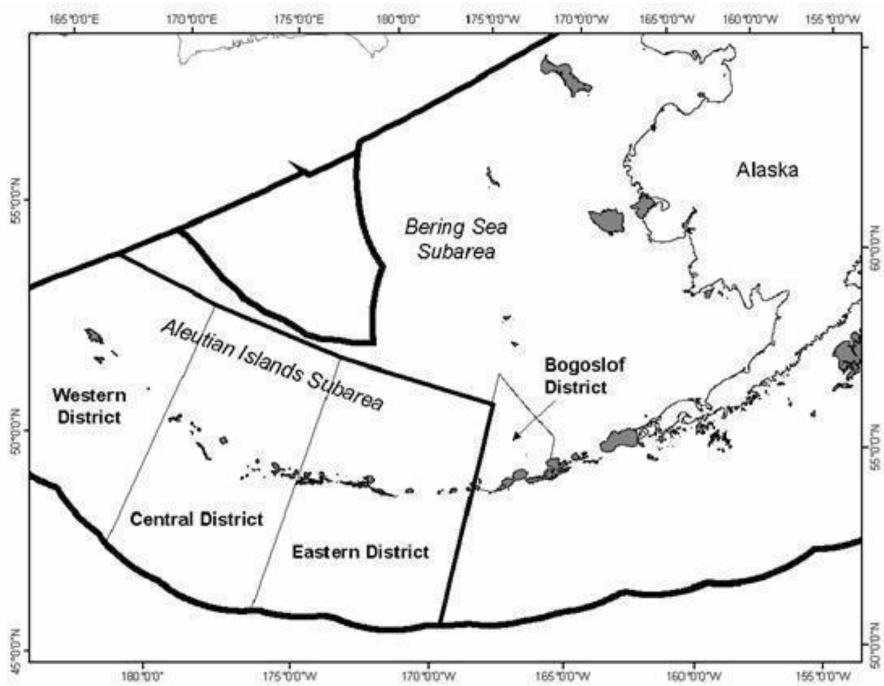
STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

FOR THE GROUNDFISH RESOURCES

OF THE BERING SEA/ALEUTIAN ISLANDS REGIONS

Compiled by:

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



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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 sections: a “Stock Assessment” section, which comprises the bulk of this document, and “Economic Status of Groundfish Fisheries off Alaska” (i.e., the “Economic SAFE report”) and “Ecosystem Considerations” sections, which are bound separately.

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.

Normally, full stock assessments are required for walleye pollock, Pacific cod, Atka mackerel, sablefish, and some flatfish stocks every year; while all rockfishes, some flatfishes, sharks, skates, octopus, squid, and sculpins require full stock assessment only during years in which the Aleutian Island bottom trawl survey is conducted (typically even-numbered years).

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 Considerations chapter 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.

Members of the BSAI Groundfish Plan Team who compiled this SAFE report were: Grant Thompson (co-chair), Dana Hanselman (co-chair), Diana Stram (BSAI Groundfish FMP coordinator), Kirstin Holsman, David Barnard, Liz Chilton, Allan Hicks, Mary Furuness, Cindy Tribuzio, Alan Haynie, Brenda Norcross, 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.

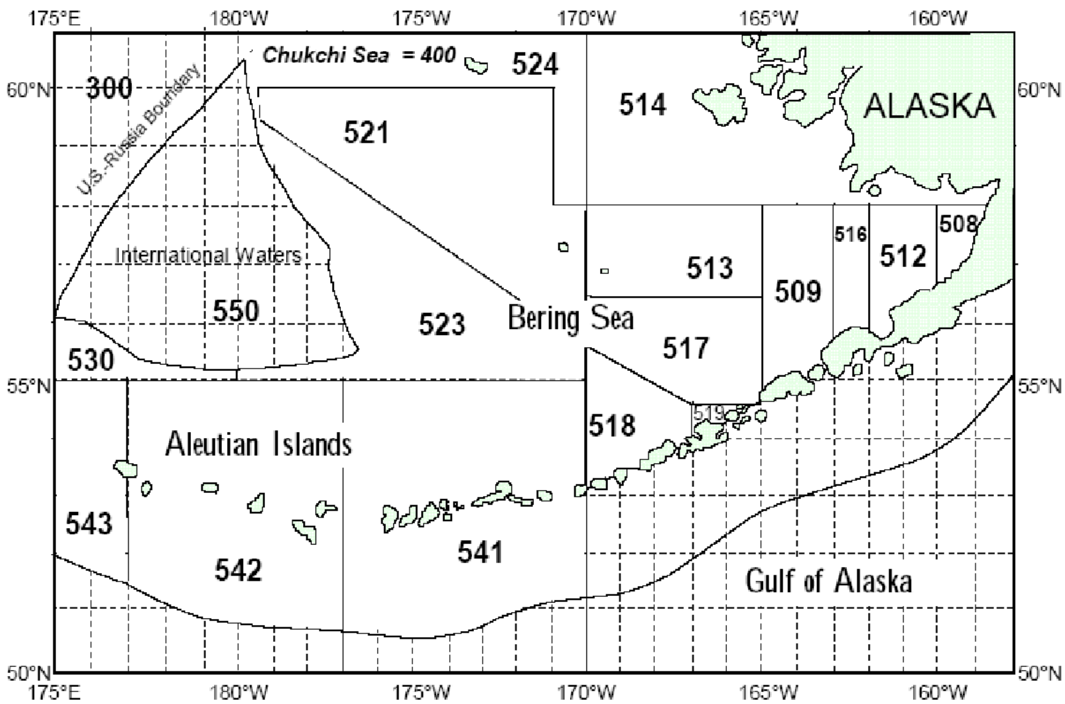

Figure 1. Bering Sea/Aleutian Islands statistical and reporting areas.

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		
Other flatfish		
Pacific Ocean perch		
Northern rockfish		
Blackspotted/Rougheye		
Shortraker rockfish		
Other rockfish		
Atka mackerel		
Skates		
Sculpins		
Sharks		
Squids		
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.

Historical Catch Statistics

Catch statistics since 1954 are shown for the Eastern Bering Sea (EBS) subarea in Table 2. 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 generally are well below the 2 million t optimal yield (OY) cap. Total groundfish catches in the EBS in 2015 totaled 1,814,145 t; catches through November 5, 2016 totaled 1,828,144 t. Pollock catches in the EBS totaled 1,321,577 t in 2015; catches through November 5, 2016 totaled 1,349,724 t.

Catches in the Aleutian Islands (AI) subarea always are much less than in the EBS (Table 3). Total AI catches peaked at 190,750 t in 1996. Total AI catches were 144,684 t in 2010, and dropped to 98,601 t in 2012 and to 84,619 in 2013. Total catch decreased again in 2014 to 82,089 but rose in 2015 to 99,916 and catch through November 5, 2016 at 102,238 t. This increase from 2015 on is largely due to increased catch of 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 and catch totaled

23,222 t through November 5, 2016. 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 is 12,357 t through November 5, 2016. 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 2016 with catch as of November 5, 2016 at 53,962 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 4. 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). BSAI catches through November 5,2016 totaled 1,930,382 t, which equaled 97% 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 each subarea are derived as 3 percent of the combined Pacific cod Bering Sea subarea ABC and 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 $F=F_{40\%}$.

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 2017 or 2018 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 2017 and 2018, 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 2017 recommended in the assessment to the *max*

F_{ABC} for 2017, and where catches for 2017 and 2018 are estimated at their most likely values given the 2017 and 2018 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 2018 or 2) above 1/2 of its MSY level in 2018 and expected to be above its MSY level in 2028 under this scenario, then the stock is not overfished.)

Scenario 7: In 2017 and 2018, *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 2018 or 2) above 1/2 of its MSY level in 2018 and expected to be above its MSY level in 2028 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 2017 and 2018 ABCs and OFLs are summarized in Tables 1, 5, and 6.

The sum of the recommended ABCs for 2017 and 2018 are 4,010,876 t and 4,171,722 t, respectively. These compare with the sums of the 2016 ABCs (3,236,662) and 2015 ABCs (2,842,543 t). The primary increase from previous years is due to EBS pollock. The Team recommended maximum permissible ABCs for all stocks, except for EBS pollock, Bogoslof pollock and Sablefish (Table 6).

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 2017. The abundances of sablefish is projected to be below $B_{35\%}$ for 2017 by approximately 1%.

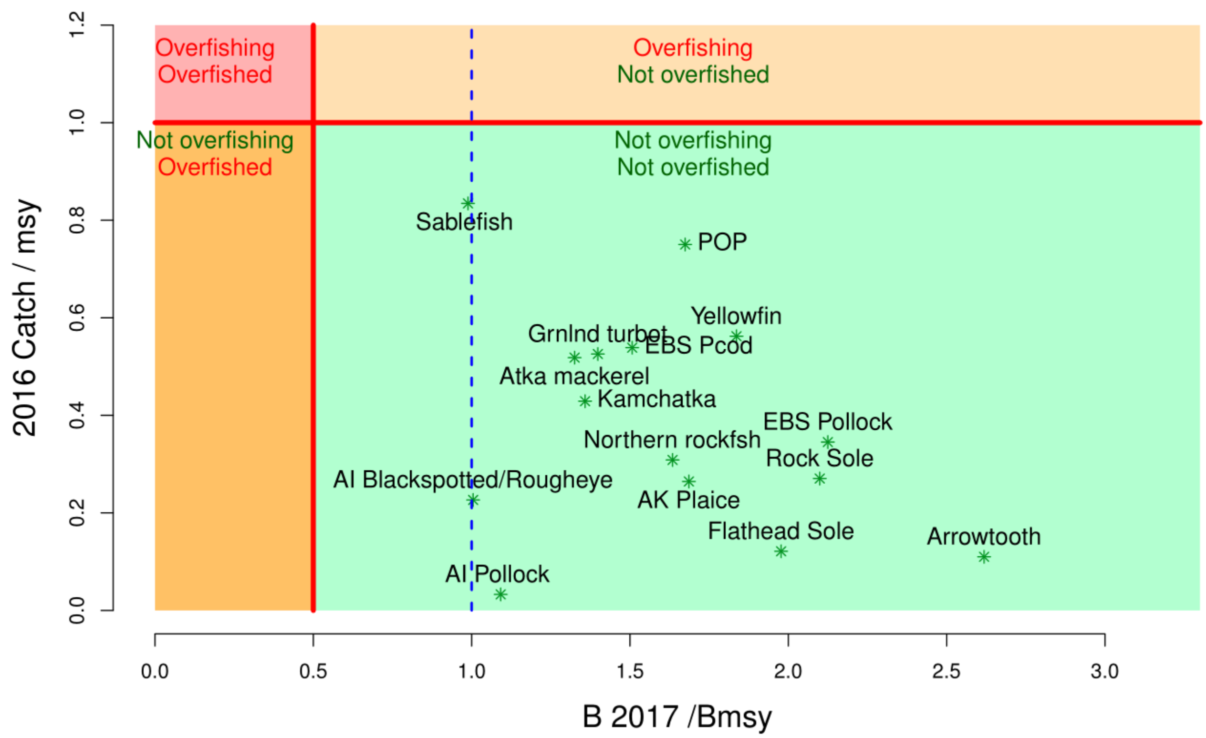

Figure 2. Summary of Bering Sea stock status next year (spawning biomass relative to B_{msy}; horizontal axis) and current year catch relative to fishing at F_{msy} (vertical axis) where F_{OFL} is taken to equal F_{msy}.

The sum of the biomasses for 2017 listed in Table 5 represents a 9% increase from 2016. The 2016 value, in turn, was represented an increase of 16% from 2015 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 5, 2016.

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 2017 harvest specifications (from Council recommendations in December 2016) are in place to start the fishery on January 1, 2017, but these will be replaced by final harvest specifications that will be recommended by the Council in December 2016. The final 2017 and 2018 harvest specifications will become effective when final rulemaking occurs in February or March 2017. 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 2018 ABC and OFL values recommended in next year's SAFE report are likely to differ from this year's projections for 2018 because of new (e.g., survey) information 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.

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*
   - $ABC \leq 0.75 \times OFL$

Ecosystem Considerations

For the third consecutive year, the eastern Bering Sea in 2016 was characterized by anomalously warm conditions. Despite near normal temperatures during the winter and spring of 2015-2016 in the Western Aleutians, the Aleutian Islands (AI) were similarly characterized by warm conditions in the summer of 2016, with notable warming to 100 m depth across all regions from East to Western AI. The strong El Niño of 2015-2016 appears to be transitioning to a weak La Niña. Somewhat unusually, the PDO remains positive, and extra heat in the upper ocean now appears present along most of the West coast of North America (deepening of SST anomaly to 200-300 m). The Alaska stream was slightly stronger than normal during late 2015 and early 2016. Spring 2016 wind anomalies would have promoted enhanced transport of warm Pacific origin water through Unimak Pass and into the S Bering Sea. In the Bering Sea spring sea ice extent was the lowest on record, and the summer cold pool was restricted to a small area in the northern Bering Sea. Both surface and bottom temperature means for the 2016 eastern Bering Sea shelf were the highest on record in the 35-year bottom trawl survey time-series. The 2016 mean surface temperature was 9.5ºC, which was 2.3ºC higher than 2015 and 3.1ºC above the time-series mean (6.4ºC). The mean bottom temperature was 4.5ºC, which was 1.2ºC higher than 2015 and 2.2ºC above the time-series mean (2.4ºC).

Many ecosystem indicators in the Bering Sea showed a continued decrease in productivity, consistent with hypothesized ecosystem-level responses to above-average thermal conditions. This was particularly evident in the Zooplankton Rapid Assessment, acoustic euphausiid estimates, jellyfish abundance, Northern fur seal pup production, and seabird breeding success indices. Small copepods dominated the entire shelf during the summer and fall, euphausiids were scarce during the summer, and large copepods were restricted to the outer shelf near mooring M5 and Unimak Pass. Jellyfish CPUE continued to decline with a 79% decrease in from 2015. Larval pollock distributions exhibited a potential spatial mismatch with concentrations of optimal prey (large copepods). That said, average fish condition (average weight per length) for age 1 and multiple groundfish species were above average (the exceptions were arrowtooth flounder, which was below average and adult pollock, which was average). Preliminary pup production estimates for St. George indicate a change between -5.0% and 16.0%, and a change between -10.0% and -15.0% on St. Paul, compared to 2014 estimates, while pup production on Bogoslof Island was 10.1%. That said, declines observed on the Pribilof Islands were much greater than the increase in numbers on Bogoslof, indicating that the decline on the Pribilofs is not due entirely to emigration. In general, the distribution of the demersal community was more northern and shallower than in previous years and multiple species exhibited declines in 2016. Exceptions to the declines include motile epifauna (e.g., brittle stars) and apex predator biomass (e.g., Pacific cod). For the third consecutive warm year, increased diversity of fish and invertebrates was observed, perhaps indicating new niche availability in the ecosystem. Finally, the Ecosystem Considerations reports include several indices of human activity, noting that the number of vessels participating in federally managed fisheries in the Alaska continued to decline, resident population rose slightly, and state-wide unemployment dipped in 2016 (despite long-term increases in some areas such the northern Bering Sea).

In contrast to the Bering Sea, patterns in biological and physical indices in the AI did not differ markedly from previous survey years. Sponges and corals remain below 1980-1990 maximum survey CPUE and continue to show declines in the western and central AI regions. Survey CPUE of jellyfish, diatoms, and motile epifauna appear to be higher in recent years, and zooplankton appeared to be sufficiently abundant to support successful breeding in zooplanktivorous auklets in the western AI. Fish condition continues to be lower than average and POP, and shortraker rockfish appear to be shallower (possibly due to increased habitat utilization by an expanding population).

Economic Summary of the BSAI commercial groundfish fisheries in 2014-15

The ex-vessel value of all Alaska domestic fish and shellfish catch, which includes the amount paid to harvesters for fish caught and the estimated value of pre-processed fish species that are caught by catcher/processors, decreased from $1,853 million in 2014 to $1,720 million in 2015. The first wholesale value of 2015 groundfish catch after primary processing was $2,262 million. The 2015 total groundfish catch decreased by 1%, and the total first-wholesale value decreased by 4%, relative to 2014.

The groundfish fisheries accounted for the largest share (52%, $894 million) of the ex-vessel value of all commercial fisheries off Alaska, while the Pacific salmon (*Oncorhynchus spp*.) fishery was second with $413 million or 24% of the total Alaska ex-vessel value. The value of the shellfish fishery amounted to $293 million or 17% of the total for Alaska and exceeded the value of Pacific halibut (*Hippoglossus stenolepis*) with $111 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 forecasts, a summary of the Alaskan community participation in fisheries, an Amendment 80 fishery economic data report (EDR) summary, an 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. The figures and tables in the report provide estimates of total groundfish catch, groundfish discards and discard rates, prohibited species catch (PSC) and PSC rates, the ex-vessel value of the groundfish catch, the ex-vessel value of the catch in other Alaska fisheries, the gross product value of the resulting groundfish seafood products, the number and sizes of vessels that participated in the groundfish fisheries off Alaska, vessel activity, and employment on at-sea processors. Appendices contain species specific ex-vessel and first-wholesale data for flatfish and rockfish, data on fishmeal, global whitefish production from the FAO, fisheries export data from the Census Bureau, employment data from the Alaska Dept. of Labor, and alternative ex-vessel pricing and value based on CFEC fish tickets. Generally, the data presented in this report cover 2011 - 2015, but limited catch and ex-vessel value data are reported for earlier years in order 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 http://www.afsc.noaa.gov/refm/Socioeconomics/SAFE/default.php

Decomposition of the change in first-wholesale revenues from 2014-15 in the BSAI

The following brief analysis summarizes the overall changes that occurred between 2014-15 in the quantity produced and revenue generated from BSAI groundfish. According to data reported in the 2016 Economic SAFE report, the ex-vessel value of BSAI groundfish decreased from $726 million in 2014 to $688 million in 2015 (Figure 3), and first-wholesale revenues from the processing and production of groundfish in the BSAI fell from $1,958 million in 2014 to $1,912 million in 2015, a decrease of 2% (Figure 4).

The total quantity of groundfish products from the BSAI decreased from 844 thousand metric tons in 2014 to 819 thousand metric tons in 2014, a difference of 25 thousand metric tons. These changes in the BSAI account for part of the change in first-wholesale revenues from Alaska groundfish fisheries overall which decreased by $83 million, a relative decrease of 4% in 2015 compared to 2014.

By species group, a negative quantity effect of $36 million for flatfish, and positive price effect of $26 million for cod, were the largest changes in first-wholesale revenues from the BSAI for 2014-15 (Figure 5). A positive quantity effect for Atka mackerel of $32 million largely offset the negative quantity effect for flatfish. Other notable changes in the BSAI were negative price and quantity effects for pollock that produced a negative net effect of $28 million. By product group, negative price and quantity effects were distributed among fillets, roe, and whole head & gut, for negative net effects of $46 million, $41 million, and $23 million, respectively. In contrast, surimi showed positive price and quantity effects for a positive net effect of $52 million in the BSAI first-wholesale revenue decomposition for 2014-15.

In summary, first-wholesale revenues from the BSAI groundfish fisheries decreased by $46 million from 2014-15. Major drivers were a negative quantity effect for flatfish, and negative price and quantity effects for pollock. In comparison, first-wholesale revenues decreased by $37 million from 2014-15 in the GOA, due primarily to a negative quantity effect for flatfish, and negative price and quantity effects for cod.

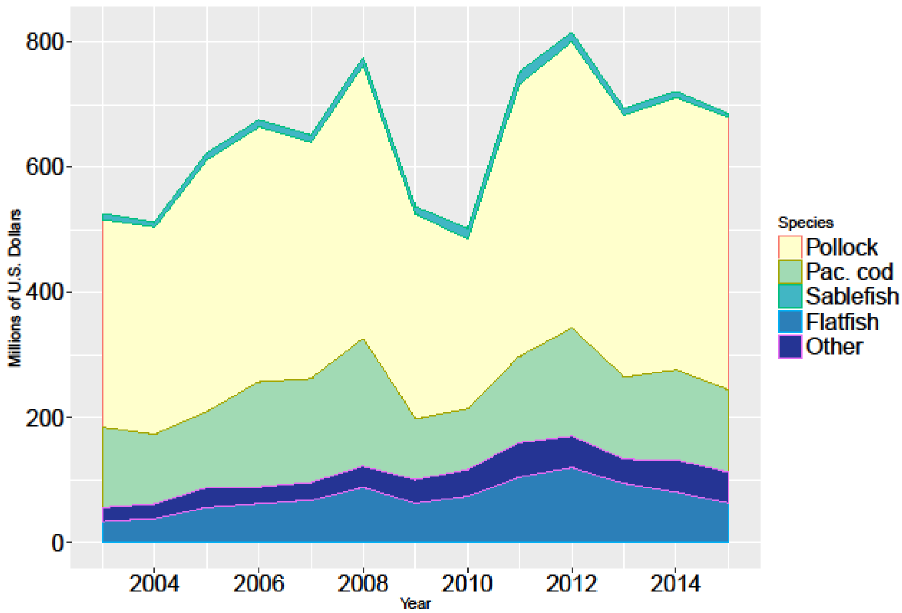

Figure 3. Real ex-vessel value of the groundfish catch in the domestic commercial fisheries in the BSAI area by species, 2003-2015 (base year = 2015).

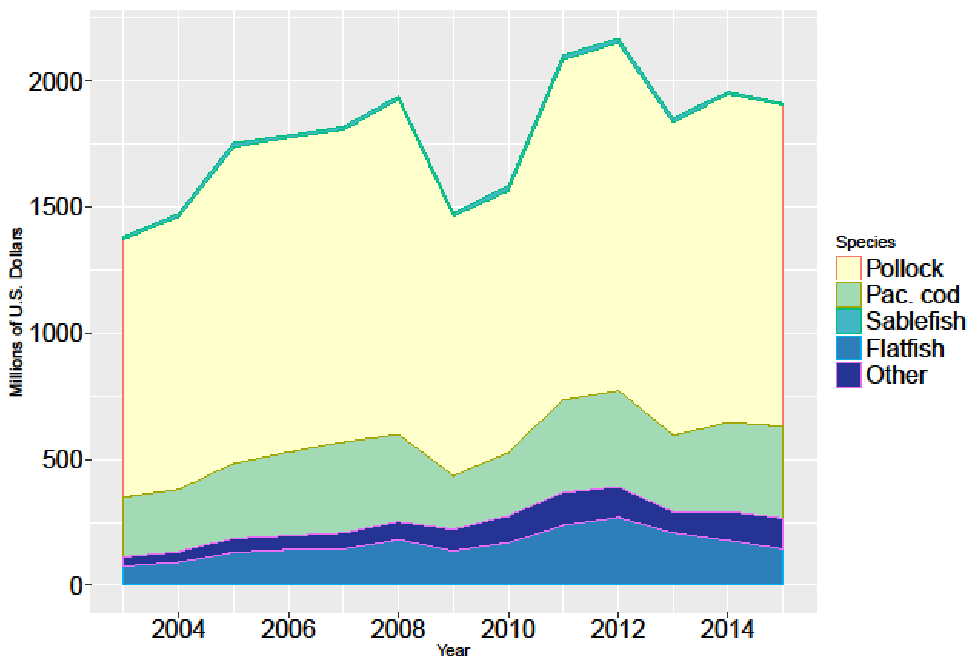

Figure 4. Real gross product value of the groundfish catch in the BSAI area by species, 2003-2015 (base year = 2015).

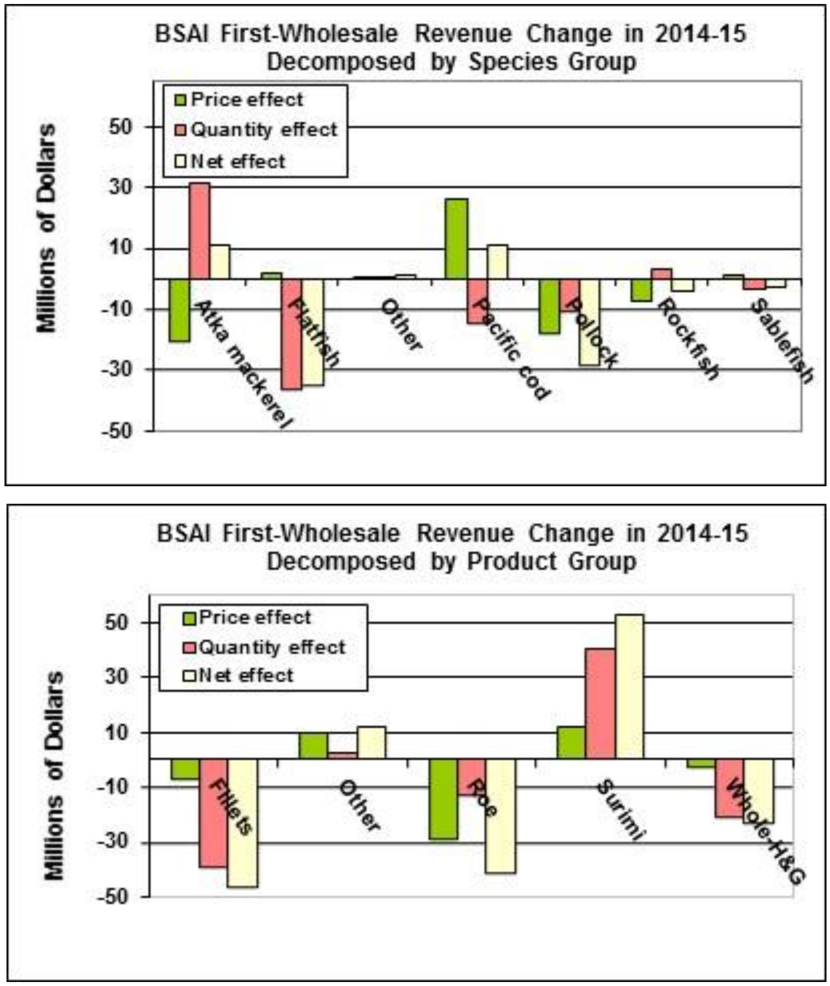

Figure 5. Decomposition of the change in firs-wholesale revenues from 2014-15 in the BSAI area. The first decomposition is by the species groups used in the Economic SAFE report, and the second decomposition is by product group. The price effect refers to the change in revenues due to the change in the 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).

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 2017 and 2018 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Biomass	OFL	ABC	TAC	Catch
Eastern Bering Sea	2015	9,203,000	3,330,000	1,637,000	1,310,000	1,321,577
	2016	11,300,000	3,910,000	2,090,000	1,340,000	1,349,724
	2017	13,000,000	3,640,000	2,800,000	n/a	n/a
	2018	12,100,000	4,360,000	2,979,000	n/a	n/a
Aleutian Islands	2015	228,102	36,005	29,659	19,000	915
	2016	241,929	39,075	32,227	19,000	1,288
	2017	250,221	43,650	36,061	n/a	n/a
	2018	271,831	49,291	40,788	n/a	n/a
Bogoslof	2015	106,000	21,200	15,900	100	733
	2016	106,000	31,906	23,850	500	1,005
	2017	434,760	130,428	51,300	n/a	n/a
	2018	434,760	130,428	51,300	n/a	n/a

*In 2015, NMFS reallocated 14,454 t of pollock TAC from the Aleutian Islands to the Bering Sea, which increased the Bering Sea TAC to 1,324,454 t and decreased the Aleutian Islands TAC to 4,546 t. In 2016, 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 2016 NMFS bottom-trawl survey (BTS) biomass and abundance at age estimates
- The 2016 NMFS acoustic-trawl survey (ATS) biomass and abundance at age estimates
- Observer data for catch-at-age and average weight-at-age from the 2015 fishery
- Updated total catch as reported by NMFS Alaska Regional office 2015 and estimated catch for 2016

Methodological changes in this year's assessment include the following:

- The model was fit to survey biomass rather than survey abundance (numbers of fish)
- Sample sizes specified for the robust-multinomial likelihood were revised, based on the "Francis method"
- The method for estimating current and future year mean body weight at age was improved
- For purposes of estimating biological reference points (BRPs) and making projections (but not for estimating historical or current non-BRP parameter values or derived time series), the model was re-run with greater weight given to the prior distribution for the stock-recruitment "steepness" parameter.

Spawning biomass and stock trends

Spawning biomass in 2008 was at the lowest level since 1980, but has increased by 152% since then, with a further increase projected for next year, followed by a decreasing trend. The 2008 low was the result of extremely poor recruitments from the 2002-2005 year classes. Recent and projected increases are fueled by recruitment from the very strong 2008 and 2012 year classes (131% and 158% above average, respectively), along with reductions in average fishing mortality (ages 3-8) from 2009-2010 and 2013-2016. Spawning biomass is projected to be 112% above B_{MSY} in 2017.

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 2.165 million t, up 9% from last year's estimate of 1.984 million t. Projected spawning biomass for 2017 is 4.6 million t, placing EBS walleye pollock in sub-tier "a" of Tier 1. As in recent assessments, 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 0.398, down 1% from last year's value of 0.401. The harvest ratio of 0.398 is multiplied by the geometric mean of the projected fishable biomass for 2017 (7.83 million t) to obtain the maximum permissible ABC for 2017, which is 3.12 million t, up 2% and 13% from the maximum permissible ABCs for 2016 and 2017 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. They list nine reasons for doing so in the SAFE chapter.

During the period 2010-2013, the Team and SSC based ABC recommendations on the most recent 5-year average fishing mortality rate. Beginning in 2014, however, the Team and SSC felt that stock conditions had improved sufficiently that an increase in the ABC harvest rate was appropriate. Specifically, the Team and SSC recommended basing the ABCs on the harvest rate associated with Tier 3, the stock's Tier 1 classification notwithstanding. The Team recommends continuing this approach for setting the 2017 and 2018 ABCs, giving values of 2.800 million t and 2.979 million t, respectively.

The OFL harvest ratio under Tier 1a is 0.526, 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 2017 determines the OFL for 2017, which is 3.640 million t. The current projection for OFL in 2018 given a projected 2017 catch of 1.350 million t is 4.360 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

An appendix to the SAFE chapter describes a multi-species model 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. Both the multi-species model and the assessment model in the main text estimate increases in spawning biomass between 2015 and 2016. Differences between the two models include the following: 1) The multi-species model estimates a decline in age 1 recruitment between 2015 and 2016 due to anomalously high predation mortality in 2015-2016 (the highest during the estimated time series), but the assessment model in the main text does not. 2) The multi-species model estimates a slight decline in total biomass between 2015 and 2016, but the assessment model in the main text does not.

Several of the concerns listed by the authors in support of their ABC recommendation involve ecosystem considerations, specifically:

- The conditions in summer 2016 were the warmest recorded over the period 1982-2016; additional precaution may be warranted since warm conditions are thought to negatively affect the survival of larval and juvenile pollock.
- The multi-species model suggests that the B_{MSY} level is around 3.6 million t instead of the ~2 million t estimated in the current assessment (noting that the total natural mortality is higher in the multi-species model).

- The euphausiid index decreased from the 2014 estimates and has declined since the 2009 peak. This may negatively affect survival rates of juvenile pollock prior to recruiting to the fishery.
- Pollock are an important prey species for the ecosystem; there's been a 12% decline in St. Paul Island pup production from 2014-2016 which, when combined with information on the other fur seal population components (Bogoslof and St. George Islands), indicates an estimated 2.5% decline in the overall Eastern Stock fur seal population. Maintaining prey availability may provide better foraging opportunities for the fur seal stock to reduce further declines.

Aleutian Islands pollock

Changes from previous assessment

The new data in the model consist of updated catch information, the 2016 AI bottom trawl survey biomass estimate, and the 2014 AI bottom trawl survey age composition. There were no changes to the assessment model.

Spawning biomass and stock trends

This year's assessment estimates that spawning biomass reached a minimum level of about $B_{30\%}$ in 1999 and then has generally increased, with a projected value of $B_{38\%}$ for 2017. The increase in spawning biomass since 1999 has resulted more from a dramatic decrease in harvest than from good recruitment, as there have been no above-average year classes spawned since 1989. Spawning biomass for 2017 is projected to be 77,579 t.

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 $B_{40\%}$ at a value of 81,240 t, placing the AI pollock stock in sub-tier "b" of Tier 3. The model estimates the values of $F_{35\%}$ as 0.42 and $F_{40\%}$ as 0.33. Under Tier 3b, with the adjusted $F_{40\%}$=0.30, the maximum permissible ABC is 36,061 t for 2017. The Team recommends setting the 2017 ABC at this level. Following the Tier 3b formula with the adjusted $F_{35\%}$=0.38, OFL for 2017 is 43,650 t. If the 2016 catch is 1,500 t and 1,157 for 2017 (i.e., equal to the five year average for 2011-2015), the 2018 maximum permissible ABC would be 40,788 t and the 2018 OFL would be 49,291t. The Team recommends setting 2018 the 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 2015 and 2016 were updated and the 2016 acoustic-trawl survey biomass estimate and preliminary 2016 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.

Spawning biomass and stock trends

NMFS acoustic-trawl survey biomass estimates are the primary data source used in this assessment. Between 2000 and 2014, the values varied between 292,000 t and 67,000 t. The most recent acoustic-trawl survey of the Bogoslof spawning stock was conducted in March of 2016 and resulted in a biomass estimate of 506,228 t. The random-effects method of survey averaging resulted in 434,760 t, compared to the 2016 point estimate of 506,228 t. The degree of uncertainty in the estimate increases going forward and is fairly substantial. As an alternative method, the three-survey average approach gives an estimate of 228,000 t from which to make the Tier 5 calculations.

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. Given the large degree of uncertainty in the 2016 survey estimate, and the fact that the next survey is scheduled for 2018, the assessment authors and the Team recommend using the biomass estimate based on the average of the three most recent surveys (228,000 t) for ABC.

The maximum permissible ABC value for 2017 is 97,428 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 2017 = 228,000 x M x 0.75 = 51,300 t. The recommended ABC for 2018 is the same. The recommended ABC for 2017 is close to what would be obtained from a two-year stair-step (60,800 t).

The OFL was calculated using the random effects estimate for the survey biomass. Following the Tier 5 formula with M=0.3, OFL for 2017 is 130,428 t. The OFL for 2018 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. 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 recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Age 0+ biomass	OFL	ABC	TAC*	Catch
Eastern Bering Sea	2015	1,680,000	346,000	255,000	240,000	224,825
	2016	1,830,000	390,000	255,000	238,680	210,110
	2017	1,260,000	284,000	239,000	n/a	n/a
	2018	1,110,000	302,000	255,000	n/a	n/a
Aleutian Islands	2015	68,900**	23,400	17,600	9,422	9,064
	2016	68,900**	23,400	17,600	12,836	12,357
	2017	79,600**	28,700	21,500	n/a	n/a
	2018	79,600**	28,700	21,500	n/a	n/a

*In 2015 and 2016, 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 is set equal to 3% of the BSAI ABC in 2015 and 6.4% of the Bering Sea ABC and 27% for the AI ABC in 2016. Catch includes only that which accrues to the Federal TAC.

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

Eastern Bering Sea Pacific cod

Changes from previous assessment

Substantive changes have been made in the EBS Pacific cod assessment.

1. Catch data for 1991-2015 were updated, and preliminary catch data for 2016 were incorporated.
2. Commercial fishery size composition data for 2015 were updated, and preliminary size composition data from the 2016 commercial fisheries were incorporated.
3. Size composition data from the 2016 EBS shelf bottom trawl survey were incorporated.
4. The numeric abundance estimate from the 2016 EBS shelf bottom trawl survey was incorporated (the 2016 estimate of 640 million fish was down about 35% from the 2015 estimate).
5. Age composition data from the 2015 EBS shelf bottom trawl survey were incorporated.

Additionally, many changes were made or considered in the stock assessment model since the 2015 assessment (Thompson 2015). Six models were presented in this year's preliminary assessment (Appendix 2.1), as requested in May and June by the Joint Team Subcommittee on Pacific Cod Models and the SSC. After reviewing the preliminary assessment, the BSAI Plan Team and SSC requested that two models from the preliminary assessment (one of which is the base model that has been used for setting harvest specifications since the 2011 assessment) and four new models be presented in the final assessment. Changes to the model presented here for use in setting harvest specifications for 2017 and 2018 include elimination of intra-annual seasons, collapsing all gear types into a single fishery, internal estimation of the natural mortality rate and trawl survey catchability, forcing the fishery and survey selectivity schedules to be asymptotic, and removal of all time variability from both fishery and survey selectivity.

Spawning biomass and stock trends

Survey abundance in 2016 (944,621 t) was down by 35% from 2015 (1,102,261 t) and biomass in 2016 was 14% less than in 2014 (1,079,712 t). As estimated in the present model, spawning biomass is well above $B_{40\%}$ and has been increasing since 2010 due to a number of strong year-classes beginning in 2006. However, spawning biomass is projected to begin declining again in the near future.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

This stock is assigned to Tier 3a. The maximum 2017 ABC in this tier as calculated using the present model fit is 239,000 t, and the author and Team recommend that the ABC be the same. The Team recommends an ABC of 255,000 t for the preliminary 2018 ABC. The 2017 OFL from this new model is 284,000 t, which is less than the projected OFL from the previous assessment. The 2018 projected OFL is 302,000 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 cod since 2013, and managed separately since 2014. The stock has been managed under Tier 5 since it was first assessed separately. Both age-structured (Tier 3) and survey-based (Tier 5) assessments have been considered, and a CIE review from February 16-19, 2016 provided many useful comments. One Tier 5 model and five age-structured models were presented in the 2016 preliminary assessment, but after review, both the Plan Team and the SSC recommended that the analyst spend time developing age-structured models for the Bering Sea Pacific cod stock and revisit alternate approaches for this assessment in the future while retaining the status quo Tier 5 assessment for 2017. Therefore, no changes were made to assessment methodology.

A random effects model of the trawl survey biomass trajectory was used to estimate the biomass and provide management advice. Changes to the input data included updating the biomass estimate from the 2016 AI bottom trawl survey, updating the catch data for 1991-2015, and including preliminary catch data for 2016.

Spawning biomass and stock trends

After declining by more than half between 1991 and 2002, survey biomass has since stayed in the range of 50-100 kilotons. The 2016 Aleutians survey biomass estimate (84,409 t) was up about 15% from the 2014 estimate (73,608 t).

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The analyst and Plan Team recommend using the Tier 5 assessment again for 2017: ABC=21,500 t, OFL=28,700 t. These are greater than last year because the 2016 Aleutian Islands trawl survey estimate increased in 2016 and because the estimate of the natural mortality rate increased from 0.34 to 036.

Status determination

This stock 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.

3. Sablefish

Status and catch specifications (t) of sablefish in recent years. Biomass for each future 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 recommended by the Plan Team. The ABC is lower than the maximum ABC because it incorporates the authors' estimates of whale depredation. Catch data are current through November 5, 2016.

Area	Year	Age 4+ Biomass	OFL	ABC	TAC	Catch
Bering Sea	2015	34,000	1,574	1,333	1,333	210
	2016	25,000	1,304	1,151	1,151	518
	2017	24,000	1,551	1,274	n/a	n/a
	2018	24,000	1,572	1,291	n/a	n/a
Aleutian Islands	2015	24,000	2,128	1,802	1,802	430
	2016	23,000	1,766	1,557	1,557	349
	2017	43,000	2,101	1,735	n/a	n/a
	2018	44,000	2,129	1,758	n/a	n/a

Changes from previous assessment

Relative to last year's assessment, the following substantive changes in the current assessment were made.

Changes in the input data:

New data included in the assessment model were relative abundance and length data from the 2016 longline survey, relative abundance and length data from the 2015 longline fishery, length data from the 2015 trawl fisheries, age data from the 2015 longline survey and 2015 fixed gear fishery, updated catch for 2015, and projected 2016 - 2018 catches. In addition to these usual new data updates, the following substantive new changes were made to the data inputs:

1) New analytical variance calculations for the domestic longline survey abundance index
2) New area sizes for the domestic longline survey abundance index
3) Domestic longline survey estimates corrected for sperm whale depredation
4) Estimates of killer and sperm whale depredation in the fishery

Changes in the assessment methodology:

The 2016 Center for Independent Experts (CIE) review panel had several recommendations to improve aspects of the model that has been used since 2010. The 2010 model (10.3) and seven alternatives that sequentially address some of the key recommendations made by the panel were presented. The first five alternative models address the data inputs described above. The authors consider the first two of these alternatives to be minor model changes (incorporating the area sizes and variance estimates for the domestic longline survey). The next three models incorporate corrections of the domestic longline survey and longline fishery for whale depredation, which the authors consider to be a benchmark change that was recommended by the CIE.

The final two models address the CIE panel's concern that the model provided "overly precise" estimates of management quantities. These models reweight the abundance indices relative to obtaining a standard deviation of normalized residuals of one for the domestic longline survey abundance index, while maintaining a value of one for the previously tuned age and length compositions. These two models increase the uncertainty around estimates of spawning biomass and other key management results. Finally, the recommended model estimates natural mortality with a prior distribution, which further propagates uncertainty. In addition, the recommended model has the best retrospective performance of all models considered.

Spawning biomass and stock trends

Projected 2017 spawning biomass is 35% of unfished spawning biomass. The longline survey abundance index increased 34% from 2015 to 2016 following a 21% decrease from 2014 to 2015 which was the lowest point of the time series. The fishery abundance index decreased 12% from 2014 to 2015 and is the time series low (the 2016 data are not available yet). There was no Gulf of Alaska (GOA) trawl survey in 2016. Spawning biomass is projected to decrease slightly from 2017 to 2019, and then stabilize.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Sablefish are managed under Tier 3 of NPFMC harvest rules. Reference points are calculated using recruitments from 1977-2013. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from this assessment are 105,836 t (combined across the EBS, AI, and GOA), 0.094, and 0.113, respectively. Projected female spawning biomass (combined areas) for 2017 is 91,553 t (87% of $B_{40\%}$, or $B_{35\%}$), placing sablefish in sub-tier "b" of Tier 3. The maximum permissible value of FABC under Tier 3b is 0.081, which translates into a 2017 ABC (combined areas) of 13,509 t. The OFL fishing mortality rate is 0.097 which translates into a 2017 OFL (combined areas) of 15,931 t.

Area apportionment

Apportionments have been held constant since 2013. The Teams recommend retaining these apportionments for another year while alternative strategies undergo evaluation.

Status determination

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

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 2017 and 2018 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Age 6+ Biomass	OFL	ABC	TAC	Catch
BSAI	2015	2,127,800	266,400	248,800	149,000	126,937
	2016	2,170,000	228,100	211,700	144,000	128,236
	2017	2,290,100	287,000	260,800	n/a	n/a
	2018	2,202,300	276,000	250,800	n/a	n/a

The Flatfish Flexibility Exchange Program increased the TAC from 149,000 t to 159,998 t in 2015 and from 144,000 t to 154,278 t in 2016.

Changes from previous assessment

Changes to the input data include:

- 2015 fishery age composition
- 2015 survey age composition
- 2016 trawl survey biomass point estimate and standard error
- Estimate of the discarded and retained portions of the 2015 catch
- Estimate of total catch made through the end of 2016. Catch of 150,000 t assumed for 2017 and 2018 projection

Changes to the assessment methodology:

Changes were made to the fishery weight-at-age where the average of the fishery aged samples from 2008-2014 were used for 2008-2016, replacing previous values that were time-invariant.

Spawning biomass and stock trends

The projected female spawning biomass estimate for 2017 is 778,600 t, which is 1.8×B_{MSY}. This is an 11% increase from last year's 2016 estimate (702,200 t). Although there was an increase in projected spawning biomass for 2017, the overall trend has been a general decline that has prevailed since 1993, with some indication of stabilizing over the past few years. The total stock biomass has slowly declined over most of the past 30 years.

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 424,000 t, and projected spawning biomass for 2017 is 778,600 t, meaning that yellowfin sole qualify for management under Tier 1a. Corresponding to the approach used in recent years, the 1978-2010 age 1 recruitments (and corresponding spawning biomasses) were used this year to determine the Tier 1 harvest recommendation. This provided a maximum permissible ABC harvest ratio (the harmonic mean of the F_{MSY} harvest ratio) of 0.114. The current value of the OFL harvest ratio (the arithmetic mean of the F_{MSY} ratio) is 0.125. The product of the maximum permissible ABC harvest ratio and the geometric mean of the 2017 biomass estimate produced the 2017 ABC of 260,800 t recommended by the author and Team, and the corresponding product using the OFL harvest ratio produces the 2017 OFL of 287,000 t. For 2018, the corresponding quantities are 250,800 t and 276,000 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 2017 and 2018 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Age 1+ Biomass	OFL	ABC	TAC	Catch
BSAI	2015	122,298	3,903	3,172	2,648	2,204
	2016	114,438	4,194	3,462	2,873	2,105
	2017	121,804	11,615	9,825	n/a	n/a
	2018	122,032	12,831	10,864	n/a	n/a
Eastern Bering Sea	2015	n/a	n/a	2,448	2,448	2,090
	2016	n/a	n/a	2,673	2,673	2,084
	2017	n/a	n/a	8,577	n/a	n/a
	2018	n/a	n/a	9,484	n/a	n/a
Aleutian Islands	2015	n/a	n/a	724	200	114
	2016	n/a	n/a	789	200	121
	2017	n/a	n/a	1,248	n/a	n/a
	2018	n/a	n/a	1,380	n/a	n/a

Changes from previous assessment

Changes to the input data include:

- Updated 2015 and projected 2016 catch data
- 2016 EBS shelf trawl survey estimates
- 2016 EBS slope trawl survey estimates
- 2016 ABL longline survey estimates
- 2016 EBS shelf survey, slope survey, and ABL longline length composition estimates

- 2015 EBS shelf survey age composition
- Updated fishery catch-at-length data for 2016

Changes to the assessment methodology:

There were no changes made to the base model which has the same configuration as model 15.1 from 2015 except the addition of catch and size composition data from both the longline and trawl fisheries for 2016 as well as the addition of the 2016 Slope trawl survey index value and size composition data.

The author's and Plan Team's accepted model (16.4) had a number of modifications from the base model:

- To better fit the size composition data, the size bins for males and females were combined for composition lengths shorter than 52 cm.
- Residuals for the 2012 and 2016 Slope survey composition data remained problematic. In addition, longline fishery data had substantial residual patterns with overestimates of larger fish than what was observed. To better fit these data a new block was created for 2011 through 2016 for the Slope survey species composition data and the longline fishery data were allowed to be dome-shaped.
- To simplify data conflicts, the ABL longline size composition data were removed. These data were aggregated by sex and fit poorly, likely due to the high degree of sexual dimorphism found in this species (bimodal size distribution when aggregated).

Spawning biomass and stock trends

The projected 2017 female spawning biomass is 50,461 t, which is a 63% increase from last year's 2016 estimate of 31,028 t. Female spawning biomass is projected to increase to 55,347 t in 2018. The effects of the incoming 2007-2009 year classes are creating a steep increase 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. Projections for 2017 and onward predict an increase in spawning biomass as these year classes grow and mature.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The B40% value using the mean recruitment estimated for the period 1978-2014 gives a long-term average female spawning biomass of 41,239 t. The projected 2017 female spawning biomass was at 50,461 t or, well above the estimate of B40% (41,239 t). Because the projected spawning biomass in year 2017 is above B40%, Greenland turbot ABC and OFL levels will be determined at Tier 3a of Amendment 56. The maximum permissible value of F_{ABC} under this tier translates into an OFL of 11,615 t for 2017 and 12,831 t for 2018 and a maximum permissible ABC of 9,825 t for 2017 and 10,864 t for 2018. These are the authors' and Team's OFL recommendations. The author recommended a more conservative maximum permissible ABC of 7,000 t for both 2017 and 2018 due to the likelihood that this stock will continue to have poor recruitment for the foreseeable future. The Team disagreed with the author's ABC choice as it was subjective and not supported by the model and recommended that the ABCs for 2017 and 2018 be set at maximum permissible.

Area apportionment

As in previous assessments, apportionment recommendations are 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 authors' and Team's recommended 2017 and 2018 ABCs in the EBS are 8,577 and 9,484 t. The 2017 and 2018 ABCs for the AI are 1,248 t and 1,380 t. Area apportionment of 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. 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 recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Age 1+ Bio	OFL	ABC	TAC	Catch
BSAI	2015	908,379	93,856	80,547	22,000	11,267
	2016	910,012	94,035	80,701	14,000	10,346
	2017	779,195	76,100	65,371	n/a	n/a
	2018	772,153	67,023	58,633	n/a	n/a

Changes from previous assessment

This is an "on-year" for the BSAI ATF. New survey information is incorporated into the assessment model for this assessment include:

2. Survey size compositions from the 2015 and 2016 Eastern Bering Sea shelf survey, 2016 Eastern Bering Sea slope survey, and 2016 Aleutian Islands survey.
3. Biomass point-estimates and standard errors from the 2015 and 2016 Eastern Bering Sea shelf surveys, 2016 Eastern Bering Sea slope survey, and 2016 Aleutian Islands survey.
4. Fishery size compositions for 2015 and 2016.
5. Estimates of catch through October 26, 2016.
6. Age data from the 1993, 1994, 2012, 2014, and 2015 Bering Sea shelf and 2014 Aleutian Islands surveys, as well as the 2012 Eastern Bering Sea slope survey.

Changes in the assessment methodology:

The age-structured assessment model is similar to the model used for the 2014 and 2015 assessments The 2016 model implemented the following changes based on Plan Team and SSC comments:

1. Survey biomass and composition data were reweighted.
2. A likelihood component was added to incorporate the 2012 slope survey age data.
3. The model uses an improved length-age conversion matrix that corrects for stratified sampling.

Spawning biomass and stock trends

The projected age 1+ total biomass for 2017 is 779,195 t, a decrease from the value of 920,920 t projected for 2017 in last year's assessment. The projected female spawning biomass for 2017 is 485,802 t which is a decrease from last year's 2017 estimate of 534,347 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 212,054 t and 0.129. The projected 2017 spawning biomass is above $B_{40\%}$, so ABC and OFL recommendations for 2017 were calculated under sub-tier "a" of Tier 3. The authors and Team recommend setting F_{ABC} at the $F_{40\%}$ level, which is the maximum permissible level under Tier 3a, resulting in 2017 and 2018 ABCs of 65,371 t and 58,633 t, respectively, and 2017 and 2018 OFLs of 76,100 t and 67,023 t.

Status determination

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

Ecosystem Considerations

In contrast to the Gulf of Alaska, 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. 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 recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Age 1+ Biomass	OFL	ABC	TAC	Catch
BSAI	2015	174,500	10,500	9,000	6,500	4,996
	2016	182,300	11,100	9,500	5,000	4,762
	2017	170,300	10,360	8,880	n/a	n/a
	2018	181,000	10,700	9,200	n/a	n/a

Changes from previous assessment

This assessment is a full update of the 2014 stock assessment. The 2015 assessment was an off-cycle assessment that did not re-run an updated assessment model; instead the projection model was run with updated catch information only to provide estimates of 2016 and 2017 ABC and OFL without re-estimating the stock assessment model parameters and biological reference points. The stock is estimated to be 19% above $B_{40\%}$ in both 2016 and 2017 and has been harvested at about half the ABC level the past 3 years.

Summary of changes in assessment input:

1) Estimate of catch for 2015 and 2016. The estimated 2016 catch of 4,530 t was used as the catch value for the 2017 and 2018 ABC and OFL projections.
2) 2016 slope survey biomass and standard error estimates.
3) 2015 and 2016 shelf survey length composition
4) 2015 and 2016 shelf survey biomass and standard error estimates.
5) 2015 Aleutian Islands survey biomass and standard error.
6) 2016 Aleutian Islands survey length composition.
7) 2016 slope survey length composition.

No changes were made to the assessment methodology.

Spawning biomass and stock trends

Kamchatka flounder has a widespread distribution along the deeper waters of the BSAI region. Spawning biomass increased continuously, at an average rate of about 5% per year, from the start of the model time series in 1991 to a peak of 62,963 t in 2009. Spawning biomasses from 2006 through 2014 have all been within 10% of the peak value. The 2000-2002, 2008-2010, and 2012 year classes are all estimated to be well above average, with the 2002, 2008, and 2010 year classes estimated to be at least twice average. Projected 2017 female spawning biomass is estimated at 60,300 t, above the $B_{40\%}$ level of 50,800 t, and is projected to remain above $B_{40\%}$.

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 2017 is above $B_{40\%}$, placing Kamchatka flounder in sub-tier “a” of Tier 3. For the 2017 fishery, the authors and Team recommend setting 2017 ABC at the maximum permissible value of 8,880 t from the projection model. This value is an increase of 25% over the 2016 ABC (7,100 t). The recommended 2017 OFL is 10,360 t, a 25% increase from 8,270 t for 2016.

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 2016 and 2017 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Age 6+ Biomass	OFL	ABC	TAC	Catch
BSAI	2015	1,233,400	187,600	181,700	69,250	45,467
	2016	1,085,200	165,900	161,100	57,100	44,873
	2017	1,000,600	159,700	155,100	n/a	n/a
	2018	923,200	147,300	143,100	n/a	n/a

The Flatfish Flexibility Exchange Program decreased the TAC from 69,250 t to 65,315 t in 2015 and from 57,100 t to 52,659 t in 2016.

Changes from previous assessment

The last full assessment was in November 2015, therefore changes to input data in this analysis include:

- Estimates of catch (t) and discards for 2015-2016
- 2015 fishery age composition
- 2015 survey age composition
- 2016 trawl survey biomass point estimates and standard errors

The chapter contains summaries for several assessment models. The Team recommends using Model 15.1, which is the model that has been used for the last several years.

Spawning biomass and stock trends

Spawning biomass was at a low in 2008, but has increased continuously since then. The 2001-2005 year classes are all estimated to be above average; however, the spawning biomass has peaked and is now projected to be declining. The stock assessment model projects a 2017 spawning biomass of 539,500 t. This was slightly more than the 2017 value projected in last year's assessment. The projected spawning biomass for 2018 is 472,200 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 2017 is projected to be well above the B_{MSY} estimate of 257,000, placing northern rock sole in sub-tier "a" of Tier 1. The Tier 1 2017 ABC harvest recommendation is 155,100 t (F_{ABC} = 0.155) and the 2017 OFL is 159,700 t (F_{OFL} = 0.160). The 2018 ABC and OFL values are 143,100 t and 147,300 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 of the northern rock sole stock.

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 2017 and 2018 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Age 3+ Biomass	OFL	ABC	TAC	Catch
BSAI	2015	736,947	79,419	66,130	24,250	11,307
	2016	737,777	79,562	66,250	21,000	9,655
	2017	747,557	81,654	68,278	n/a	n/a
	2018	758,543	79,136	66,164	n/a	n/a

The Flatfish Flexibility Exchange Program decreased the TAC from 24,250 t to 17,187 t in 2015 and 21,000 to 15,163 t in 2016.

Changes from previous assessment

This assessment was changed to a bi-ennial cycle beginning with the 2014 assessment; this is a full assessment year. Changes to the input data in this analysis include:

- 2016 catch biomass was added to the model
- 2015 catch biomass was updated to reflect October – December 2015 catches
- 2013-2015 fishery age composition data were added
- 2015-2016 fishery length composition data were added to the model.
- 2015-2016 Eastern Bering Sea (EBS) shelf survey biomass and 2016 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 1982-2016 based on updated linear regression results.
- 2015-2016 survey bottom temperatures were added to the model.
- 2014-2015 survey age composition data were added to the model.
- 2015-2016 survey length composition data were added to the model
- Estimates of the length-at-age, length-weight, and weight-at-age relationships, and the length-at-age transition matrices were updated by adding data from 2001 to 2015. Growth estimates therefore include data from 1985, 1992-1995, and 2000-2015.

Changes to the assessment methodology:

All age- and length-composition data were weighted using methods described in McAllister and Ianelli (1997) to approximate effective sample size for each year and data type. The harmonic mean over years was used to approximate the effective sample size for each data type and the assessment model was iteratively tuned such that input and effective sample sizes were approximately equal.

Spawning biomass and stock trends

Age 3+ biomass has declined slowly since the mid 1990's (20% overall), although spawning biomass has remained relatively stable over the same time period. Estimates for 2018 show continued declines are likely.

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 $B_{40\%}$=129,175 t, $F_{40\%}$=0.34, and $F_{35\%}$=0.41. Because projected spawning biomass for 2017 (223,469 t) is above $B_{40\%}$, flathead sole is in Tier 3a. The authors and Team recommend setting ABCs for 2017 and 2018 at the maximum permissible values under Tier 3a, which are 68,278 t and 66,164 t, respectively. The 2017 and 2018 OFLs under Tier 3a are 81,654 t and 79,136 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 2016 and 2017 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Age 3 + Biomass	OFL	ABC	TAC	Catch
BSAI	2015	471,500	54,000	44,900	18,500	14,614
	2016	468,100	49,000	41,000	14,500	12,957
	2017	412,600	42,800	36,000	n/a	n/a
	2018	407,300	36,900	32,100	n/a	n/a

Changes from previous assessment

This assessment was changed to a biennial cycle beginning with the 2013 assessment; 2015 was is an off-cycle year and only a projection model was run. The last full assessment was in November 2014. Changes to the input data in this full analysis include:

- Estimates of catch (t) and discards for 2015-2016
- 2015 and 2016 trawl survey biomass estimates and standard errors
- 2015 and 2016 survey length composition
- 2014 survey age composition
- 2013–2015 fishery length composition
- No modifications were made for this assessment methodology.

Spawning biomass and stock trends

Last year's assessment indicated that above average recruitment strength in 1998 and exceptionally strong recruitment in 2001 and 2002 have contributed to recent highs level of female spawning biomass. The spawning stock biomass is projected to decline as these year classes exit the population.

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 $B_{40\%}$ = 110,500 t, $F_{40\%}$ = 0.128, and $F_{35\%}$ = 0.154. Given that the projected 2017 spawning biomass of 186,300 t exceeds $B_{40\%}$, the ABC and OFL recommendations for 2017 were calculated under sub-tier "a" of Tier 3. Projected harvesting at the $F_{40\%}$ level gives a 2017 ABC of 36,000 t and a 2018 ABC of 32,100 t. The recommended Tier 3a OFLs are 42,800 t and 36,900 t for 2017 and 2018, 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 2016 and 2017 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Total Biomass	OFL	ABC	TAC	Catch
BSAI	2015	143,000	17,700	13,250	3,620	2,415
	2016	102,300	17,414	13,061	2,500	2,810
	2017	113,450	21,860	16,395	n/a	n/a
	2018	113,450	21,860	16,395	n/a	n/a

In 2016, the other flatfish TAC increased to 2,862 t after a reallocation of 362 t from the non-specified reserves.

Changes from previous assessment

The assessment incorporates 2015 and 2016 total and discarded catch and 2016 EBS shelf trawl survey biomass, 2016 AI trawl survey biomass, and 2016 EBS slope trawl survey biomass. 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. The EBS and AI survey estimate for 2016 was 113,450 t, about 10% above that of last year. Starry flounder, rex sole, and butter sole comprise the majority of the fishery catch with a negligible amount of other species caught in recent years. Starry flounder continues to dominate the shelf survey biomass in the EBS.

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. Projected harvesting at the 0.75 M level (biomass-weighted) average F_{ABC} = 0.117) gives a 2016 ABC of 16,395 t for the “other flatfish” complex. The corresponding 2016 OFL (average F_{OFL} = 0.155) is 21,860 t.

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 2017 and 2018 are those recommended by the Team. Catch data are current through November 5, 2016.

Area	Year	Age 3+ Bio	OFL	ABC	TAC	Catch
BSAI	2015	577,967	42,558	34,988	32,021	31,425
	2016	557,886	40,529	33,320	31,900	30,408
	2017	767,767	53,152	43,723	n/a	n/a
	2018	753,302	51,950	42,735	n/a	n/a
Eastern Bering Sea	2015	n/a	n/a	8,771	8,021	7,918
	2016	n/a	n/a	8,353	8,000	7,186
	2017	n/a	n/a	11,789	n/a	n/a
	2018	n/a	n/a	11,523	n/a	n/a
Eastern Aleutian Islands	2015	n/a	n/a	8,312	8,000	7,865
	2016	n/a	n/a	7,916	7,569	7,569
	2017	n/a	n/a	10,441	n/a	n/a
	2018	n/a	n/a	10,205	n/a	n/a
Central Aleutian Islands	2015	n/a	n/a	7,723	7,000	6,834
	2016	n/a	n/a	7,355	7,000	6,765
	2017	n/a	n/a	8,113	n/a	n/a
	2018	n/a	n/a	7,930	n/a	n/a
Western Aleutian Islands	2015	n/a	n/a	10,182	9,000	8,808
	2016	n/a	n/a	9,696	9,000	8,888
	2017	n/a	n/a	13,380	n/a	n/a
	2018	n/a	n/a	13,077	n/a	n/a

Changes from previous assessment

This chapter is a full assessment and the authors recommended several important changes to the data and model. The POP assessment had included a fishery CPUE index for the years 1968 - 1977. This index has been removed. The EBS slope survey and associated compositions are now included in the recommended model. This follows requests made by the Team and the SSC. Updated data included catch for 2015, estimated catches for 2016 - 2018, 2016 survey biomass estimates for the AI and EBS Slope, and recent age and length compositions. The authors also recommended a new way to weight the compositional data.

Spawning biomass and stock trends

The survey biomass estimates in the Aleutian Islands were high in 2016, which followed two previous high survey biomass estimates in 2012 and 2014. These continued high survey biomass estimates have contributed to a substantial increase in estimated stock size in recent years. Spawning biomass is projected to be 314,489 t in 2017 and to decline to 307,808 t 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 POP for management under Tier 3. The current estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ are 214,685 t, 0.082, and 0.101, respectively. Spawning biomass for 2017 (314,489 t) is projected to exceed $B_{40\%}$, thereby placing POP in sub-tier “a” of Tier 3. The 2017 and 2018 catches associated with the $F_{40\%}$ level of 0.082 are 43,723 t and 42,735 t, respectively, and are the authors’ and Team’s recommended ABCs. The 2017 and 2018 OFLs are 53,152 t and 51,950 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 2017): EBS = 11,789 t, Eastern Aleutians (Area 541) = 10,441 t, Central Aleutians (Area 542) = 8,113 t, and Western Aleutians (Area 543) = 13,380 t. The recommended OFLs for 2017 and 2018 are not regionally apportioned.

Status determination

Pacific ocean perch 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 2017 and 2018 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Age 3+ Biomass	OFL	ABC	TAC	Catch
BSAI	2015	218,901	15,337	12,488	3,250*	7,197
	2016	213,674	14,689	11,960	4,500	4,532
	2017	248,160	16,242	13,264	n/a	n/a
	2018	245,693	15,584	12,947	n/a	n/a

*In 2015, the northern rockfish TAC increased to 7,263 t after a reallocation of 4,013 t from the non-specified reserves.

Changes from previous assessment

This chapter is a full assessment and the authors explored several different alternative models. Updated data included catch for 2015, estimated catches for 2016 - 2018, a new survey biomass estimate from the AI, and recent age and length compositions. The authors recommended a new approach to weighting the compositional data.

Spawning biomass and stock trends

Survey biomass was sharply down in 2016, but was down from a high biomass estimate in 2014. Spawning biomass has been increasing slowly and almost continuously since 1977 until recent years, when it appears to be leveling off. Female spawning biomass is projected to be 107,660 t and 106,184 t in 2017 and 2018, respectively. Recent recruitment has generally been below average with few large year classes since 1998.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that this stock qualifies for management under Tier 3 due to the availability of reliable estimates for $B_{40\%}$ (65,870 t), $F_{40\%}$ (0.065), and $F_{35\%}$ (0.080). Because the projected female spawning biomass of 107,660 t is greater than $B_{40\%}$, sub-tier "a" is applicable, with maximum permissible $F_{ABC} = F_{40\%}$ and $F_{OFL} = F_{35\%}$. Under Tier 3a, the maximum permissible ABC for 2017 is 13,264 t, which is the authors' and Team's recommendation for the 2017 ABC. Under Tier 3a, the 2017 OFL is 16,242 t for the Bering Sea/Aleutian Islands combined. The Team continues to recommend setting a combined BSAI OFL and ABC. The Team recommendation for 2017 ABC is 13,264 t and the 2017 OFL is 16,242 t.

Status determination

Northern rockfish 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 2017 and 2018 are those recommended by the Team. Catch data are current through November 5, 2016.

Area/subarea	Year	Total Biomass (t)*	OFL	ABC	TAC	Catch
BSAI	2015	41,730	560	453	349	180
	2016	43,944	693	561	300	157
	2017	35,669	612	501	n/a	n/a
	2018	37,474	750	614	n/a	n/a
Western/Central	2015			304	200	117
Aleutian Islands	2016			382	200	87
	2017			207	n/a	n/a
	2018			252	n/a	n/a
Eastern AI/	2015			149	149	64
Eastern Bering Sea	2016			179	100	70
	2017			294	n/a	n/a
	2018			362	n/a	n/a

*For 2015-16, the total biomass is from the AI age-structured model, and survey biomass estimates from EBS. For 2017-2018, the total biomass is from a BSAI age-structured model.

Changes from previous assessment

This chapter is a full assessment and the author recommends that Tier 3 age-structured model be applied to the BSAI whereas previously the model was only used for the AI portion of the assessment. The new model includes the EBS Slope survey and associated age and length composition data. This follows requests made by the Team and the SSC. New data included updated catch for 2015, estimated catches for 2016 - 2018, a 2016 survey biomass estimate for the AI, and recent length and age composition data. Because some stations could not be surveyed in the 2016 EBS slope survey, the assessment utilizes previous slope surveys, through 2012.

Spawning biomass and stock trends

Spawning biomass for BSAI blackspotted/rougheye rockfish in 2017 is projected to be 7,305 t and is projected to increase. This increasing trend is supported by evidence of several large recruitments in the 2000s. The most recent survey in the AI (2016) increased substantially from the low estimate in 2014.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

For the BSAI, this stock qualifies for management under Tier 3 due to the availability of reliable estimates for $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$. Because the projected female spawning biomass for 2017 of 7,305 t is less than $B_{40\%}$, (8,311 t) the stock qualifies as Tier 3b and the adjusted $F_{ABC} = F_{40\%}$ values for 2017 and 2018 are 0.039 and 0.044, respectively. The maximum permissible ABC for the Aleutian Islands is 501 t, which is the authors' and Team's recommendation for the AI portion of the 2017 ABC. The apportionment of 2017 ABC to subareas is 207 t for the Western and Central Aleutian Islands and 294 t for the Eastern Aleutian Islands and Eastern Bering Sea. The Team recommends an overall 2017 ABC of 501 t and a 2017 OFL of 612 t.

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 be calculated and presented. The maximum subarea species catch (MSSC) levels within the WAI/CAI, based on the random effects model, are as follows:

	WAI	CAI
MSSC (2017)	31	176
MSSC (2018)	37	215

Status determination

The blackspotted and rougheye rockfish complex is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

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 2017 and 2018 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Survey Biomass	OFL	ABC	TAC	Catch
BSAI	2015	23,009	690	518	250	153
	2016	23,009	690	518	200	103
	2017	22,191	666	499	n/a	n/a
	2018	22,191	666	499	n/a	n/a

Changes from previous assessment

2016 is a full assessment for this Tier 5 stock; there were no changes in the assessment methodology. New data included updated catch from 2015, estimated catch for 2016 and the biomass estimates from the 2016 Aleutian Islands and Eastern Bering Sea slope surveys were added to the model.

The 2017 biomass estimate is based on the Aleutian Island survey data through 2016 as well as the 2002-2012, and 2016 eastern Bering Sea slope survey data. The 2014 eastern Bering Sea slope survey was cancelled. Prior to 2012, the EBS slope survey data had not been included in previous biomass estimates for this species.

Spawning biomass and stock trends

Estimated shortraker rockfish biomass in the BSAI has been relatively stable since 2002. Biomass estimates have decreased slightly from 23,009 t in the 2014 assessment to 22,191 t in the current assessment. For the period 2002-2016, EBS slope survey biomass estimates ranged from a low of 2,570 t in 2004 to a high of 9,299 t in 2012 with CVs at 0.22 and 0.57, respectively. For the period 1991-2016, the AI survey biomass estimates ranged from a low of 12,961 t in 2006 to a high of 38,487 t in 1997 with CVs at 0.23 and 0.26, respectively. According to the random effects model, total biomass (AI and EBS slope combined) from 2002-2016 has been very stable, ranging from a low of 21,214 t in 2006 to a high of 23,990 t in 2002. 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.

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 499 t for 2017 and 2018 and the OFL is 666 t for 2017 and 2018.

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 2017 and 2018 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Survey Biomass	OFL	ABC	TAC	Catch
BSAI	2015	49,630	1,667	1,250	880	686
	2016	49,630	1,667	1,250	875	791
	2017	55,353	1,816	1,362	n/a	n/a
	2018	55,353	1,816	1,362	n/a	n/a
Eastern Bering Sea	2015	n/a	n/a	695	325	185
	2016	n/a	n/a	695	325	278
	2017	n/a	n/a	791	n/a	n/a
	2018	n/a	n/a	791	n/a	n/a
Aleutian Islands	2015	n/a	n/a	555	555	501
	2016	n/a	n/a	555	555	513
	2017	n/a	n/a	571	n/a	n/a
	2018	n/a	n/a	571	n/a	n/a

Changes from previous assessment

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

- Catch and fishery length data updated through October 2016
- Biomass estimates, catch per unit effort (CPUE), and length frequency compositions were included from the 2016 AI trawl survey, the 2016 EBS slope survey, and the 2015 and 2016 EBS shelf surveys.

There were no changes to the assessment methodology.

Spawning biomass and stock trends

This is a Tier 5 complex, thus trends in spawning biomass *per se* are unknown. However, the random effects biomass estimates for the short-spined thornyhead (SST) in the Aleutian Islands and EBS slope have been increasing. The non-SST portion of the complex also appears to be increasing, but only in the Aleutian Islands. Biomass estimates are often 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 other rockfish species in the "other rockfish" complex yields 2017 and 2018 ABCs of 791 t in the EBS and 571 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 1,816 t for 2017 and 2018.

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 2017 and 2018 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Age 1+ Biomass	OFL	ABC	TAC	Catch
BSAI	2015	694,421	125,297	106,000	54,500	53,265
	2016	672,184	104.749	90,340	55,000	54,293
	2017	598,791	102,700	87,200	n/a	n/a
	2018	611,442	99,900	85,000	n/a	n/a
E Aleutian Islands / EBS	2015	n/a	n/a	38,493	27,000	26,344
	2016	n/a	n/a	30,832	28,500	28,168
	2017	n/a	n/a	34,890	n/a	n/a
	2018	n/a	n/a	34,000	n/a	n/a
Central Aleutian Islands	2015	n/a	n/a	33,108	17,000	16,672
	2016	n/a	n/a	27,216	16,000	15,795
	2017	n/a	n/a	30,330	n/a	n/a
	2018	n/a	n/a	29,600	n/a	n/a
Western Aleutian Islands	2015	n/a	n/a	34,400	10,500	10,253
	2016	n/a	n/a	32,292	10,500	10,330
	2017	n/a	n/a	21,980	n/a	n/a
	2018	n/a	n/a	21,400	n/a	n/a

Changes from previous assessment

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

- Total 2015 year-end catch was updated, and the projected total catch for 2016 was set equal to the 2016 TAC.
- The 2015 fishery age composition data were added.
- The biomass estimate from the 2016 AI bottom trawl survey was added.

Methodological changes included the following:

- In the assessment model: Input sample sizes for compositional data were set proportional to the number of sampled hauls containing Atka mackerel, rather than the number of sampled Atka mackerel. The average sample sizes (across years) were held constant at the values used in last year's assessment, however.
- In the projection model:
    - The selectivity schedule used for projections was equal to the average of the most recent five years for which model estimates are available, rather than the most recent five years (with the current year set equal to the previous year).
    - Catches for 2017 and 2018 were assumed to equal 62% of the BSAI-wide ABC, based on an analysis of the effect of the revised Steller Sea Lion Reasonable and Prudent Alternatives that were implemented in 2015, rather than the 80% rate that was used in last year's assessment.

Spawning biomass and stock trends

Spawning biomass reached an all-time high in 2005, then decreased continuously through 2016 (a decline of 56%), and is projected to decrease further, at least through 2018. The 1998-2001 year classes were all very strong, but since then, the 2006 and 2007 year classes were the only ones that were above average. In particular, the 2011year class, which was estimated to be above average in last year's assessment, is now estimated to be below average. However, the projected female spawning biomass for 2017 (145,258 t) is still above $B_{40\%}$ (125,288 t), and the stock is projected to remain above $B_{40\%}$ through the next several years.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The projected female spawning biomass under the recommended harvest strategy is estimated to be above $B_{40\%}$, thereby placing BSAI Atka mackerel in Tier 3a. The projected 2017 yield (ABC) at $F_{40\%}$ = 0.34 is 87,200 t, down 3% from the 2016 ABC and up 2% from last year's projected ABC for 2017. The projected 2017 overfishing level at $F_{35\%}$ = 0.40 is 102,700 t, down 2% from the 2016 OFL and up 3% from last year's projected OFL for 2017.

Area apportionment

As in last year's assessment, the standard Tier 5 random effects model was used to apportion the ABC among areas. The recommended ABC apportionments by subarea for 2017 are 34,890 t for Area 541 and the southern Bering Sea region (a 13 % increase), 30,330 t for Area 542 (and 11 percent increase), and 21,980 t for Area 543 (a 32 % decrease from the 2016 level of 32,292).

Status determination

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

Ecosystem Considerations

Temperature may affect recruitment of Atka mackerel and availability to the bottom trawl survey.

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 continued declines, particularly 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 2017 and 2018 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Age 0+ Biomass	OFL	ABC	TAC	Catch
BSAI	2015	625,314	49,575	35,551	25,700	28,125
	2016	631,614	50,215	42,134	26,000	25,624
	2017	605,617	49,063	41,144	n/a	n/a
	2018	577,276	46,583	39,008	n/a	n/a

For 2016, NMFS increased the TAC to 27,100 t with a reallocation of 1,100 t from the non-specified reserves.

Changes from previous assessment

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

- Total 2015 year-end catch was updated and incomplete 2016 catches are provided.
- New biomass estimates from the 2016 eastern Bering Sea (EBS) shelf, EBS slope and Aleutian Islands bottom trawl surveys have been added.
- The Alaska skate model now incorporates EBS shelf survey biomass estimates through 2016, EBS shelf size composition through 2016, fishery length compositions through 2015, catch data through 2016, and an additional length-at-age dataset from vertebrae collected during 2015 on the EBS shelf trawl survey.

Methodological changes included the following:

- There were no changes to the assessment methodology. Model 14.2, accepted in 2014, continues to be the author's preferred model. Model 14.2 was updated to include new catch and survey data as well as a new length-at-age dataset.
- The random effects model continues to be used for estimating biomass for the "other skates" group, and was updated to include 2015 and 2016 survey biomass estimates.

Spawning biomass and stock trends

The results of the Alaska skate model were similar to those presented in 2014. Although the 2016 EBS shelf survey biomass estimate was substantially higher than in 2014, the model predicted a slight decline in spawning biomass. Total skate biomass increased on the EBS shelf after 2014, while it declined in the Aleutian Islands. Total skate biomass on the EBS slope was slightly lower in 2016 relative to 2012.

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 2017 (108,926 t) exceeds $B_{40\%}$ (72,222 t), Alaska skates are managed in sub-tier "a" of Tier 3. Other reference points are $maxF_{ABC} = F_{40\%} = 0.079$ and $F_{OFL} = F_{35\%} = 0.092$. The Alaska skate portions of the 2017 and 2018 ABCs are 33,634 t and 31,498 t, respectively, and the Alaska skate portions of the 2016 and 2017 OFLs are 39,050 t and 36,570 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 2017 and 2018 ABCs is 7,510 t for both years and the "other skates" portion of the 2017 and 2018 OFLs is 10,013 t for both years.

For the skate complex as a whole, OFLs for 2017 and 2018 total 49,063 t and 46,583 t, respectively, and ABCs for 2017 and 2018 total 41,144 t and 39,008 t, respectively.

Status determination

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

19. Sculpins

Status and catch specifications (t) of sculpins in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2017 and 2018 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	*2015	180,570	52,365	39,725	4,700*	4,981
	2016	180,570	52,365	39,725	4,500	4,476
	2017	199,937	56,582	42,387	n/a	n/a
	2018	199,937	56,582	42,387	n/a	n/a

*For 2015, NMFS increased the BSAI TAC to 4,795 t with a reallocation of 95 t from the non-specified reserves.

Changes from previous assessment

2016 is a full assessment for this Tier 5 stock. The assessment methodology to determine sculpin complex exploitable biomass has changed from an average of the last three survey year's biomass estimate to a random effects model for each region to calculate the biomass estimate for the entire BSAI area. Biomass estimates and length compositions were included from the 2016 Aleutian Island trawl and eastern Bering Sea slope survey, and the 2015 and 2016 eastern Bering Sea shelf survey.

Spawning biomass and stock trends

Although no great sculpin (*Myoxocephalus polyacanthocephalus*) were caught on the 2016 eastern Bering Sea slope survey, biomass estimates derived from the random effects model for 6 of the most abundant sculpin species on the EBS shelf seem to be relatively stable and comprise 95% of the total sculpin biomass. EBS slope trawl surveys, conducted since 2002, show a different sculpin community than seen on the EBS shelf and AI.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Team supported the authors' recommendation to use an average *M* rate using a biomass-weighted average of the instantaneous natural mortality rates for the six most abundant sculpin species in the BSAI. The complex mortality rate changed from M = 0.29 in 2014 to M = 0.283 in 2017 with the new survey data from 2015 and 2016. The Team recommends to adopt the author's approach of using the random effects model to estimate the biomass for the entire BSAI area. The total (Tier 5) sculpin recommended ABCs and OFLs for 2017 and 2018 are 42,387 t and 56,582 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 2017 and 2018 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2015	n/a	1,363	1,022	125	107
	2016	n/a	1,363	1,022	125	121
	2017	n/a	689	517	n/a	n/a
	2018	n/a	689	517	n/a	n/a

Changes from previous assessment

Total catch is updated for 2015 and 2016 (as of Oct 3, 2016). The IPHC survey RPNs are updated through 2015. The biomass estimates have been updated for the Aleutian Islands and EBS shelf/slope surveys through 2016.

Changes in assessment methodology

The 2016 SAFE uses a new time series of catch for calculating OFL and ABC. The OFL equals maximum catch (2003–2015) and ABC equals 0.75*OFL, rather than the OFL equal to maximum catch from the years 1997–2007. This decreases the OFL and ABC, but TAC and catch has been well below these new amounts.

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. However, all sleeper sharks taken in the survey and fisheries are juveniles, so it is impossible to know what effect those catches have on spawning stock biomass. The authors plan to continue studies to investigate stock structure of Pacific sleeper sharks and further investigate methods for assessing size and maturity for sharks caught in both survey and commercial fishing operations. 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 authors reviewed the catch history and found an unreasonably high estimate from a shark observation in 2002. Based on the increased species identification and better catch estimates from the restructured observer program in the catch accounting system, the Team recommended not including catch data prior to 2003 and setting OFL at the maximum catch during 2003–2015 (689 t), and ABC at 75 percent 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. Squids

Status and catch specifications (t) of squid 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 recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2015	n/a	2,624	1,970	400	2,364
	2016	n/a	6,912	5,184	1,500	1,281
	2017	n/a	6,912	5,184	n/a	n/a
	2018	n/a	6,912	5,184	n/a	n/a

In 2015, the squids TAC increased to 1,970 t after a reallocation of 1,570 t from the non-specified reserves.

Changes from previous assessment

The author presented updated survey biomass estimates and size compositions from the 2015 and 2016 eastern Bering Sea trawl survey, 2016 EBS slope survey, and the 2016 AI trawl survey and the fishery. Additional information has also been provided on the ecology of different squid species, an exploration of CPUE and effort during the early part of the historical catch time series (1977-1990), and discussion of the implications of basing catch limits on historical catch. A range of approaches that have been previously considered were outlined again with further discussion of the issues and relative merits of each approach.

Spawning biomass and stock trends

Survey biomass is not considered a reliable indicator of stock trends for squid.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Squids are managed under Tier 6 because the groundfish bottom trawl surveys do not provide reliable biomass estimates. As with last year, the Team recommends an OFL based on the use of an alternativ period (1977-1981) which may be more representative of incidental catch levels. This leads to an OFL = 6,912 t and an ABC of 5,184 t.

Status determination

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

22. Octopus

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 2017 and 2018 are those recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2015	n/a	3,452	2,589	400	446
	2016	n/a	3,452	2,589	400	426
	2017	n/a	4,769	3,576	n/a	n/a
	2018	n/a	4,769	3,576	n/a	n/a

For 2015, NMFS increased the TAC to 500 t with a reallocation of 100 t from the non-specified reserves.

Changes from previous assessment

No changes were 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. Recent increases in both Pacific cod and percentage of octopus in Pacific cod diet increased the annual consumption estimates from 2009-2015

In addition to the new cod stomach data described above, the following new data were included in this year's assessment:

- Updated 2015 and preliminary 2016 catch
- 2016 EBS shelf survey, EBS slope survey, and Aleutian Islands survey biomass estimates

Spawning biomass and stock trends

All of the estimated survey biomass estimates in 2016 were at or higher than in all the previous surveys.The substantial recent increase in octopus biomass in 2015 and 2016 also appeared in the Gulf of Alaska. Species composition and size frequencies from the surveys were similar to previous years.

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 is 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. The 2012 and 2013 Pacific cod diet data were not available for this assessment. The author will include them when they become available. The ABC and OFL estimates increased based on the increase in Pacific cod and more octopus in Pacific cod stomach samples. The recommended ABCs and OFLs for 2017 and 2018 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. Grenadiers

An abbreviated grenadier assessment is provided in Appendix 1; while not required, it is provided to assist the Council in tracking abundance of the assemblage in the groundfish FMPs. The Secretary of Commerce approved Amendments 100/91 on August 6, 2014, which added the grenadier complex into both FMPs as Ecosystem Components. Under this rule, they are not allowed to be targeted but there is an 8% Maximum Retainable Allowance (MRA) (Federal Register, Proposed Rules, Vol. 79, No. 93). As an Ecosystem Component, a stock assessment is not required and there is no ABC or OFL.

Status and catch specifications (t) of grenadiers 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 recommended by the Plan Team. Catch data are current through November 5, 2016.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2015	1,286,734	100,365	75,274	n/a	2,403
	2016	1,286,734	100,365	75,274	n/a	2,985
	2017	1,197,110	93,375	70,031	n/a	n/a
	2018	1,197,110	93,375	70,031	n/a	n/a

Area	Year	Biomass	OFL	ABC	TAC	Catch
GOA	2015	524,624	40,921	30,691	n/a	6,513
	2016	524,624	40,921	30,691	n/a	7,256
	2017	507,888	39,615	29,711	n/a	n/a
	2018	507,888	39,615	29,711	n/a	n/a

Changes from previous assessment

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

- Updated catch data through 2016
- Updated 2016 Aleutian Island (AI) biomass using the estimation method presented in the 2012 SAFE
- NMFS longline survey Relative Population Weights (RPWs) for 2015 and 2016
- Updated GOA biomass time series through 2015 using a random effects model
- EBS slope biomass for 2016.

There were no changes to assessment methodology.

Spawning biomass and stock trends

The main grenadier species taken in the BSAI or GOA fisheries (mainly sablefish) are giant grenadiers. The random effects estimated biomass in the GOA increased from 1984 through 2005 and has remained relatively stable since. Both the Aleutian Islands (adjusted Aleutian Islands trawl survey biomass) and Bering Sea (Eastern Bering Sea slope trawl survey) are relatively stable over the time series.

Recent catch levels have been well below ABC. The total catch for both FMPs is dominated by catch occurring in the GOA. The GOA catch has been declining in general and volatile over the last few years. Similarly, the catch in the Bering Sea has shown a similar trend, but catches in both the GOA and BS increased slightly in 2016. Catch in the Aleutian Islands has been highly variable, and has decreased since a peak catch in 2012.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

A Tier 5 status is not determined, nor ABCs and OFLs set for Ecosystem Component species or complexes. However, Tier 5 methods are used for the grenadier complex to estimate ABC and OFL values to monitor the complex. The 2017 ABC for the BSAI is 70,031 t with OFL = 93,375 t. The 2017 ABC for the GOA is 29,711 t with OFL = 39,615.

Status determination

A status is not determined for Ecosystem Component species, however, using the Tier 5 criteria, the complex is not subject to overfishing. The Tier 5 methods do not provide a means to determine if the complex is overfished.

Table 1. BSAI Groundfish Plan Team Recommended OFLs, and ABCs for 2017 and 2018; OFL, ABC, TAC and catch through November 5th 2016.

		2016			2016 Catch	2017		2018	
Species	**Area**	**OFL**	**ABC**	**TAC**	**as of 11/5/16**	**OFL**	**ABC**	**OFL**	**ABC**
Pollock	EBS	3,910,000	2,090,000	1,340,000	1,349,724	3,640,000	2,800,000	4,360,000	2,979,000
	AI	39,075	32,227	19,000	1,288	43,650	36,061	49,291	40,788
	Bogoslof	31,906	23,850	500	1,005	130,428	51,300	130,428	51,300
Pacific cod	BS	390,000	255,000	238,680	210,110	284,000	239,000	302,000	255,000
	AI	23,400	17,600	12,839	12,357	28,700	21,500	28,700	21,500
Sablefish	BS	1,304	1,151	1,151	518	1,551	1,274	1,572	1,291
	AI	1,766	1,557	1,557	349	2,101	1,735	2,129	1,758
Yellowfin sole	BSAI	228,100	211,700	144,000	128,236	287,000	260,800	276,000	250,800
Greenland turbot	BSAI	4,194	3,462	2,873	2,205	11,615	9,825	12,831	10,864
	BS	n/a	2,673	2,673	2,084	n/a	8,577	n/a	9,484
	AI	n/a	789	200	121	n/a	1,248	n/a	1,380
Arrowtooth flounder	BSAI	94,035	80,701	14,000	10,346	76,100	65,371	67,023	58,633
Kamchatka flounder	BSAI	11,100	9,500	5,000	4,762	10,360	8,880	10,700	9,200
Northern rock sole	BSAI	165,900	161,000	57,100	44,873	159,700	155,100	147,300	143,100
Flathead sole	BSAI	79,562	66,250	21,000	9,655	81,654	68,278	79,136	66,164
Alaska plaice	BSAI	49,000	41,000	14,500	12,957	42,800	36,000	36,900	32,100
Other flatfish	BSAI	17,414	13,061	2,500	2,810	21,860	16,395	21,860	16,395
Pacific Ocean perch	BSAI	40,529	33,320	31,900	30,408	53,152	43,723	51,950	42,735
	BS	n/a	8,353	8,000	7,186	n/a	11,789	n/a	11,523
	EAI	n/a	7,916	7,900	7,569	n/a	10,441	n/a	10,205
	CAI	n/a	7,355	7,000	6,765	n/a	8,113	n/a	7,930
	WAI	n/a	9,696	9,000	8,888	n/a	13,380	n/a	13,077
Northern rockfish	BSAI	14,689	11,960	4,500	4,532	16,242	13,264	15,854	12,947
Blackspotted/Rougheye	BSAI	693	561	300	157	612	501	750	614
Rockfish	EBS/EAI	n/a	179	100	70	n/a	294	n/a	362
	CAI/WAI	n/a	382	200	87	n/a	207	n/a	252
Shortraker rockfish	BSAI	690	518	200	103	666	499	666	499
Other rockfish	BSAI	1,667	1,250	875	791	1,816	1,362	1,816	1,362
	BS	n/a	695	325	278	n/a	791	n/a	791
	AI	n/a	555	550	513	n/a	571	n/a	571
Atka mackerel	BSAI	104,749	90,340	55,000	54,293	102,700	87,200	99,900	85,000
	EAI/BS	n/a	30,832	28,500	28,168	n/a	34,890	n/a	34,000
	CAI	n/a	27,216	16,000	15,795	n/a	30,330	n/a	29,600
	WAI	n/a	32,292	10,500	10,330	n/a	21,980	n/a	21,400
Skates	BSAI	50,215	42,134	26,000	25,624	49,063	41,144	46,583	39,008
Sculpins	BSAI	52,365	39,725	4,500	4,476	56,582	42,387	56,582	42,387
Sharks	BSAI	1,363	1,022	125	121	689	517	689	517
Squids	BSAI	6,912	5,184	1,500	1,281	6,912	5,184	6,912	5,184
Octopuses	BSAI	3,452	2,589	400	426	4,769	3,576	4,769	3,576
Total	BSAI	5,324,080	3,236,662	2,000,000	1,913,407	5,114,722	4,010,876	5,812,341	4,171,722

Table 2. Groundfish catches (metric tons) in the eastern Bering Sea, 1954-2016.

Year	Pollock	Pacific Cod	Sable fish	Yellowfin Sole	Greenland Turbot	Arrowtooth Flounder/a	Kamchatka Flounder/b	Rock Sole/c	Flathead Sole	Alaska Plaice	Other Flatfish
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/e	1,350,729	226,203	518	128,236	2,084	9,019	3,076	44,632	9,629	12,957	2,789

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 shortraker, rougheye, northern, and sharpchin rockfish until 2004.
e/ Data through November 5, 2016.
f/ Octopus, sculpin, sharks, skates included in Other Species prior to 2011.

Table 2 (continued). Groundfish catches (metric tons) in the eastern Bering Sea, 1954-2016.

Year	POP Complex/d	POP	N. Rockfish	RE Rockfish	BS/SR Rockfish	Other Rockfish	Atka Mack.	Other Species/f	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/e		7,186	199	40	50	278	330		24,467	3,964	110	1,231	417	1,828,144

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69.
b/ Kamchatka flounder included in Arrowtooth flounder prior to 2011.
c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in Other Flatfish catch statistics.
d/ Includes POP shortraker, rougheye, northern, and sharpchin rockfish until 2004.
e/ Data through November 5, 2016.
f/ Octopus, sculpin, sharks, skates included in Other Species prior to 2011.

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

Table 3. Groundfish catches (metric tons) in the Aleutian Islands, 1954-2016.

Year	Pollock	Pacific Cod	Sable fish	Yellowfin Sole	Greenland Turbot	Arrowtooth Flounder/a	Kamchatka Flounder/b	Rock Sole/c	Flathead Sole	Alaska Plaice	Other Flatfish
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/e	1,288	13,239	349	0	121	1,328	1,685	241	26	0	21

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 shortraker, rougheye, northern, and sharpchin rockfish until 2004.

e/ Data through November 5, 2016.

f/ Octopus, sculpin, sharks, skates included in Other Species prior to 2011.

Table 3 (continued). Groundfish catches (metric tons) in the Aleutian Islands, 1954-2016.

Year	POP Complex/d	POP	N. Rockfish	RE Rockfish	BS/SR Rockfish	Other Rockfish	Atka Mack.	Other Species/f	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/e		23,222	4,333	117	53	513	53,962		1,157	512	11	50	10	102,238

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 shortraker, rougheye, northern, and sharpchin rockfish until 2004.

e/ Data through November 5, 2016.

f/ Octopus, sculpin, sharks, skates included in Other Species prior to 2011.

Table 4. Groundfish catches (metric tons) in the Bering Sea and Aleutian Islands, 1954-2016.

Year	Pollock	Pacific Cod	Sablefish	Yellowfin Sole	Greenland Turbot	Arrowtooth Flounder/a	Kamchatka Flounder/b	Rock Sole/c	Flathead Sole	Alaska Plaice	Other Flatfish
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/e	1,352,017	239,442	867	128,236	2,205	10,347	4,761	44,873	9,655	12,957	2,810

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 shortraker, rougheye, northern, and sharpchin rockfish until 2004.

e/ Data through November 5, 2016.

f/ Octopus, sculpin, sharks, skates included in Other Species prior to 2011.

Table 4 (continued). Groundfish catches (metric tons) in the Bering Sea and Aleutian Islands, 1954-2016.

Year	POP Complex/d	POP	N. Rockfish	RE Rockfish	BS/SR Rockfish	Other Rockfish	Atka Mack.	Other Species/f	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		31,425	7,197	181	153	686	53,270	0	28,123	4,980	107	2,364	446	1,914,061
2016/e		30,408	4,532	157	103	791	54,292	0	25,624	4,476	121	1,281	427	1,930,382

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 shortraker, rougheye, northern, and sharpchin rockfish until 2004.
e/ Data through November 5, 2016.
f/ Octopus, sculpin, sharks, skates included in Other Species prior to 2011.

Table 5. 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 2017 and 2018. "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	2017 Biomass	2017 OFL	2017 ABC	2017 F_{OFL}	2017 F_{ABC}	2018 OFL	2018 ABC	2018 F_{OFL}	2018 F_{ABC}
Pollock	1a	EBS	13,000,000	3,640,000	2,800,000	0.526	0.360	4,360,000	2,979,000	0.526	0.370
	3b	Aleutian Is.	250,221	43,650	36,061	0.378	0.304	49,291	40,788	0.397	0.319
	5	Bogoslof	434,760	130,428	51,300	0.300	0.120	130,428	51,300	0.300	0.120
Pacific cod	3a	BS	1,260,000	284,000	239,000	0.380	0.310	302,000	255,000	0.380	0.310
	5	AI	79,600	28,700	21,500	0.360	0.270	28,700	21,500	0.360	0.270
Sablefish	3b	BS	24,000	1,551	1,274	0.097	0.078	1,572	1,291	0.097	0.075
	3b	AI	43,000	2,101	1,735	0.097	0.079	2,129	1,758	0.097	0.076
Yellowfin sole	1a	BSAI	2,290,100	287,000	260,800	0.125	0.114	276,000	250,800	0.125	0.114
Greenland turbot	3b	BSAI	121,804	11,615	9,825	0.290	0.180	12,831	10,864	0.290	0.180
Arrowtooth flounder	3a	BSAI	779,195	76,100	65,371	0.151	0.129	67,023	58,633	0.151	0.129
Kamchatka flounder	3a	BSAI	170,300	10,360	8,880	0.078	0.066	10,700	9,200	-0.078	0.066
North rock Sole	1a	BSAI	1,000,600	159,700	155,100	0.160	0.155	147,300	143,100	0.160	0.155
Flathead sole	3a	BSAI	747,557	81,654	68,278	0.410	0.340	79,136	66,164	0.410	0.340
Alaska plaice	3a	BSAI	412,600	42,800	36,000	0.154	0.128	36,900	32,100	0.154	0.128
Other flatfish	5	BSAI	113,450	21,860	16,395	0.17/.085/.15	.128/.064/.113	21,860	16,395	0.17/.085/.15	.128/.064/.113
Pacific ocean perch	3a	BSAI	767,767	53,152	43,723	0.101	0.082	51,950	42,735	0.101	0.082
Northern rockfish	3a	BSAI	248,160	16,242	13,264	0.080	0.065	15,854	12,947	0.080	0.065
Shortraker rockfish	5	BSAI	22,191	666	499	0.030	0.0225	666	499	0.030	0.0225
Rougheye/ Blackspotted	3a	BSAI	35,669	612	501	0.048	0.039	750	614	0.054	0.044
Other rockfish	5	BSAI	55,353	1,816	1,362	.03/.09	0.0225/.0675	1,816	1,362	.03/.09	0.0225/.0675
Atka mackerel	3a	BSAI	598,791	102,700	87,200	0.400	0.340	99,900	85,000	0.400	0.340
Skate	3a/5	BSAI	605,617	49,063	41,144	0.092/.100	0.079/.075	46,583	39,008	0.092/.100	0.079/.075
Sculpin	5	BSAI	199,937	56,582	42,387	0.283	0.212	56,582	42,387	0.283	0.212
Shark	6	BSAI	n/a	689	517	n/a	n/a	689	517	n/a	n/a
Squid	6	BSAI	n/a	6,912	5,184	n/a	n/a	6,912	5,184	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	**23,260,672**	**5,114,722**	**4,010,876**			**5,812,341**	**4,171,722**		

Table 6. 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 2017-2018. 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.

		2017					
Species or Complex	**Area**	**Tier**	**max F_{ABC}**	**F_{ABC}**	**max ABC**	**ABC**	**% Red.**
Pollock	EBS	1a	0.398	0.360	3,120,000	2,800,000	10%
Pollock	BOG	5	.225	.120	97,821	51,300	48%
Sablefish	BSAI	3b	0.081	0.078	3,101	3,009	3%
		2018					
Species or Complex	**Area**	**Tier**	**max F_{ABC}**	**F_{ABC}**	**max ABC**	**ABC**	**% Red.**
Pollock	EBS	1a	0.398	0.360	4,360,000	2,979,000	32%
Pollock	BOG	5	.225	.120	97,821	51,300	48%
Sablefish	BSAI	3b	0.078	0.076	3,142	3,049	3%

Table 7. Species included in assessments for the 2016 BSAI SAFE report (extends over several pages).

Chapter	Common name	Scientific name	Count
1	**Walleye Pollock**	*Gadus chalcogrammus*	1
2	**Pacific cod**	*Gadus macrocephalus*	1
3	**Sablefish**	*Anoplopoma fimbria*	1
4	**Yellowfin sole**	*Limanda aspera*	1
5	**Greenland turbot**	*Reinhardtius hippoglossoides*	1
6	**Arrowtooth flounder**	*Atherestes stomias*	2
7	**Kamchatka flounder**	*Atherestes evermanni*	
8	**Northern rock sole**	*Lepidopsetta polyxystra n. sp.*	2
	Southern rock sole	*Lepidopsetta bilineata*	
9	**Flathead sole**	*Hippoglossoides classodon*	2
	Bering flounder	*Hippoglossoides robustus*	
10	**Alaska plaice**	*Pleuronectes quadrituberculatus*	1
11	**Other flatfish**		15
	Arctic flounder	*Liopsetta glacialis*	
	butter sole	*Isopsetta isolepis*	
	curlfin sole	*Pleuronectes decurrens*	
	deepsea sole	*Embassichths bathybius*	
	Dover sole	*Microstomus pacificus*	
	English sole	*Parophrys vetulus*	
	longhead dab	*Limanda proboscidea*	
	Pacific sanddab	*Citharichthys sordidus*	
	petrale sole	*Eopsetta jordani*	
	rex sole	*Glyptocephalus zachirus*	
	roughscale sole	*Clidodoerma asperrimum*	
	sand sole	*Psettichthys melanostictus*	
	slender sole	*Lyopsetta exilis*	
	starry flounder	*Platichthys stellatus*	
	Sakhalin sole	*Pleuronectes sakhalinensis*	
12	**Pacific Ocean perch**	*Sebastes alutus*	1
13	**Northern rockfish**	*Sebastes polyspinus*	1
14	**Blackspotted/Rougheye**		2
	Blackspotted rockfish	*Sebastes melanostictus*	
	Rougheye rockfish	*Sebastes aleutianus*	

Table 7. Species included in assessments for the 2016 BSAI SAFE report (extends over several pages).

Chapter	Common name	Scientific name	Count
15	**Shortraker rockfish**	*Sebastes borealis*	1
16	**Other rockfish***		
	Shortspine thornyhead	*Sebastolobus alascanus*	7
	Dusky rockfish	*Sebastes variabilis*	
	Red banded rockfish	*Sebastes babcocki*	
	Redstripe rockfish	*Sebastes proriger*	
	Harlequin rockfish	*Sebastes variegatus*	
	Sharpchin rockfish	*Sebastes zacentrus*	
	Yelloweye rockfish	*Sebastes ruberrimus*	
17	**Atka mackerel**	*Pleurogrammus monopterygius*	1
18	**Skates**		15
	deepsea skate	*Bathyraja abyssicola*	
	Aleutian skate	*Bathyraja aleutica*	
	Bering skate (complex?)	*Bathyraja interrupta*	
	Commander skate	*Bathyraja lindbergi*	
	whiteblotched skate	*Bathyraja maculata*	
	butterfly skate	*Bathyraja mariposa*	
	whitebrow skate	*Bathyraja minispinosa*	
	Alaska skate	*Bathyraja parmifera*	
	"Leopard" parmifera	*Bathyraja sp. cf. parmifera*	
	mud skate	*Bathyraja taranetzi*	
	roughtail skate	*Bathyraja trachura*	
	Okhotsk skate	*Bathyraja violacea*	
	big skate	*Raja binoculata*	
	roughshoulder skate	*Amblyraja badia*	
	longnose skate	*Raja rhina*	
19	**Sculpins**		48
	Scaled sculpin	*Archistes biseriatus*	
	Bride sculpin	*Artediellus miacanthus*	
	Pacific hookear sculpin	*Artediellus pacificus*	
	Broadfin sculpin	*Bolinia euryptera*	
	Antlered sculpin	*Enophrys diceraus*	
	Leister sculpin	*Enophrys lucasi*	
	Purplegray sculpin	*Gymnocanthus detrisus*	
	Armorhead sculpin	*Gymnocanthus galeatus*	
	threaded sculpin	*Gymnocanthus pistilliger*	
	Arctic staghorn sculpin	*Gymnocanthus tricuspis*	
	Banded Irish lord	*Hemilepidotus gilberti*	
	Red Irish Lord	*Hemilepidotus hemilepidotus*	
	Yellow Irish Lord	*Hemilepidotus jordani*	
	Butterfly sculpin	*Hemilepidotus papilio*	
	Longfin Irish lord	*Hemilepidotus zapus*	
	Northern sculpin	*Icelinus borealis*	
	Blacknose sculpin	*Icelus canaliculatus*	
	Wide-eye sculpin	*Icelus euryops*	
	Spatulate sculpin	*Icelus spatula*	
	thorny sculpin	*Icelus spiniger*	
	Uncinate sculpin	*Icelus uncinalis*	
	Longfin sculpin	*Jordania zonope*	
	Pacific staghorn sculpin	*Leptocottus armatus*	
	Plain sculpin	*Myoxocephalus jaok*	
	Great sculpin	*Myoxocephalus polyacanthocephalus*	
	Fourhorn sculpin	*Myoxocephalus quadricornis*	
	Warty sculpin	*Myoxocephalus verrucocus*	
	Slim sculpin	*Radulinus asprellus*	
	Roughskin sculpin	*Rastrinus scutiger*	
	Sponge sculpin	*thyriscus anoplus*	
	Scissortail sculpin	*Triglops forficatus*	
	Roughspine sculpin	*Triglops macellus*	
	Crescent-tail sculpin	*Triglops metopias*	
	Ribbed sculpin	*Triglops pingelii*	

Table 7. Species included in assessments for the 2016 BSAI SAFE report (extends over several pages).

Chapter	Common name	Scientific name	Count
	Spectacled sculpin	*Triglops septicus*	
	Scalybreasted sculpin	*Triglops xenostethus*	
	Flabby sculpin	*Zesticelus profundorum*	
	Crested sculpin	*Blepsias bilobus*	
	Bigmouth sculpin	*Hemitripterus bolini*	
	Sailfin sculpin	*Nautichthys oculofasciatus*	
	Eyeshade sculpin	*Nautichthys pribilovius*	
	Spinyhead sculpin	*Dasycottus setiger*	
	Smoothcheek sculpin	*Eurymen gyrinus*	
	Darkfin sculpin	*Malacoccottus zonurus*	
	Blackfin sculpin	*Malacocottus kincaidi*	
	Tadpole sculpin	*Psychrolutes paradoxus*	
	Blob sculpin	*Psychrolutes phrictus*	
	Grunt sculpin	*Rhamphocottus richardsoni*	
20	**Sharks**		8
	brown cat shark	*Apristurus brunneus*	
	White shark	*Carcharodon carcharias*	
	basking shark	*Cetorhinus maximus*	
	sixgill shark	*Hexanchus griseus*	
	salmon shark	*Lamna ditropis*	
	blue shark	*Prionace glauca*	
	Pacific sleeper shark	*Somniosus pacificus*	
	Spiny dogfish	*Squalus acanthias*	
21	**Squids**		14
		Chiroteuthis calyx	
	"glass squids"	*Belonella borealis*	
		Galiteuthis phyllura	
	minimal armhook squid	*Berryteuthis anonychus*	
	magistrate armhook squid	*Berryteuthis magister*	
		Eogonatus tinro	
	boreopacific armhook squid	*Gonatopsis borealis*	
	Berry armhook squid	*Gonatus berryi*	
		Gonatus madokai	
		Gonatus middendorffi	
	clawed armhook squid	*Gonatus onyx*	
	robust clubhook squid	*Moroteuthis robusta*	
	boreal clubhook squid	*Onychoteuthis borealijaponicus*	
	North Pacific bobtail squid	*Rossia pacifica*	
22	**Octopus**		8
	flapjack devilfish	*Opisthoteuthis cf californiana*	
	pelagic octopus	*Japetella diaphana*	
	smooth octopus	*Benthoctopus leioderma*	
		Benthoctopus oregonensis	
		Benthoctopus salebrosus	
	giant octopus	*Enteroctopus dofleini*	
		Granelodone boreopacifica	
	stubby octopus	*Sasakiopus salebrosus*	
Total number of species			**133**