since 1989 to exceed the 1977-2015 average (the 2015 year class is about 2% above average)

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that this stock qualifies for management under Tier 3. The Team concurred and supported continued use of last year's model for evaluating stock status and recommending ABC. The model estimates 2019 spawning biomass at 95,253 t which is above the $B_{40\%}$ value of 81,312 t, moving the AI pollock stock from sub-tier "b" as assessed last year to sub-tier "a" of Tier 3 this year. The model estimates the values of $F_{40\%}$ as 0.331 and $F_{35\%}$ as 0.415. Under Tier 3a, the 2019 maximum permissible ABC and OFL are 52,887 t and 66,981 t, respectively. The Team recommends setting the 2019 ABC and OFL at these values. Projections assumed catches of 1,750 t for 2018 and 1,650 t for 2019, based on the five-year average F (2013-2017) of 0.009, which were used in place of maximum permissible ABC. Following the Tier 3a formula, the 2020 maximum permissible ABC is 55,125 t and the 2020 OFL is 66,981 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

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 x 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 2018 and 2019 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Age 0+ biomass	OFL	ABC	TAC*	Catch
Eastern Bering Sea	2017	1,260,000	284,000	239,000	223,704	222,814
	2018	918,000	238,000	188,000	188,136	168,962
	2019	824,000	216,000	144,800**	n/a	n/a
	2020	683,000	183,000	123,200**	n/a	n/a
Aleutian Islands	2017	79,600***	28,700	21,500	15,695	12,258
	2018	79,600***	28,700	21,500	15,695	14,549
	2019	80,700***	27,400	27,400	n/a	n/a
	2020	80,700***	27,400	27,400	n/a	n/a

*In 2017, 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% Bering Sea and 31% 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 1991-2017 were updated, and a preliminary catch estimate for 2018 were incorporated.
2. Commercial fishery size compositions for 1991-2017 were updated, and a preliminary size composition from the 2018 commercial fishery was incorporated.
3. The numeric abundance estimate and size composition from the 2018 EBS shelf bottom trawl survey "standard" area were incorporated into some of the models.
4. The 1987-2018 time series of numerical abundance and size composition from the EBS shelf bottom trawl survey "expanded" area (= standard area + strata 82 and 90) were incorporated into some of the models, in lieu of the corresponding time series from the standard area.
5. The age composition from the 2017 EBS shelf bottom trawl survey standard area was incorporated into some of the models.
6. The 1994-2017 time series of age compositions from the EBS shelf bottom trawl survey expanded area was incorporated into some of the models, in lieu of the corresponding time series from the standard area.
7. Age compositions from the 2010-2012 and 2017 fisheries were incorporated into some of the models.
8. The time series of numerical abundance and size composition from the northern Bering Sea (NBS) bottom trawl surveys were incorporated into some of the models

Many changes to the stock assessment model have been considered since the 2017 assessment. Sixteen models were considered in the preliminary assessment, which included last year's model, models with updated treatment of the NBS survey data, and complex models that included time-varying parameters and/or multiple areas with movement between them. Eight models were presented in the final assessment. None of the final assessment models considered multiple areas, but some did treat the EBS and NBS surveyed areas as separate time-series.

Spawning biomass and stock trends

Four different survey abundance time-series were calculated using three different areas: the standard EBS shelf survey area, the expanded EBS shelf survey area which includes strata 82 and 90, and the NBS area with the truncated survey stations used in 2018. The expanded EBS survey area was preferred over the standard area and showed a 32% decline in abundance (numbers of fish) from 2017 to 2018. The NBS survey showed a 78% increase in abundance from 2017 to 2018, and summing the expanded EBS survey and the NBS survey results in a 1.8% decrease in abundance from 2017. Estimated spawning biomass (from the preferred model) increased from 2009 through 2017 to 303,676 t, and is predicted to decrease to 290,205 t in 2019, which is still above $B_{40\%}$. Recruitment is estimatted to have been below average since the 2014 year class.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

This stock is assigned to Tier 3a for 2019. The maximum 2019 ABC in this tier as calculated using the present model fit is 181,000 t. However, the Team felt that an ABC reduction might be warranted, and so completed a risk matrix for this stock, resulting in "concern" levels of 3 for all categories (assessment, population dynamics, and environmental/ecosystem). Among the reasons for the Team's ratings were uncertainty in distribution of Pacific cod, dramatic declines in the EBS shelf survey index, recent poor environmental conditions, lack of incoming recruitment, and structural uncertainty across presented assessment models. Given these levels of concern, the Team recommends that the 2019 ABC be reduced to 144,800 t.. Averaging a set of models that represents the structural uncertainty was also considered by the Team as an alternative method to account for these uncertainties. The Team recommends that the maxABC of 154,000 t for the preliminary 2020 ABC be reduced to 123,200 t, given the recommended reduced ABC in 2019, to account for the uncertainties listed above. The 2019 OFL from the new model is 216,000 t, which is greater than the projected OFL from the previous assessment. The 2019 projected OFL, given a 2019 ABC of 144,800 t is 183,000 t, and would be 164,000 t with a 2019 ABC of 181,000 t. The stock would drop well into Tier 3b in 2020 if the full ABC of 181,000 t were taken in 2019, but would almost remain in Tier 3a in 2020 with the recommended 2019 ABC of 144,800 t.

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 data were updated with recent observations. Catch data from 1991-2018 were updated by including updated catch for 2017 and preliminary catch data for 2018, and the 2018 biomass point estimate and standard error were added to the survey time series. 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 about 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 2019. 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 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3rd, 2018.

Area	Year	Age 4+ Biomass	OFL	ABC	TAC	Catch
Bering Sea	2017	24,000	1,499	1,274	1,274	1,159
	2018	94,000	2,887	1,464	1,464	1,573
	2019	52,000	3,221	1,489	n/a	n/a
	2020	52,000	4,441	1,994	n/a	n/a
Aleutian Islands	2017	43,000	2,101	1,735	1,735	590
	2018	65,000	3,917	1,988	1,988	644
	2019	98,000	4,350	2,008	n/a	n/a
	2020	99,000	5,997	2,688	n/a	n/a

Changes from previous assessment

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

- Relative abundance and length data from the 2018 longline survey
- Relative abundance and length data from the 2017 fixed gear fishery
- Length data from the 2017 trawl fisheries, age data from the 2017 longline survey, and 2017 fixed gear fishery
- Updated catch for 2017 and projected 2018 - 2020 catches
- Estimates of killer and sperm whale depredation in the fishery were updated and projected for 2018-2020

There were no changes in the assessment methodology. As in previous assessments, the authors recommend an ABC lower than the maximum permissible. However, the authors' recommendation this year isbased on the new risk matrix approach.

The assessment chapter includes appendices pertaining to apportionment (3D) and modeling explorations (3E), both of which were reviewed at the September 2018 Joint Groundfish Plan Team meeting.

Spawning biomass and stock trends

Projected 2018 spawning biomass is 33% of unfished spawning biomass. The longline survey abundance index increased 9% from 2017 to 2018, following a 14% increase in 2017 from 2016. The lowest point of the time series was 2015. The fishery abundance index stayed constant from 2016 to 2017 and is the time series low (the 2018 data are not available yet). Consistent with 2017 projections, spawning biomass is projected to increase rapidly from 2019 to 2022, and then stabilize.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Sablefish are managed under Tier 3 of the NPFMC harvest control rules. Reference points were calculated using recruitments from 1977-2014. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from this assessment are

116,738 t (combined across the EBS, AI, and GOA), 0.099, and 0.117, respectively. Projected female spawning biomass (combined areas) for 2018 is 96,687 t (83% of $B_{40\%}$, or $B_{33\%}$), placing sablefish in Tier 3b.

The Team concurred with the authors' recommended 2019 ABC, which was set equal to the 2018 ABC recommendation and resulted in a 45% downward adjustment from maximum permissible ABC. The authors used a risk matrix approach to assess reductions and determined an overall score of level 4 (the maximum level across the three categories), indicating "extreme concern." The authors detail 12 reasons in the "Additional ABC/ACL considerations and Ecosystem and Socioeconomic Profile" that range from substantially increased concerns about the stock assessment, including positive retrospective bias in the last two years; extreme concerns about the population dynamics of this stock related to recruitment, an inability to rebuild spawning stock biomass, and a lack of old fish in the population; and substantially increased concern in the ecosystem conditions that suggest another marine heat wave is forming in 2018 which, while potentially positive for recruitment, could result in increased natural mortality on the 2014 year class. Additionally, the ABC was decreased to account for estimates of whale depredation occurring in the fishery in the same way that was recommended and accepted in 2016 and 2017.

The maximum permissible value of F_{ABC} under Tier 3b is 0.081, and the adjusted OFL fishing mortality rate is 0.096. After accounting for risk matrix reductions and whale depredation, the authors' recommended F_{ABC} equals 0.044, which results in a recommended 2019 ABC of 15,068 t for all areas combined. This 2019 ABC is the same as the authors' 2018 ABC as recommended in last year's assessment, with the only difference due to updating whale depredation estimates. This results in 2019 ABCs of 1,489 t and 2,008 t and OFLs of 3,221 t and 4,350 t for the Bering Sea and Aleutian Islands, respectively.

Status determination

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

Area apportionment

Apportionments have been held constant since the 2013 fishery and the Teams concurred with the authors' recommendation to retain this approach for 2019 and 2020. Apportionment values presented here include whale depredation adjustments:

	2018			2019		2020	
Region	**OFL**	**ABC**	**TAC**	**OFL**	**ABC**	**OFL**	**ABC**
W	--	1,544	1,544	--	1,581	--	2,105
C	--	5,158	5,158	--	5,178	--	6,931
*WYAK	--	1,829	1,829	--	1,828	--	2,433
*SEO	--	2,974	2,974	--	2,984	--	3,993
GOA	**22,703**	**11,505**	**11,505**	**25,227**	**11,571**	**34,782**	**15,462**
BS	**2,887**	**1,464**	**1,460**	**3,221**	**1,489**	**4,441**	**1,994**
AI	**3,917**	**1,988**	**1,988**	**4,350**	**2,008**	**5,997**	**2,688**
Total	29,507	14,957	14,957	32,798	15,068	45,220	20,144

* 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 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Age 6+ Biomass	OFL	ABC	TAC	Catch
BSAI	2017	2,290,000	287,000	260,800	154,000	132,266
	2018	2,553,100	306,700	277,500	154,000	124,519
	2019	2,462,400	290,000	263,200	n/a	n/a
	2020	2,411,700	284,000	257,800	n/a	n/a

The Flatfish Flexibility Exchange Program increased the 2017 TAC from 154,000 t to 154,699 t. Through November 3, 2018 the Flatfish Flexibility Exchange program has increased the TAC from 154,000 t to 155,545 t for 2018.

Changes from previous assessment

Changes to the input data include:

- 2017 fishery age composition
- 2017 survey age composition
- 2018 trawl survey biomass point estimate and standard error
- Estimate of the discarded and retained portions of the 2017 catch
- Estimate of total catch made through the end of 2018
- Updated weight at age for survey and fishery

The preferred model (18_1) 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 2019 is 850,600 t, which is 1.85×B_{MSY}. This is a 5.0% decrease from last year's 2018 estimate (895,600 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

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 460,800 t, and projected spawning biomass for 2019 is 850,600 t, meaning that yellowfin sole qualify for management under Tier 1a. Corresponding to the approach used in recent years, the 1978-2012 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 0.107. The current value of the OFL harvest ratio (the arithmetic mean of the F_{MSY} ratio) is 0.118. The product of the maximum permissible ABC harvest ratio and the geometric mean of the 2019 biomass estimate produced the 2019 ABC of 263,200 t recommended by the author and Team, and the corresponding product using the OFL harvest ratio produces the 2019 OFL of 290,000 t. For 2020, the corresponding quantities are 257,800 t and 284,000 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 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Age 1+ Biomass	OFL	ABC	TAC	Catch
BSAI	2017	121,804	11,615	6,644	4,500	2,834
	2018	126,417	13,148	11,132	5,294	1,825
	2019	105,930	11,362	9,658	n/a	n/a
	2020	98,876	10,476	8,908	n/a	n/a
Eastern Bering Sea	2017	n/a	n/a	8,577	4,375	2,712
	2018	n/a	n/a	9,718	5,125	1,664
	2019	n/a	n/a	8,431	n/a	n/a
	2020	n/a	n/a	7,777	n/a	n/a
Aleutian Islands	2017	n/a	n/a	1,248	125	122
	2018	n/a	n/a	1,414	169	161
	2019	n/a	n/a	1,227	n/a	n/a
	2020	n/a	n/a	1,131	n/a	n/a

Changes from previous assessment

Changes to the input data include:

- Updated 2017 and projected 2018 catch data
- 2018 fishery size composition data
- 2017 EBS shelf survey age comps and size-at-age data
- 2018 EBS shelf survey and ABL longline survey estimates
- 2018 EBS shelf trawl survey and ABL longline survey size compositions

The only change to the base model is that ABL longline survey catchability is now a statistically estimated parameter (this change was made in response to a previous SSC request).

Spawning biomass and stock trends

The projected 2019 female spawning biomass is 54,244 t, which is a 7% decrease from last year's 2018 projection of 58,035 t. Female spawning biomass is projected to increase slightly to 52,743 t in 2020. The effects of the incoming 2007-2009 year classes are creating increases in both the female spawning biomass and total biomass estimates. These increases are also due, in part, to the increase in average weight at age with the inclusion of the 2015 length at age data.

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 2019 female spawning biomass is 54,244 t, which is well above the estimate of $B_{40\%}$ (36,213 t). Because the projected spawning biomass in year 2019 is above $B_{40\%}$, Greenland turbot ABC and OFL levels will be determined under Tier 3a of Amendment 56. The OFLs for 2019 and 2020 are 11,362 t and 10,476 t, respectively, and the corresponding maximum permissible ABCs are 9,658 t and 8,908 t, respectively. The author recommended setting ABC at the maximum permissible values for 2019 or 2020, 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. As in previous assessments, this value 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 2019 and 2020 ABCs in the EBS are 8,885 t and 8,195 t. The 2019 and 2020 ABCs for the AI are 773 t and 713 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 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Age 1+ Bio	OFL	ABC	TAC	Catch
BSAI	2017	779,195	76,100	65,371	14,000	6,518
	2018	785,141	76,757	65,932	13,621	6,506
	2019	892,591	82,939	70,673	n/a	n/a
	2020	932,024	83,814	71,411	n/a	n/a

Changes from previous assessment

New data in the 2018 assessment include:

- Length compositions from the 2017 and 2018 Eastern Bering Sea shelf survey, and 2018 Aleutian Islands survey.
- Biomass point-estimates and standard errors from the 2017 and 2018 Eastern Bering Sea shelf surveys, and 2018 Aleutian Islands survey.
- Fishery size compositions for 2017 and 2018.
- 2018 catch data through October 19, 2018, and estimated catch for remainder of 2018.
- Estimated total catch of 6,387 t for 2019 and 10,878 t for 2020.
- Age data from the 2016 and 2017 Bering Sea shelf and the 2012 and 2016 Aleutian Islands surveys.
- Removed Bering Sea slope survey data for 1979-1991

The age-structured assessment model is similar to the model used for the 2016 and 2017 assessments. The 2018 model implemented the following changes based on Plan Team and SSC comments and authors' recommendations:

- The model uses a smoothed length-age conversion matrix that corrects for stratified sampling.
- The model uses an ageing error matrix to account for error in age reading.
- Eastern Bering Sea slope data from 1979-1991 were excluded based on concerns about methodology and species identification.

Spawning biomass and stock trends

The projected age 1+ total biomass for 2019 is 892,591 t, an increase from the value of 782,840 t projected for 2019 in last year's assessment. The projected female spawning biomass for 2019 is 482,174 t which is an increase from last year's 2019 estimate of 472,562 t.

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 0.131. The projected 2019 spawning biomass is above $B_{40\%}$, so ABC and OFL recommendations for 2019 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 2019 and 2020 ABCs of 70,673 t and 71,411 t, respectively, and 2019 and 2020 OFLs of 82,939 t and 83,814 t. 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.

Ecosystem Considerations

Arrowtooth flounder is not a dominant predator on the EBS shelf. Arrowtooth flounder in the EBS is an occasional prey in the diets of groundfish, being eaten by Pacific cod, walleye pollock, Alaska skates, and sleeper sharks. However, given the large biomass of most of the predator species in the EBS, these occasionally recorded events translate into considerable total mortality for the arrowtooth flounder population in the EBS ecosystem.

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 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Age 2+ Biomass	OFL	ABC	TAC	Catch
BSAI	2017	170,300	10,360	8,880	5,000	4,503
	2018	189,868	11,347	9,737	5,000	3,053
	2019	155,251	10,965	9,260	n/a	n/a
	2020	156,450	11,260	9,509	n/a	n/a

Changes from previous assessment

Changes to the input data include:

- Estimates of catch were updated for all years. The estimate of 2018 catch was derived as the product of the TAC (5,000 t) and the average proportion (~87%) of the TAC captured over the last 5 years.
- All years of fishery length compositions
- The 2017 and 2018 shelf survey length composition estimates
- All years of shelf survey biomass and standard error estimates
- The 2018 Aleutian Islands survey biomass and standard error estimates
- All years of the Aleutian Islands survey length composition estimates

No changes were made to the assessment methodology.

Spawning biomass and stock trends

The projected 2019 female spawning biomass is 54,779 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 2019 is above $B_{40\%}$, placing Kamchatka flounder in sub-tier “a” of Tier 3. For the 2019 fishery, the authors and Team recommend setting 2019 ABC at the maximum permissible value of 9,260 t from the projection model. This value is a decrease of 5% from the 2018 ABC (9,737 t). The recommended 2019 OFL is 10,965 t, a 3% decrease from 11,347 t for 2018.

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 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Age 6+ Biomass	OFL	ABC	TAC	Catch
BSAI	2017	1,000,600	159,700	155,100	47,100	35,214
	2018	923,200	147,300	143,100	47,100	28,219
	2019	828,000	122,000	118,900	n/a	n/a
	2020	1,001,400	147,500	143,700	n/a	n/a

Changes from previous assessment

This chapter was presented as a full assessment. Changes to the input data in this full analysis include:

- Estimates of catch (t) for 2017 and 2018
- Estimates of retained and discarded portions of the 2017 catch
- 2017 and 2018 shelf trawl survey biomass estimates and standard errors
- 2016 and 2017 survey age composition
- 2016 and 2017 fishery age composition

No modifications were made to the assessment methodology.

Spawning biomass and stock trends

Spawning biomass steadily increased from 2009 until 2015, but has since decreased. The two most recent trawl survey biomass estimates are the lowest since 1987. The 2001, 2002, 2003, 2005, and 2014 year classes are all estimated to be at least 60% above average. The stock assessment model projects a 2019 spawning biomass of 417,800 t. The projected spawning biomass for 2020 is 338,300 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 2019 is projected to be well above the B_{MSY} estimate of 186,000 t, placing northern rock sole in sub-tier “a” of Tier 1. The Tier 1 2019 ABC harvest recommendation is 118,900 t (F_{ABC} = 0.144) and the 2019 OFL is 122,000 t (F_{OFL} = 0.147). The 2020 ABC and OFL values are 143,700 t and 147,500 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 2019 and 2020 are those recommended by the Plan Team. Catch data are current through October 6, 2018.

Area	Year	Age 3+Biomass	OFL	ABC	TAC	Catch
BSAI	2017	747,557	81,654	68,278	14,500	9,149
	2018	762,513	79,862	66,773	14,500	10,649
	2019	673,718	80,918	66,625	n/a	n/a
	2020	686,431	83,190	68,448	n/a	n/a

The Flatfish Flexibility Exchange Program decreased the TAC from 14,500 t to 14,076 t in 2017. The TAC was increased from 14,500 t to 17,105 t in 2018.

Changes from previous assessment

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

Changes to the input data in this analysis include:

- 2018 catch biomass through October 6, 2018 and 1964-1976 catch biomass were added to the model.
- 2017 catch biomass was updated to reflect October – December 2017 catches.
- Historical catch prior to 1964 was set equal to the average catch from 1964-1977 (11,659 t).
- 2015-2017 fishery age composition data were added.
- 2016-2018 fishery length composition data were added to the model.
- 2017-2018 Eastern Bering Sea (EBS) shelf survey biomass and 2018 Aleutian Islands (AI) survey biomass were added to the linear regression used to determine estimates of AI survey biomass in years when no AI survey occurred; a new survey biomass index was added to the assessment model for 1982-2018 based on updated linear regression results.
- 2017-2018 survey bottom temperatures were added to Model 16.0; all survey bottom temperatures were removed from new 2018 models.
- 2016-2017 survey age composition data were added to the model.
- 2017-2018 survey length composition data were added to the model.
- Data for age within each length bin were added to all versions of Models 18.1 and 18.2 to estimate growth. Growth estimates therefore include data from 1985, 1992-1995, and 2000-2017.
- Fishery and survey length compositions for lengths less than 6cm were added to the model.
- Fishery and survey age compositions for ages 0-2 were added to the model.

Changes to the assessment methodology:

- Models 18.0, 18.0b, 18.1, 18.1b, 18.2, 18.2b, and 18.2c were done using the Stock Synthesis assessment framework (see Appendix B for full details).
- The age-length transition matrix was calculated within the assessment model using model estimates of the CV of length-at-age for ages 3 and 21, as well as the parameters of the von-Bertalanffy growth curve.
- Models 18.1, 18.1b, 18.2, 18.2b, and 18.2c estimated growth within the assessment model based on age data collected within each length bin (a “conditional age-at-length” approach).
- Male and female fishery selectivity were estimated as separate curves (as for the most recent accepted model, the fishery selectivity was modeled as length-based and logistic).
- Model 18.1b, 18.2b, and 18.2c model separate fishery selectivity curves for the time period 1964-1988.
- Model 18.1b and 18.2b model separate fishery selectivity curves for the time period 1989-2007.
- Male and female survey selectivity were estimated as separate curves using an age-based double-normal asymptotic curve to provide for additional flexibility in the curve’s shape.

- Model 18.2 (all versions) use the number of hauls from which length data originated as input sample sizes for survey and fishery length and age compositions.
- Age- and length-composition data were weighted using methods described in Francis (2011) to approximate effective sample size for each year and data type for all models 18.0-18.2 variants.
- Recruitment deviations were estimated through 2014 for age 0 recruits.
- A sum-to-zero constraint was used in the likelihood component for recruitment deviations.
- Historical mean recruitment was set equal to non-historical mean recruitment.
- The temperature-catchability relationship that was assumed in the 2012, 2014, and 2016 models was removed from the model.

The authors recommend use of Model 18.2c for use in setting the 2019-2020 harvest specifications, and the Team concurs. See Team minutes for the Team's rationale in making this recommendation.

Spawning biomass and stock trends

Age 3+ biomass declined by 31% from 1994 through 2015, but has increased by 14% since then. Spawning biomass has declined consistently since the 1998 (a 33% decline as of 2018), although spawning biomass is projected to begin increasing in 2020. No year class has been more than 60% above average since the 1987 cohort, but the 2002, 2011, and 2014 year classes are all at least 40% above average.

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 2019 (153,203 t) is above $B_{40\%}$, flathead sole is in Tier 3a. The authors and Team recommend setting ABCs for 2019 and 2020 at the maximum permissible values under Tier 3a, which are 66,625 t and 68,448 t, respectively. The 2019 and 2020 OFLs under Tier 3a are 80,918 t and 83,190 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 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Age 3 + Biomass	OFL	ABC	TAC	Catch
BSAI	2017	412,600	42,800	36,000	13,000	16,492
	2018	417,300	41,170	34,590	16,100	23,028
	2019	400,700	39,880	33,600	n/a	n/a
	2020	394,700	37,860	31,900	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 2018 assessment included updated 2017 catch and estimated 2018 catches. No changes were made to the assessment model. Because this is an "off" year, the assessment includes a figure describing exploitation rate (i.e., catch/biomass).

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 highs 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 $B_{40\%}$ = 126,900 t, $F_{40\%}$ = 0.124, and $F_{35\%}$ = 0.149. Given that the projected 2019 spawning biomass of 186,100 t exceeds $B_{40\%}$, the ABC and OFL recommendations for 2019 were calculated under sub-tier "a" of Tier 3. Projected harvesting at the $F_{40\%}$ level gives a 2019 ABC of 33,600 t and a 2020 ABC of 31,900 t. The recommended Tier 3a OFLs are 39,880 t and 37,860 t for 2019 and 2020, 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

Status and catch specifications (t) of other flatfish in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Total Biomass	OFL	ABC	TAC	Catch
BSAI	2017	113,450	17,591	13,193	2,500	4,133
	2018	113,450	17,591	13,193	4,000	5,974
	2019	141,325	21,824	16,368		
	2020	141,325	21,824	16,368		

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 2019 and 2020 are those recommended by the Team. Catch data are current through November 3, 2018.

Area	Year	Age 3+ Bio	OFL	ABC	TAC	Catch
BSAI	2017	767,767	53,152	43,723	34,900	35,544
	2018	749,925	51,675	42,509	37,361	33,506
	2019	934,293	61,067	50,594		n/a
	2020	914,577	59,396	49,211		n/a
Eastern Bering Sea	2017			12,199	11,000	8,987
	2018			11,861	11,861	9,272
	2019			14,675	n/a	n/a
	2020			14,274	n/a	n/a
Eastern Aleutian Islands	2017			10,307	7,900	7,803
	2018			10,021	9,000	8,067
	2019			11,459	n/a	n/a
	2020			11,146	n/a	n/a
Central Aleutian Islands	2017			8,009	7,000	6,868
	2018			7,787	7,500	7,312
	2019			8,435	n/a	n/a
	2020			8,205	n/a	n/a
Western Aleutian Islands	2017			13,208	9,000	8,886
	2018			12,840	9,000	8,855
	2019			16,025	n/a	n/a
	2020			15,586	n/a	n/a

Changes from previous assessment

This chapter was presented as a full assessment. Changes to the input data included updated catch data through 2017, projected 2018-2020 catch estimates, fishery age data from 2015 and 2017, fishery length data from 2016, biomass estimate and length data from the 2018 Aleutian Islands (AI) bottom trawl survey, age data from the 2016 AI and eastern Bering Sea (EBS) bottom trawl surveys, updated length-at-age, weight-at-age, and age-to-length conversion matrices, and reweighted age and length data using the iterative reweighting procedure. The only change to the assessment methodology was an increase in the number of year nodes for the fishery selectivity spline (from 4 nodes to 5).

Spawning biomass and stock trends

The survey biomass estimates in the Aleutian Islands increased by 3% from 2016, continuing the high survey biomass trend over the last three surveys. The 2018 estimates in the AI regions were within 6% of the 2016 estimates; however, there was a large increase (30%) in the EBS area between 2016 and 2018. These continued high survey biomass estimates have contributed to a substantial increase in estimated stock size in recent years; however, there remains a poor residual pattern in the fit to this survey index. Spawning biomass is projected to be 399,024 t in 2019 and decline to 386,835 t in 2020. The 2000, 2005, and 2008 year classes are estimated to be 198%, 99%, and 104% above average, respectively.

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 (399,024 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 2019 ABC of 50,594 t and 2020 ABC of 49,211 t. The OFL fishing mortality rate is 0.095. which results in a 2019 OFL of 61,067 t and 2020 OFL of 59,396 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 2019): EBS = 14,675 t, Eastern Aleutians (Area 541) = 11,459 t, Central Aleutians (Area 542) = 8,435 t, and Western Aleutians (Area 543) = 16,025 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 2019 and 2020 are those recommended by the Team. Catch data are current through November 3, 2018.

Area	Year	Age 3+ Biomass	OFL	ABC	TAC	Catch
BSAI	2017	248,160	16,242	13,264	5,000	4,699
	2018	246,160	15,888	12,975	6,100	5,730
	2019	244,196	15,507	12,664	n/a	n/a
	2020	242,426	15,180	12,396	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 2018 assessment included updated 2017 catch and estimated 2018-2020 catches. No changes were made to the assessment model. Exploitation rates (i.e., catch/biomass) have averaged 0.015 from 2004-2018, which is below the exploitation rate associated with fishing at $F_{40\%}$.

Spawning biomass and stock trends

New projections were very similar to last year's projections because observed catches were very similar to the estimated catches used last year. Spawning biomass is projected to be 104,201 t in 2019 and to decline to 102,480 t in 2020. Exploitation rates by area since 2004 appeared to be low in all areas in most years with some increase in all areas except the eastern AI in 2018.

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 65,870 t, 0.065, and 0.080, respectively. Spawning biomass for 2018 (104,201 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 0.065, which results in the author and Plan Team recommended 2019 ABC of 12,664 t and 2020 ABC of 12,396 t. The OFL fishing mortality rate is 0.080 which results in a 2019 OFL of 15,507 t and 2020 OFL of 15,180 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. **The OFL and ABC for 2019 and 2020 are those recommended by the Team and are the result of averaging results from Models 18.1 and 18.2**. Catch data are current through November 3, 2018.

Area/subarea	Year	Total Biomass (t)*	OFL	ABC	TAC	Catch
BSAI	2017	35,669	612	501	225	205
	2018	37,453	749	613	225	226
	2019	32,436	547	451	n/a	n/a
	2020	33,943	658	545	n/a	n/a
Western/ Central Aleutian Islands	2017			306	100	134
	2018			374	75	168
	2019			163	n/a	n/a
	2020			200	n/a	n/a
Eastern AI/ Eastern Bering Sea	2017			195	125	71
	2018			239	150	47
	2019			288	n/a	n/a
	2020			345	n/a	n/a

*For 2017-18, the total biomass is from a BSAI age-structured model. For 2019-2020, the total biomass is from averaging the AI age-structured models, and adding survey biomass estimates from the EBS.

Changes from previous assessment

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

Changes to the input data include:

- Catch data were updated through 2017, and total catch for 2018 was projected.
- The AI survey age/length composition data and biomass estimates were recomputed so as to correspond to only the AI management area (excluding the southern Bering Sea area).
- The fishery age/length compositional data were recomputed to exclude the data in the EBS management area.
- The 2018 AI survey biomass estimate and length composition were included in the assessment.
- The 2016 AI survey age composition was included in the assessment.
- The 2015 and 2017 AI fishery age compositions were included in the assessment.
- The 2016 AI fishery length compositions were included in the assessment.
- The length-at-age, weights-at-age, and age-to-length conversion matrices were updated based on data from the NMFS AI trawl survey beginning in 1991.

Changes in the assessment methodology:

- Two age-structured models were configured for only the AI area (with the EBS portion of the stock assessed using Tier 5 methods), whereas in the 2016 assessment the age-structured models were configured for the overall BSAI area.
- The weights assigned to compositional data in the author's recommended model from this year's assessment (18.2) were computed using the Francis method, whereas the alternative new model (18.1) used the McAllister-Ianelli method, as did the recommended model from the 2016 assessment.
- In the recommended model, a two-parameter logistic curve was used for fishery selectivity rather than the four-parameter double logistic curve used in the 2016 assessment. Preliminary runs with the recommended model indicated that the descending slope was estimated at 0, essentially fitting a 2-parameter logistic curve. Nearly identical results were obtained with either a logistic or double logistic

curve but use of the 2-parameter logistic curve improved model stability and estimated parameter variances due to removing parameters that had little effect on model results.

Although the author recommended use of a single model (18.2), the Team recommends combining the results of Models 18.1 and 18.2 by model averaging (with equal weighting) to estimate total biomass, spawning biomass, OFL, and maxABC for this stock. See Team minutes for the Team's rationale in making this recommendation.

Spawning biomass and stock trends

Spawning biomass for AI blackspotted/rougheye rockfish in 2019 is projected to be 6,858 t and is projected to continue increasing (based on averaging Models 18.1 and 18.2). There is some evidence of several large recruitments in the 2000s, but there is also evidence of relatively high mortality and declining abundance of larger/order fish. The most recent survey in the AI (2018) was nearly identical to the previous survey in 2016.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The BSAI was separated into AI and BS components for this assessment 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 2019 of 6,858 t is less than $B_{40\%}$, (8,611 t) the stock qualifies as Tier 3b and is projected to remain in Tier 3b in 2020. The adjusted $F_{ABC}=F_{40\%}$ values for 2019 and 2020 are 0.027 and 0.0295, respectively. For the BS, this stock qualifies for management under Tier 5 with a projected biomass for both 2019 and 2020 of 1,371 t.

The Team recommends an overall 2019 ABC of 451 t and a 2019 OFL of 547 t. The apportionment of the 2019 ABC to subareas is 163 t for the Western and Central Aleutian Islands and 288 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**
2019 MSSCs	29	134
2020 MSSCs	36	164

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

Status and catch specifications (t) of shortraker rockfish in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Survey Biomass	OFL	ABC	TAC	Catch
BSAI	2017	22,191	666	499	125	161
	2018	22,191	666	499	150	238
	2019	24,055	722	541	n/a	n/a
	2020	24,055	722	541	n/a	n/a

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 rom 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

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 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Survey Biomass	OFL	ABC	TAC	Catch
BSAI	2017	55,312	1,816	1,362	875	831
	2018	55,312	1,816	1,362	845	944
	2019	53,290	1,793	1,344	n/a	n/a
	2020	53,290	1,793	1,344	n/a	n/a
Eastern Bering Sea	2017	n/a	n/a	791	325	261
	2018	n/a	n/a	791	275	201
	2019	n/a	n/a	956	n/a	n/a
	2020	n/a	n/a	956	n/a	n/a
Aleutian Islands	2017	n/a	n/a	571	550	570
	2018	n/a	n/a	571	570	743
	2019	n/a	n/a	388	n/a	n/a
	2020	n/a	n/a	388	n/a	n/a

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 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Age 1+ Biomass	OFL	ABC	TAC	Catch
BSAI	2017	598,791	102,700	87,200	65,000	64,449
	2018	599,000	108,600	92,000	71,000	67,954
	2019	498,320	79,200	68,500	n/a	n/a
	2020	514,400	73,400	63,400	n/a	n/a
E Aleutian Islands / EBS	2017	n/a	n/a	34,890	34,500	34,267
	2018	n/a	n/a	36,820	36,500	33,646
	2019	n/a	n/a	23,970	n/a	n/a
	2020	n/a	n/a	22,190	n/a	n/a
Central Aleutian Islands	2017	n/a	n/a	30,330	18,000	17,749
	2018	n/a	n/a	32,000	21,000	20,889
	2019	n/a	n/a	14,390	n/a	n/a
	2020	n/a	n/a	13,310	n/a	n/a
Western Aleutian Islands	2017	n/a	n/a	21,980	12,500	12,433
	2018	n/a	n/a	23,180	13,500	13,419
	2019	n/a	n/a	30,140	n/a	n/a
	2020	n/a	n/a	27,900	n/a	n/a

Changes from previous assessment

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

- Total 2017 year-end catch was updated, and the projected total catch for 2018 was set equal to the 2018 TAC.
- The 2017 fishery age composition data were added.
- The 2018 Aleutian Islands survey biomass estimates were added.
- 1986 Aleutian Islands survey age composition was *removed*.

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 2018 (the estimated spawning biomass in 2019 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 2006 and 2007 year classes 56% and 33% above average. The projected female spawning biomass for 2019 (106,800 t) is projected to be below $B_{40\%}$ (113,510 t), and the stock is projected to remain below $B_{40\%}$ through 2023.

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 2019 yield (ABC) at $F_{40\%adj}$ = 0.44 is 68,500 t, down 26% from the 2018 ABC and down 19% from last year's projected ABC for 2019. The projected 2019 overfishing level at $F_{35\%}$ = 0.53 is 79,200 t, down 27% from the 2018 OFL and down 19% from last year's projected OFL for 2019.

A risk matrix was completed for this stock with, Level 1 ratings for all three 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 2019 are 23,970 t for Area 541 and the Bering Sea region (a 35% decrease from 2018), 14,390 t for Area 542 (a 55% decrease from 2018), and 30,140 t for Area 543 (a 30% increase from 2018).

Status determination

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

Ecosystem Considerations

This section of the assessment chapter was updated with the 2018 survey information. Temperature anomaly profiles from the 2018 Aleutian Island survey data show that the water temperature continues to be warm at depth. Temperature may affect recruitment of Atka mackerel and availability to the bottom trawl survey. It is possible that the reduced recruitment since 2007 is due to changing environmental factors such as water temperature, which is known to affect Atka mackerel eggs, larvae, and hatching times, and could possibly have an impact on productivity and food supply for larval Atka mackerel. However, this has not yet been evaluated fully. The large drop in the Central area survey biomass was inconsistent with Atka mackerel biomass changes in the other Aleutian Islands areas (Eastern and Western Aleutians), and reported fishing conditions in the region. The lack of any moderate to large catches of Atka mackerel by the survey in only one area may have been due to a combination of environmental factors that could have affected catchability, Atka mackerel availability, and fish movement and behavior.

Atka mackerel is the most common prey item of the endangered western Steller sea lion throughout the year in the Aleutian Islands. Steller sea lion (SSL) surveys indicate slight population increases, except in the western Aleutians (area 543).

Regulations implemented in 2015 significantly adjusted SSL management measures that were in place from 2011-2014 and re-opened area 543 to directed fishing for Atka mackerel (but with a maximum TAC of 65% of the area ABC), removed the TAC reduction in area 542, and re-opened areas in 541 and 542 that had been closed to directed Atka mackerel fishing. Prior to 2011, a "platoon" system was in place that restricted the timing of fishing effort in the AI.

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 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Age 0+ Biomass	OFL	ABC	TAC	Catch
BSAI	2017	607,051	49,063	41,144	26,000	31,892
	2018	578,436	46,668	39,082	29,080	27,815
	2019	624,338	51,152	42,714	n/a	n/a
	2020	601,440	48,944	40,813	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

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

1. A new time series of skate catches by species was created for this assessment, as well as corresponding exploitation rates by species.
2. Catch data have been updated through October 25, 2018.
3. New biomass estimates from the 2018 eastern Bering Sea (EBS) shelf and Aleutian Islands bottom trawl surveys have been added. The EBS slope survey did not occur in 2018.

4. The Alaska skate model now incorporates EBS shelf survey biomass estimates through 2018, EBS shelf size compositions through 2018, fishery length compositions through 2017, and catch data through 2018.
5. Abundance estimates from the AFSC longline survey are reported.

Methodological changes included the following:

1) There were no changes to the Alaska skate assessment methodology. Model 14.2 was approved for use in the 2014 and 2016 assessments.
2) A new method for estimating catches of Alaska skate and the other species in the skate complex was created. Estimates from this method were used in the Alaska skate model and to produce exploitation rates for the skates in the "other skates" group.
3) The random effects (RE) model continues to be used for estimating biomass for the "other skates" group, but in a slightly different way from previous assessments. Rather than run a single model for all skates in aggregate, individual RE models were constructed for each species separately in each area where they were sufficiently abundant to enable a model run. Less common species were run in aggregate in each area. The RE-model estimates for the various species were then summed to produce a biomass estimate used for harvest recommendations. The RE models were also updated to include 2017 and 2018 survey biomass estimates.

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 2019 (115,957 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 2019 and 2020 ABCs are 33,730 t and 31,829 t, respectively, and the Alaska skate portions of the 2019 and 2020 OFLs are 39,173 t and 36,965 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 2019 and 2020 ABCs is 8,984 t for both years and the "other skates" portion of the 2019 and 2020 OFLs is 11,979 t for both years.

For the skate complex as a whole, ABCs for 2019 and 2020 total 42,714 t and 40,813 t, respectively, and OFLs for 2019 and 2020 total 51,152 t and 48,944 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 [from the 2017 partial assessment]

In accordance with the approved schedule, no assessment was conducted for sculpins this year, however, a full stock assessment will be conducted in 2019. Until then, the values generated from the previous stock assessment (below) will be rolled over for 2019 specifications. Additional information listed below summarizes the 2017 partial assessment. The last full assessment was conducted in 2016.

The OFL and ABC for 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2017	199,937	56,582	42,387	4,500	5,342
	2018	188,656	53,201	39,995	5,000	4,882
	2019	188,656	53,201	39,995	n/a	n/a
	2020	188,656	53,201	39,995	n/a	n/a

*For 2017, NMFS increased the BSAI TAC to 5,325 t with a reallocation of 825 t from the non-specified reserves.

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 biomass changed for one species, plain sculpin, which declined from 53,570 t in 2016 to 33,962 t in 2017. The 5-year average (2012-2016) for plain sculpin was 56,951 t so the 2017 estimate appears to be a decline. Catch and retention for BSAI sculpins has been updated for 2018. Catches appear stable, with 4,967 t in 2015, 4,892 t in 2016, 5,035 t in 2017, and 4,882 t in 2018 (through November 3, 2018). Retention is low at about 2%. The catch to biomass ratio has been stable with catch to biomass at 2% 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 39,995 t and 53,201 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

Status and catch specifications (t) of sharks 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 2018 and 2019 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2017	n/a	689	517	125	142
	2018	n/a	689	517	180	96
	2019	n/a	689	517	n/a	n/a
	2019	n/a	689	517	n/a	n/a

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.

21. Squid (moved to Ecosystem Component) See Appendix 1

22. Octopus

Status and catch specifications (t) of octopus 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 2019 and 2020 are those recommended by the Plan Team. Catch data are current through November 3, 2018.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2017	n/a	4,769	3,576	400	281
	2018	n/a	4,769	3,576	250	270
	2019	n/a	4,769	3,576	n/a	n/a
	2020	n/a	4,769	3,576	n/a	n/a

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

- 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.

Appendix 1. Squids

Status and catch specifications (t) of squids 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 2017 and 2018 are those in the harvest specifications. Catch data are current through November 3, 2018.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2017	n/a	6,912	5,184	1,342	1,996
	2018	n/a	6,912	5,184	1,200	1,731
	2019	n/a	n/a	n/a	n/a	n/a
	2020	n/a	n/a	n/a	n/a	n/a

Reclassify Squid as an Ecosystem Species

On July 6, 2018, NMFS published the final rule to implement Amendment 117 to the FMP (83 FR 31460). This rule reclassified squids in the FMP as an "Ecosystem Component" species, which is a category of non-target species that are not in need of conservation and management. Starting in 2019, NMFS will no longer set an Overfishing Level (OFL), ABC, and TAC for squids in the BSAI groundfish harvest specifications. Amendment 117 prohibits directed fishing for squids, while maintaining recordkeeping and reporting requirements for squid. Amendment 117 also establishes a squid maximum retainable amount when directed fishing for halibut and groundfish species at 20 percent to discourage targeting squids. The catch of squids will be reported on the weekly report for forage fish and grenadiers. Catch is associated with the Bering Sea pollock seasons with catch increasing in the B season that starts on June 10 each year.

Tables

Table 1. BSAI Groundfish Plan Team Recommended OFLs and ABSs for 2019 and 2020 (metric tons); OFL, ABS, TAC and catch through November 3, 2018.

Species	Area	2018 OFL	2018 ABC	2018 TAC	Catch as of 11/3/2018	2019 OFL	2019 ABC	2020 OFL	2020 ABC
Pollock	EBS	4,797,000	2,592,000	1,364,341	1,376,730	3,914,000	2,163,000	3,082,000	1,792,000
	AI	49,289	40,788	19,000	1,805	64,240	52,887	66,981	55,125
	Bogoslof	130,428	60,800	450	9	183,080	137,310	183,080	137,310
Pacific cod	BS	238,000	201,000	188,136	168,962	216,000	144,800	183,000	123,200
	AI	28,700	21,500	15,695	14,549	27,400	20,600	27,400	20,600
Sablefish	BS	2,887	1,464	1,464	1,573	3,221	1,489	4,441	1,994
	AI	3,917	1,988	1,988	644	4,350	2,008	5,997	2,688
Yellowfin sole	BSAI	306,700	277,500	154,000	124,519	290,000	263,200	284,000	257,800
Greenland turbot	BSAI	13,148	11,132	5,294	1,825	11,362	9,658	10,476	8,908
	BS	n/a	9,718	5,125	1,664	n/a	8,431	n/a	7,777
	AI	n/a	1,414	169	161	n/a	1,227	n/a	1,131
Arrowtooth flounder	BSAI	76,757	65,932	13,621	6,506	82,939	70,673	83,814	71,411
Kamchatka flounder	BSAI	11,347	9,737	5,000	3,053	10,965	9,260	11,260	9,509
Northern rock sole	BSAI	147,300	143,100	47,100	28,219	122,000	118,900	147,500	143,700
Flathead sole	BSAI	79,862	66,773	14,500	10,649	80,918	66,625	83,190	68,448
Alaska plaice	BSAI	41,170	34,590	16,100	23,028	39,880	33,600	37,860	31,900
Other flatfish	BSAI	17,591	13,193	4,000	5,974	21,824	16,368	21,824	16,368
Pacific Ocean perch	BSAI	51,675	42,509	37,361	33,506	61,067	50,594	59,396	49,211
	BS	n/a	11,861	11,861	9,272		14,675		14,274
	EAI	n/a	10,021	9,000	8,067		11,459		11,146
	CAI	n/a	7,787	7,500	7,312		8,435		8,205
	WAI	n/a	12,840	9,000	8,855		16,025		15,586
Northern rockfish	BSAI	15,888	12,975	6,100	5,730	15,507	12,664	15,180	12,396
Blackspotted/ Rougheye Rockfish	BSAI	749	613	225	226	547	451	658	545
	EBS/EAI	n/a	374	75	54	n/a	288	n/a	345
	CAI/WAI	n/a	239	150	172	n/a	163	n/a	200
Shortraker rockfish	BSAI	666	499	150	238	722	541	722	541
Other rockfish	BSAI	1,816	1,362	845	944	1,793	1,344	1,793	1,344
	BS	n/a	791	275	201		956		956
	AI	n/a	571	570	743		388		388
Atka mackerel	BSAI	108,600	92,000	71,000	67,954	79,200	68,500	73,400	63,400
	EAI/BS	n/a	36,820	36,500	33,646		23,970		22,190
	CAI	n/a	32,000	21,000	20,889		14,390		13,310
	WAI	n/a	23,180	13,500	13,419		30,140		27,900
Skates	BSAI	46,668	39,082	27,000	27,815	51,152	42,714	48,944	40,813
Sculpins	BSAI	53,201	39,995	5,000	4,882	53,201	39,995	53,201	39,995
Sharks	BSAI	689	517	180	96	689	517	689	517
Squids	BSAI	6,912	5,184	1,200	1,731	n/a	n/a	n/a	n/a
Octopuses	BSAI	4,769	3,576	250	270	4,769	3,576	4,769	3,576
Total	BSAI	6,235,729	3,779,809	2,000,000	1,911,437	5,340,826	3,331,274	4,491,575	2,953,299

Sources: 2018 OFLs, ABCs, and TACs are from harvest specifications adopted by the Council in December 2017; 2018 catches through November 3, 2018 from AKR Catch Accounting.

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 2019-2020. 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	2019					
		Tier	**maxF_{ABC}**	**F_{ABC}**	**max ABC**	**ABC**	**% Red.**
Pollock	EBS	1a	0.451	0.356	3,096,000	2,163,000	30%
Pacific cod	EBS	3a	0.310	0.248	181,000	144,800	20%
Sablefish	BSAI	3b	0.081	0.044	6,468	3,497	46%
		2020					
		Tier	**maxF_{ABC}**	**F_{ABC}**	**max ABC**	**ABC**	**% Red.**
Pollock	EBS	1a	0.510	0.375	2,437,000	1,792,000	26%
Pacific cod	EBS	3a	0.290	0.232	154,000	123,200	20%
Sablefish	BSAI	3b	0.099	0.051	8,934	4,682	48%

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 2019 and 2020. "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	2019					2020			
			Biomass	OFL	ABC	F_{OFL}	F_{ABC}	OFL	ABC	F_{OFL}	F_{ABC}
Pollock	1a	EBS	9,110,000	3,914,000	2,163,000	0.645	0.356	3,082,000	1,792,000	0.645	0.375
	3a	AI	319,892	64,240	52,887	0.415	0.331	66,981	55,125	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	824,000	216,000	144,800	0.380	0.248	183,000	123,200	0.350	0.232
	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	2,462,400	290,000	263,200	0.118	0.107	284,000	257,800	0.118	0.107
Greenland turbot	3a	BSAI	105,930	11,362	9,658	0.210	0.180	10,476	8,908	0.210	0.180
Arrowtooth flounder	3a	BSAI	892,591	82,939	83,814	0.161	0.136	83,814	71,411	0.161	0.136
Kamchatka flounder	3a	BSAI	155,251	10,965	9,260	0.108	0.090	11,260	9,509	0.108	0.090
Northern rock sole	1a	BSAI	828,000	122,000	118,900	0.147	0.144	147,500	143,700	0.147	0.144
Flathead sole	3a	BSAI	673,718	80,918	66,625	0.470	0.380	83,190	68,448	0.470	0.380
Alaska plaice	3a	BSAI	400,700	39,880	33,600	0.149	0.124	37,860	31,900	0.149	0.124
Other flatfish	5	BSAI	141,325	21,824	16,368	0.17 / 0.085 / 0.15	0.128/ 0.064 / 0.113	21,824	16,368	0.17 / 0.085 / 0.15	.128 / 0.064 / 0.113
Pacific ocean perch	3a	BSAI	934,293	61,067	50,594	0.095	0.079	59,396	49,211	0.095	0.079
Northern rockfish	3a	BSAI	244,196	15,507	12,664	0.080	0.065	15,180	12,396	0.080	0.065
Shortraker rockfish	5	BSAI	24,055	722	541	0.030	0.0225	722	541	0.030	0.0225
Blackspotted/Rougheye	3b	BSAI	32,436	547	451			658	545		
Other rockfish	5	BSAI	53,290	1,793	1,344	0.03/0.09	0.0225 / 0.0675	1,793	1,344	0.03 / 0.09	0.0225 / 0.0675
Atka mackerel	3b	BSAI	498,320	79,200	68,500	0.530	0.440	73,400	63,400	0.530	0.440
Skate	3a/5	BSAI	624,338	51,152	42,714	0.094 / 0.10	0.081 / 0.075	48,944	40,813	0.094 / 0.10	0.081 / 0.075
Sculpin	5	BSAI	188,656	53,201	39,995	0.282	0.212	53,201	39,995	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**	**19,354,358**	**5,340,826**	**3,331,274**			**4,491,575**	**2,953,299**		

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						35,643
1964	174,792	13,408	3,545	111,177	33,729						30,604
1965	230,551	14,719	4,838	53,810	9,747						11,686
1966	261,678	18,200	9,505	102,353	13,042						24,864
1967	550,362	32,064	11,698	162,228	23,869						32,109
1968	702,181	57,902	4,374	84,189	35,232						29,647
1969	862,789	50,351	16,009	167,134	36,029						34,749
1970	1,256,565	70,094	11,737	133,079	19,691	12,598					64,690
1971	1,743,763	43,054	15,106	160,399	40,464	18,792					92,452
1972	1,874,534	42,905	12,758	47,856	64,510	13,123					76,813
1973	1,758,919	53,386	5,957	78,240	55,280	9,217					43,919
1974	1,588,390	62,462	4,258	42,235	69,654	21,473					37,357
1975	1,356,736	51,551	2,766	64,690	64,819	20,832					20,393
1976	1,177,822	50,481	2,923	56,221	60,523	17,806					21,746
1977	978,370	33,335	2,718	58,373	27,708	9,454					14,393
1978	979,431	42,543	1,192	138,433	37,423	8,358					21,040
1979	913,881	33,761	1,376	99,017	34,998	7,921					19,724
1980	958,279	45,861	2,206	87,391	48,856	13,761					20,406
1981	973,505	51,996	2,604	97,301	52,921	13,473					23,428
1982	955,964	55,040	3,184	95,712	45,805	9,103					23,809
1983	982,363	83,212	2,695	108,385	43,443	10,216					30,454
1984	1,098,783	110,944	2,329	159,526	21,317	7,980					44,286
1985	1,179,759	132,736	2,348	227,107	14,698	7,288					71,179
1986	1,188,449	130,555	3,518	208,597	7,710	6,761					76,328
1987	1,237,597	144,539	4,178	181,429	6,533	4,380					50,372
1988	1,228,000	192,726	3,193	223,156	6,064	5,477					137,418
1989	1,230,000	164,800	1,252	153,165	4,061	3,024					63,452
1990	1,353,000	162,927	2,329	80,584	7,267	2,773					22,568
1991	1,268,360	165,444	1,128	94,755	3,704	12,748		46,681			30,401
1992	1,384,376	163,240	558	146,942	1,875	11,080		51,720			34,757
1993	1,301,574	133,156	669	105,809	6,330	7,950		63,942			28,812
1994	1,362,694	174,151	699	144,544	7,211	13,043		60,276			29,720
1995	1,264,578	228,496	929	124,746	5,855	8,282		54,672	14,699		20,165
1996	1,189,296	209,201	629	129,509	4,699	13,280		46,775	17,334		18,529
1997	1,115,268	209,475	547	166,681	6,589	8,580		67,249	20,656		22,957
1998	1,101,428	160,681	586	101,310	8,303	14,985		33,221	24,550		15,355
1999	988,703	146,738	678	69,275	5,401	10,585		40,505	18,534		15,515
2000	1,132,736	151,372	742	84,057	5,888	12,071		49,186	20,342		16,453
2001	1,387,452	142,452	863	63,563	4,252	12,836		28,949	17,757		9,930
2002	1,481,815	166,552	1,143	74,956	3,150	10,821		40,700	15,464		2,588
2003	1,492,039	174,687	1,039	81,050	2,565	13,667		36,375	14,132	10,118	2,922
2004	1,480,552	183,745	1,041	75,502	1,825	17,367		47,862	17,361	7,888	4,755
2005	1,483,022	182,936	1,070	94,383	2,140	13,409		36,814	16,074	11,194	4,566
2006	1,488,031	168,814	1,079	99,156	1,453	11,966		35,878	17,942	17,318	3,123
2007	1,354,502	140,129	1,182	120,962	1,481	11,082		36,364	18,929	19,522	5,699
2008	990,587	139,802	1,141	148,893	2,089	18,897		50,934	24,521	17,377	3,578
2009	810,857	147,174	916	107,512	2,252	19,212		48,145	19,535	13,944	2,133
2010	810,390	142,868	755	118,624	2,273	14,782		52,644	20,097	16,165	2,158
2011	1,199,216	209,222	705	151,166	3,136	16,864	4,478	60,353	13,546	23,655	3,121
2012	1,205,276	232,674	743	147,186	3,058	18,978	2,510	75,777	11,355	16,612	3,501
2013	1,270,823	236,700	634	164,944	1,449	14,056	2,110	59,590	17,344	23,522	1,501
2014	1,297,846	238,735	315	156,772	1,479	14,928	3,268	51,569	16,505	19,447	4,340
2015	1,322,312	232,832	210	126,937	2,090	10,330	3,386	45,347	11,293	14,614	2,386
2016	1,353,711	231,511	532	135,350	2,117	9,777	3,165	44,860	10,358	13,385	2,827
2017	1,356,445	196,761	1,150	125,620	2,691	5,680	3,166	34,877	8,859	15,549	4,089
2018/f	1,376,739	168,962	1,573	124,514	1,664	5,679	1,342	28,005	10,633	23,028	5,935

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69.
Note: Numbers don't include fish taken for research.
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 3, 2018.

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/f		9,272	180	11	158	201	1,141		26,103	4,186	89	1,696	111	1,791,237

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69. Note: Numbers don't include fish taken for research.
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 3, 2018.

Table 5. Groundfish catches (metric tons) in the 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											
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/f	1,805	14,549	644	4	161	809	1,711	214	17	0	39

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69.

Note: Numbers don't include fish taken for research.

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 3, 2018.

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							66						92,652
1965	109,100							768						111,868
1966	85,900							131						87,589
1967	55,900							8,542						66,781
1968	44,900							8,948						56,023
1969	38,800							3,088						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		24,235	5,550	215	80	743	66,813		1,712	699	7	35	159	120,201

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69.

Note: Numbers don't include fish taken for research.

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 3, 2018.

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	0	0	0	12,562	0	0	0	0		0	0
1955	0	0	0	14,690	0	0	0	0		0	0
1956	0	0	0	24,697	0	0	0	0		0	0
1957	0	0	0	24,145	0	0	0	0		0	0
1958	6,924	171	6	44,153	0	0	0	0		0	0
1959	32,793	2,864	289	185,321	0	0	0	0		0	0
1960	0	0	1,861	456,103	36,843	0	0	0		0	0
1961	0	0	15,627	553,742	57,348	0	0	0		0	0
1962	0	0	25,989	420,703	58,226	0	0	0		0	0
1963	0	0	14,370	85,810	31,572	0	0	0		0	35,643
1964	174,792	13,649	5,086	111,177	34,233	0	0	0		0	30,604
1965	230,551	15,170	6,087	53,810	10,047	0	0	0		0	11,686
1966	261,678	18,354	10,846	102,353	13,105	0	0	0		0	24,864
1967	550,362	32,357	13,350	162,228	24,263	0	0	0		0	32,109
1968	702,181	58,191	6,047	84,189	35,445	0	0	0		0	29,647
1969	862,789	50,571	17,682	167,134	36,257	0	0	0		0	34,749
1970	1,256,565	70,377	12,985	133,079	19,976	12,872	0	0		0	64,690
1971	1,743,763	45,132	18,042	160,399	42,214	19,373	0	0		0	92,452
1972	1,874,534	43,340	16,289	47,856	77,384	14,446	0	0		0	76,813
1973	1,758,919	54,363	8,859	78,240	63,946	12,922	0	0		0	43,919
1974	1,588,390	63,841	6,735	42,235	78,442	24,668	0	0		0	37,357
1975	1,356,736	54,389	4,513	64,690	67,789	21,616	0	0		0	20,393
1976	1,177,822	54,671	4,582	56,221	62,590	19,176	0	0		0	21,746
1977	985,995	36,597	4,615	58,373	30,161	11,489	0	0		0	14,393
1978	985,713	45,838	2,013	138,433	42,189	10,140	0	0		0	21,040
1979	923,385	39,354	2,158	99,017	41,409	14,357	0	0		0	19,724
1980	1,016,435	51,649	2,480	87,391	52,553	18,364	0	0		0	20,406
1981	1,029,021	62,458	3,137	97,301	57,321	17,113	0	0		0	23,428
1982	1,013,942	56,566	4,139	95,712	52,122	11,518	0	0		0	23,809
1983	1,041,389	93,167	3,368	108,385	47,558	13,969	0	0		0	30,454
1984	1,180,617	133,160	3,328	159,526	23,120	9,452	0	0		0	44,286
1985	1,238,489	145,426	3,796	227,107	14,731	7,375	0	0		0	71,179
1986	1,235,090	140,887	6,546	208,597	9,864	6,903	0	0		0	76,328
1987	1,266,317	157,746	8,012	181,429	9,599	4,539	0	0		0	50,372
1988	1,271,000	197,891	6,608	223,156	7,108	5,883	0	0		0	137,418
1989	1,386,000	168,918	4,500	153,165	8,822	3,222	0	0		0	63,452
1990	1,426,000	171,008	4,445	80,584	9,620	4,232	0	0		0	22,568
1991	1,346,464	172,158	3,199	96,135	6,878	13,686	0	46,681		0	30,489
1992	1,438,412	206,129	2,104	146,946	2,770	11,980	0	51,956		0	34,825
1993	1,358,758	167,390	2,747	105,809	8,468	9,298	0	64,260		0	28,871
1994	1,421,402	196,572	2,470	144,544	10,379	14,377	0	60,584		0	29,775
1995	1,329,503	245,030	2,048	124,752	8,193	9,283	0	55,028	14,715	0	20,196
1996	1,218,229	240,590	1,349	130,163	6,376	14,610	0	47,146	17,344	0	18,580
1997	1,142,140	234,641	1,326	166,915	7,666	9,651	0	67,520	20,688	0	22,964
1998	1,125,249	195,645	1,181	101,315	9,124	15,679	0	33,667	24,569	0	15,390
1999	989,684	174,855	1,349	69,288	5,861	11,359	0	41,085	18,568	0	15,535
2000	1,133,980	191,056	1,812	84,070	6,974	13,228	0	49,666	20,422	0	16,485
2001	1,388,276	176,659	1,937	63,578	5,312	14,056	0	29,475	17,811	0	9,973
2002	1,482,992	197,353	2,261	74,985	3,635	11,853	0	41,865	15,575	0	2,627
2003	1,493,692	207,146	2,048	81,050	3,530	14,580	0	37,339	14,181	10,118	2,954
2004	1,481,710	212,618	1,996	75,511	2,259	18,185	0	48,681	17,398	7,888	4,788
2005	1,484,643	205,635	2,551	94,385	2,608	14,243	0	37,362	16,108	11,194	4,592
2006	1,489,776	193,025	2,229	99,160	1,989	13,442	0	36,456	17,981	17,318	3,160
2007	1,357,021	174,485	2,350	120,964	2,004	11,916	0	37,126	18,958	19,522	5,724
2008	991,865	171,030	2,040	148,894	2,911	21,370	0	51,276	24,540	17,377	3,624
2009	812,520	175,756	2,016	107,513	4,515	29,900	0	48,716	19,558	13,944	2,178
2010	811,625	171,869	1,852	118,624	4,146	38,880	0	53,221	20,127	16,165	2,199
2011	1,200,424	220,080	1,730	151,168	3,668	20,133	9,971	60,632	13,553	23,655	3,177
2012	1,206,252	250,894	1,948	147,187	4,716	22,378	9,505	76,099	11,366	16,612	3,543
2013	1,273,787	250,307	1,697	164,944	1,745	20,541	7,766	59,800	17,354	23,522	1,535
2014	1,300,221	249,330	1,133	156,772	1,656	19,109	6,458	51,724	16,514	19,447	4,391
2015	1,323,227	242,057	640	126,937	2,204	11,267	4,994	45,467	11,307	14,614	2,415
2016	1,354,968	243,870	881	135,350	2,238	11,105	4,850	45,101	10,384	13,385	2,848
2017	1,357,937	209,047	1,738	125,621	2,813	6,189	4,462	35,123	8,878	15,549	4,121
2018/f	1,378,544	183,511	2.217	124,519	1,825	6,506	3,053	28,219	10,649	23,028	5,974

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69. Note: Numbers don't include fish taken for research.
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 3, 2018.

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	0	0	0	0	0	0	0	0				0		12,562
1955	0	0	0	0	0	0	0	0				0		14,690
1956	0	0	0	0	0	0	0	0				0		24,697
1957	0	0	0	0	0	0	0	0				0		24,145
1958	0	0	0	0	0	0	0	147				0		51,401
1959	0	0	0	0	0	0	0	380				0		221,647
1960	6,100	0	0	0	0	0	0	0				0		500,907
1961	47,000	0	0	0	0	0	0	0				0		673,717
1962	20,100	0	0	0	0	0	0	0				0		525,018
1963	45,300	0	0	0	0	0	0	0				0		212,695
1964	116,200	0	0	0	0	0	0	802				0		486,543
1965	125,900	0	0	0	0	0	0	2,986				0		456,237
1966	106,100	0	0	0	0	0	0	2,370				0		539,670
1967	75,500	0	0	0	0	0	0	12,920				0		903,089
1968	76,400	0	0	0	0	0	0	31,006				0		1,023,106
1969	53,300	0	0	0	0	0	0	13,547				0		1,236,029
1970	76,800	0	0	0	0	0	949	25,966				0		1,674,259
1971	31,600	0	0	0	0	0	0	16,469				0		2,169,444
1972	38,900	0	0	0	0	0	5,907	33,340				0		2,228,809
1973	15,500	0	0	0	0	0	1,712	60,070				0		2,098,450
1974	36,400	0	0	0	0	0	1,377	69,987				0		1,949,432
1975	25,200	0	0	0	0	0	13,326	63,133				0		1,691,785
1976	28,900	0	0	0	0	0	13,126	33,196				0		1,472,030
1977	10,734	0	0	0	0	3,354	20,975	52,072				6,734		1,235,492
1978	7,507	0	0	0	0	3,535	24,249	73,973				8,971		1,363,601
1979	7,210	0	0	0	0	6,625	23,264	51,701				6,538		1,234,742
1980	5,797	0	0	0	0	879	20,488	47,661				6,372		1,330,475
1981	4,844	0	0	0	0	684	19,688	42,925				5,945		1,363,865
1982	1,238	0	0	0	0	2,390	19,874	23,367				5,039		1,309,716
1983	501	0	0	0	0	1,265	11,726	19,140				3,980		1,374,902
1984	2,200	0	0	0	0	232	36,055	10,178				3,167		1,605,321
1985	1,092	0	0	0	0	191	37,860	13,553				1,620		1,762,419
1986	846	0	0	0	0	271	31,990	11,980				868		1,730,170
1987	1,934	0	0	0	0	621	30,061	9,724				131		1,720,485
1988	3,026	0	0	0	0	619	22,084	12,643				417		1,887,853
1989	4,723	0	0	0	0	673	17,994	5,101				306		1,816,876
1990	20,289	0	0	0	0	1,248	22,205	6,325				471		1,768,995
1991	7,289	0	0	0	0	945	24,523	16,376				574		1,765,397
1992	13,586	0	0	0	0	4,364	49,441	33,074				880		1,996,467
1993	17,138	0	0	0	0	685	66,006	23,953				682		1,854,065
1994	18,866	0	0	0	0	562	69,591	24,532				588		1,994,242
1995	15,944	0	0	0	0	849	81,554	22,201				459		1,929,755
1996	23,078	0	0	0	0	642	103,867	21,437				1,167		1,844,578
1997	16,747	0	0	0	0	468	65,839	22,552				1,761		1,780,878
1998	14,863	0	0	0	0	588	57,096	25,604				916		1,620,886
1999	19,155	0	0	0	0	798	56,233	20,586				401		1,424,757
2000	15,597	0	0	0	0	840	47,229	26,108				383		1,607,850
2001	16,735	0	0	0	0	906	61,560	27,177				1,766		1,815,221
2002	15,854	0	0	0	0	952	45,294	28,619				1,344		1,925,209
2003	20,156	0	0	0	0	737	59,350	28,312				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	0	23,154	5,374	107	336	587	1,817,774
2012	0	24,143	2,479	191	344	947	47,829	0	24,823	5,799	96	688	137	1,857,977
2013	0	31,362	2,038	322	371	815	23,181	0	27,030	5,828	116	300	224	1,914,585
2014	0	32,381	2,342	196	197	944	30,951	0	27,511	4,860	137	1,678	428	1,928,379
2015	0	31,425	7,197	181	153	686	53,270	0	28,123	4,980	107	2,364	446	1,914,061
2016	0	31,318	4,541	158	105	786	54,485	0	29,126	4,892	128	1,378	595	1,952,492
2017	0	32,144	4,679	197	151	820	63,656	0	28,389	5,034	178	2,099	208	1,909,033
2018/f	0	33,506	5,730	226	238	944	67,954	0	27,815	4,882	96	1,731	270	1,911,473

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69. Note: Numbers don't include fish taken for research.
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 3, 2018.