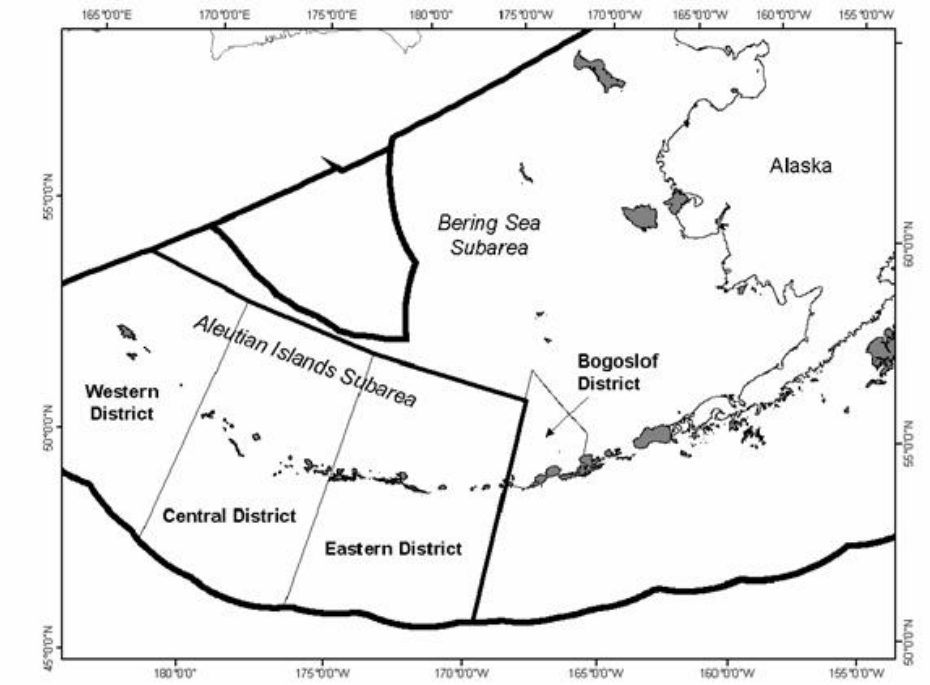
APPENDIX A

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

Compiled by

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



With Contributions by

K. Aydin, S. Barbeaux, D. Clausen, M.E. Conners, C. Conrath, M. Dalton, J. DiCosimo, K. Echave, S. Gaichas, K. Goldman, D. Hanselman, J. Heifetz, J. Hoff, T. Honkalehto, J. Ianelli, S. Kotwicki, R. Lauth, S. Lowe, C. Lunsford, D. McKelvey, B. Matta, D. Nichol, O.A. Ormseth, C.J. Rodgveller, C.N. Rooper, P. Spencer, C. Spital, I. Spies, W. Stockhausen, T. TenBrink, G. Thompson, C. Tribuzio, T. Wilderbuer, and M. Wilkins

November 2010

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

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

Table of Contents

Summary

by

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

Introduction

The *National Standard Guidelines for Fishery Management Plans* published by the National Marine Fisheries Service (NMFS) require that a stock assessment and fishery evaluation (SAFE) report be prepared and reviewed annually for each fishery management plan (FMP). The 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" 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 generally previewed at the September Plan Team meeting, and considered again by the Plan Team at its November meeting for recommending final specifications for the following two fishing years. This process is repeated annually.

This Stock Assessment section of the SAFE report for the BSAI groundfish fisheries is compiled by the BSAI Groundfish Plan Team from chapters contributed by scientists at NMFS Alaska Fisheries Science Center (AFSC). These chapters include a recommendation by the author(s) for 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 Plan Team (Table 1), along with a summary of each chapter.

The OFL and ABC recommendations by the Plan Team are reviewed by the Scientific and Statistical Committee (SSC), which may confirm the Plan Team recommendations. The Plan 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), Plan Team, nor SSC recommends TACs.

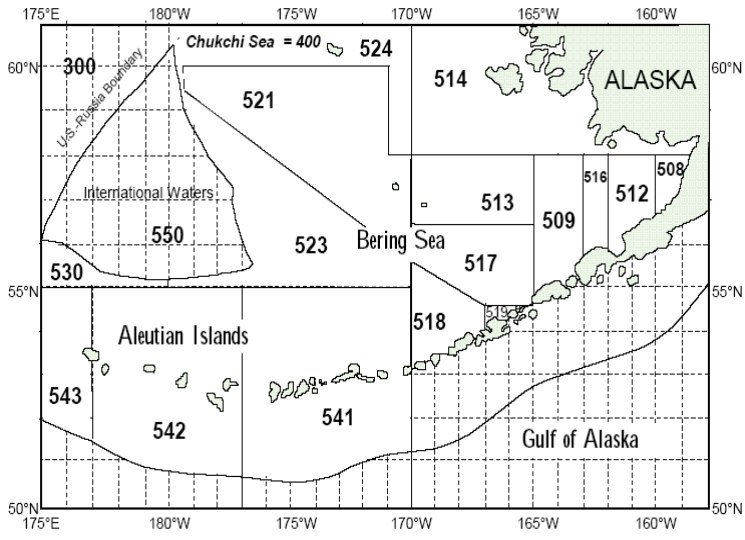


Figure 1. Bering Sea/Aleutian Islands statistical and reporting areas.

Members of the BSAI Plan Team who compiled this SAFE report were Loh-lee Low (chair), Mike Sigler (vice chair), Jane DiCosimo (BSAI Groundfish FMP coordinator), Grant Thompson, Kerim Aydin, David Barnard, David Carlile, Henry Cheng, Lowell Fritz, Mary Furuness, Dana Hanselman, Alan Haynie, Brenda Norcross, and Leslie Slater.

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 2009 for the start of the 2010 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 are listed below.

1. In the Fishery:

    a) 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. This category includes pollock, Pacific cod, sablefish, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, flathead sole, Alaska plaice, "other flatfish", Pacific ocean perch, northern rockfish, shortraker rockfish, rougheye rockfish, "other rockfish", Atka mackerel, sharks, skates, sculpins, octopus, and squid.

2. Ecosystem Component:

    a) 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 quotas have been achieved shall be treated in the same manner as prohibited species.

    b) 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.

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 implemented by the Council. Catches generally total well below the 2 million t optimal yield (OY) cap. Catches in the EBS for 2009 totaled 1,198,833 t; catches through November 6, 2010 totaled 1,183,570 t.

Species included in the BSAI Groundfish Fishery Management Plan by category

In the Fishery	
Target Species[2]	Walleye pollock Pacific cod Sablefish Yellowfin sole Greenland turbot Arrowtooth flounder Northern Rock sole Flathead sole Alaska plaice Other flatfish assemblage Pacific ocean perch Northern rockfish Shortraker rockfish Blackspotted/Rougheye rockfish assemblage Other rockfish assemblage Atka mackerel Squid assemblage Shark assemblage Skate assemblage Sculpin assemblage Octopus assemblage
Ecosystem Component	
Prohibited Species[1]	Pacific halibut Pacific herring Pacific salmon Steelhead trout King crab Tanner crab
Forage Fish Species[3]	Osmeridae family (eulachon, capelin, and other smelts) Myctophidae family (lanternfishes) Bathylagidae family (deep-sea smelts) Ammodytidae family (Pacific sand lance) Trichodontidae family (Pacific sand fish) Pholidae family (gunnels) Stichaeidae family (pricklebacks, warbonnets, eelblennys, cockscombs, and shannys) Gonostomatidae family (bristlemouths, lightfishes, and anglemouths) Order Euphausiacea (krill)

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

Catches in the Aleutian Islands (AI) subarea have always been much smaller than in the EBS. Target species have also differed (Table 3). Pacific Ocean perch (POP) was the initial target species. As POP abundance declined, the fishery diversified to different species. During the early years of exploitation, total AI groundfish catches peaked at 112,000 t in 1965. Atka mackerel is the largest fishery (72,563 t in 2009; 68,496 t through November 6, 2010) in the AI, followed by Pacific cod (28,580 t in 2009; 27,566 t through November 6, 2010). Recent catches peaked at 191,000 t in 1996. Total 2009 AI catches were 138,763 t; catches through November 6, 2010 totaled 146,446 t.

Total catches since 1954 for the BSAI, combined, are in Table 4. Total 2009 BSAI catches were 1,337,596 t (80 percent of total TACs and 67 percent of the OY); BSAI catches through November 6, 2010 totaled 1,330,016 t. The relationship of the various biological reference points (biomass, overfishing level, acceptable biological catch, total allowable catch, and catch) is depicted in Figure 2.

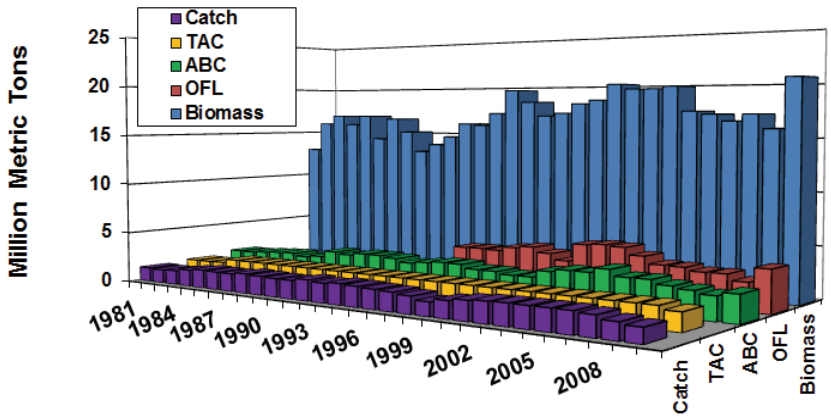


Figure 2. Biomass, Overfishing Level, Acceptable Biological Catch for 1981-2010, and Total Allowable Catch, and Catch , 1981-2009.

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. Due to recent declines in biomasses of walleye pollock and Pacific cod, for example, and prohibited species catch limits, the cap has not been met. The BSAI groundfish TACs totaled 1,840,000 t in 2008 and dropped further to 1,680,000 t in 2009 and 2010, approximately 16 percent below the OY.

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 (up from 7.5 percent prior to 2008) 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 prohibited species catch (PSC) limits.

The TAC specifications for the primary allocated species, and PSC limit specifications, are recommended by the Council at its December meeting. For the non-specified reserve, 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 placed in a non-specified reserve. Apportionments to this reserve range from 4.3 to 15 percent of

applicable TAC limits. The reserve is used for (1) correction of operational problems in the fishing fleets, (2) to promote full and efficient use of groundfish resources, (3) adjustments of species TACs according to changing conditions of stocks during fishing year, and (4) apportionments. The initial TAC (ITAC) for each species is the remainder of the TAC after the subtraction of the reserves.

New Data Summary

Since the previous SAFE Report was issued (NPFMC 2009), the following new information has been incorporated into the stock assessments:

1) Eastern Bering Sea Walleye pollock: 1) updated total catch for 2009 and a preliminary estimate of the 2010 catch; 2) updated age composition data and weight-at-age data from the 2009 fishery; 3) updated age composition data from the 2009 acoustic-trawl survey; 4) age composition data from the 2010 EBS bottom trawl survey; 5) preliminary age composition from the 2010 acoustic-trawl survey; 6) biomass estimates from the 2010 EBS bottom trawl survey and the 2010 acoustic-trawl survey; 7) annual estimates of relative precision for the acoustic-trawl survey abundance data from 1994-2010; and 8) the final model excluded the three most recent year classes from the data used to estimate the stock-recruitment relationship.

1a) Aleutian Islands Walleye pollock: 1) 2010 catch estimates and updated values for 2003 through 2009; 2) catch at age data from the 2007 and 2008 Aleutian Islands Cooperative Acoustic Survey Study; 3) 2010 Aleutian Islands bottom trawl survey biomass estimate.

1b) Bogoslof pollock: 2009 catch estimates.

2) Pacific cod: 1) all survey and commercial data series on CPUE, catch at age, and catch at length were updated.

3) Sablefish: 1) relative abundance and length data from the 2010 longline survey; 2) relative abundance and length data from the 2009 longline and trawl fisheries; 3) age data from the 2009 longline survey and longline fishery; and 4) updated 2009 catch and estimated 2010 catch.

4) Yellowfin sole: 1) 2009 fishery and survey age compositions; 2) the 2010 trawl survey biomass point estimate and standard error; 3) estimates of the discarded and retained portions of the 2009 catch; and 4) an estimate of total catch through the end of 2010.

5) Greenland turbot: 1) updated 2009 and 2010 catch data; 2) 2010 EBS shelf and slope survey biomasses; and 3) length composition estimates.

6) Arrowtooth flounder: 1) fishery catch and discards for 2009 and through 15 October 2010); and 2010 shelf, slope and Aleutian Islands surveys size composition and biomass point-estimates and standard errors.

6b) Kamchatka flounder: estimates of total catch and bottom trawl survey biomass estimates from the Bering Sea shelf, slope and Aleutian Islands surveys

7) Northern rock sole: 1) 2009 rock sole fishery age composition; 2) 2009 northern rock sole survey age composition; 3) 2010 northern rock sole trawl survey biomass point estimate and standard error; 4) estimates of retained and discarded portions of the 2009 catch; and 5) catch and discards through 26 September 2010.

8) Flathead sole: 1) 2009 fishery catch data was updated and the 2010 catch through September 25, 2010 was added to the assessment; 2) Sex-specific size compositions from the 2010 fishery; 3) Fishery size compositions from 2009 were updated; 4) estimated survey biomass and standard error from the 2010 EBS trawl survey; 5) Sex-specific size compositions from the 2010 EBS trawl survey; 6) Sex-specific age compositions from the 2009 EBS trawl survey; and 7) mean bottom temperature from the 2010 EBS trawl survey.

9) Alaska plaice: 1) 2010 survey catch and fishery catch through 15 October 2010; 2010 trawl survey biomass estimate and standard error; 3) 2010 length composition of survey catch; and 4) 2009 survey age composition.

10) Other flatfish: 1)2010 total catch and discards through 16 October 2010; 2) 2010 EBS and AI trawl survey information; 3) the natural mortality rate for species other than Dover and rex sole was changed from 0.20 to 0.15.

11) Pacific ocean perch: 1) 2010 AI survey biomass estimate and length composition; 2) 2006, 2007, and 2008 fishery age compositions; and 3) 2009 fishery length composition.

12) Northern rockfish: final 2009 catch and preliminary estimate of 2010 catch.

13a) Shortraker rockfish: 1) final 2009 catch and preliminary estimate of 2010 catch; 2) 2010 Aleutian Islands survey data; and 3) 2010 EBS slope trawl survey data.

13b) Blackspotted/rougheye rockfish: 1) biomass estimate from the 2010 AI survey; 2) 2008 fishery age composition; 3) 2009 fishery length composition; 4) 1983 and 2010 survey length compositions; and 5) final 2009 catch and preliminary estimate of 2010 catch.

14) Other rockfish: 1) 2010 AI survey; 2010 EBS slope trawl survey; and 3) final 2009 catch and preliminary estimate of 2010 catch.

15) Atka mackerel: 1) fishery catch data were updated; 2) 2009 fishery age composition data; 3) 2009 fishery catch- and weight-at-age values; 4) 2010 AI survey biomass, length and age compositions, and weight-at-age data; 5) 2010 selectivity vector; 6) assumption that 64 percent of the BSAI-wide ABC is likely to be taken under proposed Steller sea lion Reasonable and Prudent Alternatives (SSL RPAs); 7) apportionment scheme includes the 2010 survey biomass distribution; 8) distribution of survey biomass for area 541 used in the apportionment calculations was updated to include the southern Bering Sea area.

16) Squid: 1) updated catch data; 2) 2010 EBS shelf, EBS slope, and AI trawl survey biomass estimates.

17) Skate: 1) updated catch data; 2) 2010 EBS shelf, EBS slope, and AI survey updates; 3 and updated fishery and survey length compositions.

18) Shark: 1) 2010 catch data; and 2) biomass data from 2010 Bering Sea shelf, Bering Sea slope, and Aleutian Islands surveys.

19) Octopus: 1) Updated 2009 catch data; 2) preliminary catch for 2010.

20) Sculpin: 1) Updated 2009 catch data; 2) preliminary catch for 2010.

Biological Reference Points

A number of biological reference points are used in this SAFE report. Among these are the fishing mortality rate (F) and stock biomass level (B) associated with MSY (F_{MSY} and B_{MSY}, respectively), and the fishing mortality rates reduce the level of spawning biomass per recruit to some percentage of the pristine level ($F_{P\%}$). The fishing mortality rate used to compute ABC is designated F_{ABC}, and the fishing mortality rate used to compute the overfishing level (OFL) is designated F_{OFL}.

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 under "overfishing" 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% 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 typically begin with an estimated vector of 2010 numbers at age. This vector is then projected forward to the beginning of 2011 using the schedules of natural mortality and selectivity described in the assessment and the best available estimate of total (year-end) catch for 2010. 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. This projection scheme is run 1000 times to obtain distributions of possible future stock sizes, fishing mortality rates, and catches.

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*
     $F_{ABC} \le \mu_H$, *the harmonic mean of the pdf*
   - 1b) Stock status: $\alpha < B/B_{MSY} \le 1$
     $F_{OFL} = \mu_A \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
     $F_{ABC} \le \mu_H \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
   - 1c) Stock status: $B/B_{MSY} \le \alpha$
     $F_{OFL} = 0$
     $F_{ABC} = 0$
2) Information available: *Reliable point estimates of B, B_{MSY}, F_{MSY}, $F_{35\%}$, and $F_{40\%}$.*
   - 2a) Stock status: $B/B_{MSY} > 1$
     $F_{OFL} = F_{MSY}$
     $F_{ABC} \le F_{MSY} \times (F_{40\%}/F_{35\%})$
   - 2b) Stock status: $\alpha < B/B_{MSY} \le 1$
     $F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
     $F_{ABC} \le F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
   - 2c) Stock status: $B/B_{MSY} \le \alpha$
     $F_{OFL} = 0$
     $F_{ABC} = 0$
3) Information available: *Reliable point estimates of B, $B_{40\%}$, $F_{35\%}$, and $F_{40\%}$.*
   - *3a) Stock status: $B/B_{40\%} > 1$*
     $F_{OFL} = F_{35\%}$
     $F_{ABC} \le F_{40\%}$
   - *3b) Stock status: $\alpha < B/B_{40\%} \le 1$*
     $F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$
     $F_{ABC} \le F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$
   - *3c) Stock status: $B/B_{40\%} \le \alpha$*
     $F_{OFL} = 0$
     $F_{ABC} = 0$
4) Information available: *Reliable point estimates of B, $F_{35\%}$, and $F_{40\%}$.*
   $F_{OFL} = F_{35\%}$
   $F_{ABC} \le F_{40\%}$
5) Information available: *Reliable point estimates of B and natural mortality rate M.*
   $F_{OFL} = M$
   $F_{ABC} \le 0.75 \times M$
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
   $ABC \le 0.75 \times OFL$

Five of the seven standard scenarios will be used in an Environmental Assessment prepared in conjunction with the final SAFE. These five scenarios, which are designed to provide a range of harvest alternatives that are likely to bracket the final TACs for 2011 and 2012, 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 2011 recommended in the assessment to the *max* F_{ABC} for 2010. (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 2005-2009 average *F*. (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 expected to be 1) above its MSY level in 2010 or 2) above 1/2 of its MSY level in 2010 and above its MSY level in 2020 under this scenario, then the stock is not overfished.)

Scenario 7: In 2011 and 2012, 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 expected to be above its MSY level in 2023 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 2011 and 2012 ABCs and OFLs are summarized in Tables 1, 5, and 6.

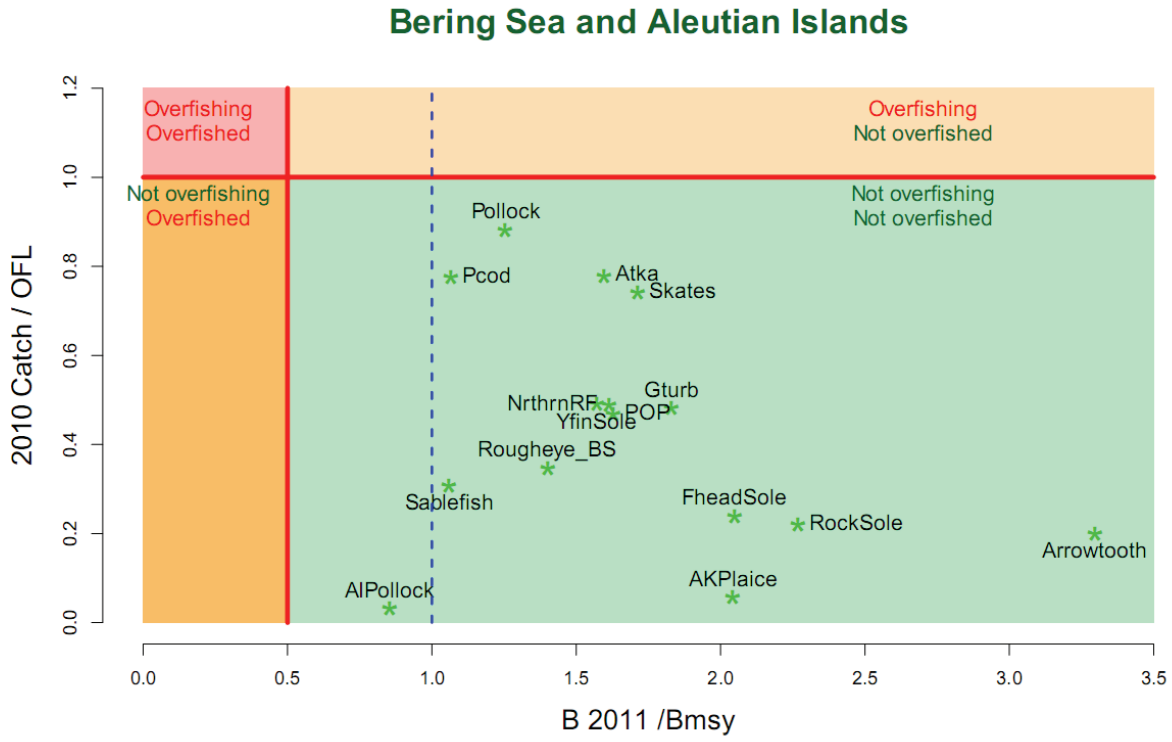


Figure 3. Summary status of age-structured BSAI species as measured by 2010 catch level relative to OFL (vertical axis) and projected 2011 spawning biomass relative to B_{MSY}.

The sum of the recommended ABCs for 2011 and 2012 are 2,530,000 t and 2,910,000 t, respectively. These are 410,000 t above and 790,000 t above the sum of the 2010 ABCs (2,120,000 t), indicating an anticipated rebound in stock status in 2011, after declines in 2009 and 2010.

Overall, the status of the stocks continues to appear relatively favorable (Figure 3). In fact, nearly all stocks are above B_{MSY} or the B_{MSY} proxy of $B_{35\%}$. Many stocks are rebounding due to increased recruitment in recent years. The abundances of EBS pollock, Pacific cod, sablefish, all rockfishes managed under tier 3, all flatfishes managed under tiers 1 or 3, and Atka mackerel are projected to be above B_{MSY} or the B_{MSY} proxy of $B_{35\%}$ in 2011. The abundance of AI pollock is the one exception, as it is projected to be about 14% below B_{MSY} in 2011. Total groundfish biomass for 2011 (20.7 million t) is up 30 percent compared to 2010 groundfish biomass (15.9 million t). Groundfish ABCs recently had trended down for gadoids, but generally up for flatfishes until an apparent rebound for many stocks in 2010. The 2010 bottom trawl survey biomass estimate for pollock was 3.75 million t, up 64 percent from the 2009 estimate, but still below average for the 1987-2010 time series. The estimate from the acoustic-trawl survey was 2.32 million t, up 151 percent from the 2009 estimate, but still below average for the 1979-2010 time series. Following the highest observation in 1994, the Pacific cod bottom trawl survey biomass estimate declined steadily through 1998 and remained around 600,000 t from 2002 through 2005. However, the survey biomass estimates were at all-time lows from 2006 through 2008. The 2009 biomass estimate was slightly higher than the 2008 estimate, and the 2010 biomass estimate was more than double the 2009 estimate. The 2006 and 2008 year classes appear to be strong, and stock abundance is expected to increase substantially in the near term; however, these follow a string of five consecutive sub-par year classes spawned from 2001-2005. The 2010 AI biomass estimate of 68,161 t was down 26 percent from the 2006 estimate, and is the lowest point in the survey time series. Updating the standard approach for estimating biomass distribution for the two areas for the time series through 2010 indicates that the best estimate is 91 percent in the EBS and 9 percent in the AI, replacing the previous proportions of 84 percent and 16 percent, respectively.

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 equated 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.

Projected ABC, OFL, and biomass levels are typically reported to three significant digits, except when quoting a Council-approved value with more than three significant digits or when a stock-specific ABC is apportioned among areas on a percentage basis, in which case four significant digits may be used if necessary to avoid rounding error. Fishing mortality rates are typically reported to two significant digits.

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 Plan Team's recommendations.

Reported catches are as of November 6, 2010.

Two-Year OFL and ABC Projections

Since 2005, annual assessments are no longer required for rockfishes since new data are limited during years when no groundfish surveys are conducted. Proposed and final 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 proposed 2011 and 2012 specifications will become effective when final rulemaking occurs in February or March 2011. The 2011 specifications (from Council recommendations in December 2009) will already be in place to start the fishery on January 1, 2011, but these will be replaced by final specifications recommended by the Council in December 2010. This process allows the Council to use the most current survey and fishery data in stock assessment models for setting the next two years' quotas, while having no gap in specifications. The 2012 ABC and OFL values recommended in next year's SAFE report are likely to differ from this year's projections for 2012 because of new (e.g., survey) information that is incorporated into the assessments.

In the case of stocks managed under tier 3, 2011 and 2012 ABC and OFL projections are typically based on the output for Scenarios 1 or 2 from the standard projection model using assumed (best estimates) of actual catch levels. For stocks managed under tiers 4-6, 2012 projections are set equal to the Plan Team's recommended values for 2011.

Ecosystem Considerations

This year, in response to SSC comments from a February 2010 workshop, the Ecosystem Chapter included a strong synthesis section that included a Bering Sea "Report Card". This report card substantially synthesized information on ecosystem-level production into a succinct summary of the current state and understanding of the Bering Sea ecosystem. The Plan Team strongly agreed with the methodology and results of this synthesis; they appear (Bering Sea specific) on page 1 of the Ecosystem Considerations chapter. Other aspects of ecosystems considerations were discussed during the Plan Team meeting as pertained to individual stocks. Important highlights follow.

1. New data on zooplankton (copepods and euphausiids) and pollock caloric contents, as reported in the chapter, suggest that from 2006-2010 conditions for planktivores (particularly pollock) were greatly improved from the time period 2001-2005; this information is consistent with the recent (including 2009-2010) results from the pollock assessment indicating recent above-average recruitment.
2. Trends in fish apex predators have remained stable over the last 20 years as a total complex; however, as individual species within the group, arrowtooth have greatly increased while cod has decreased.
3. There were questions on whether the ongoing decline in Northern fur seals could be attributed, in part, to the increase in arrowtooth flounder (and secondarily, skates) around the Pribilof Islands, as all three species have strong diet overlap. The Ecosystem Team offered to prepare a specific report or "Hot topic" for next year's assessment.
4. In addition to the ongoing concern about Steller sea lions in the Aleutian Islands, the Plan Team expressed concerns and interest in trends in the groundfish survey which are now apparent since the 2010 survey was the first since 2006. The large gap between surveys may have had consequences on how the ecosystem processes have been viewed and understood in the last few years; particularly with regard to the east/west proportioning of biomass. The Ecosystem Team offered to prepare an "Aleutian Islands" synthesis for next year, based largely on species guild trends as made available through the most recent survey.

Uncertainty

Statistical uncertainty is addressed in the individual assessments, and to some degree, by the tiers used to establish ABCs. In the past, statistical uncertainty or natural variability in the stock has led the Plan Team to recommend ABC values lower than the maximum permissible level for walleye pollock, Pacific cod, and Greenland turbot. The Plan Team's recommended 2011 and 2012 ABCs for EBS pollock are reduced by 41 percent and 29 percent, respectively. Bogoslof pollock ABCs are reduced by 99 percent in both years, in accord with the SSC approach (Table 6).

Effects of Cancelled Surveys

Except under tier 1, current harvest rules do not automatically adjust for assessment uncertainty. Assessment uncertainty is increasing in Alaska groundfish assessments because some surveys have been cancelled due to decreased funding. Lacking an uncertainty adjustment, ABC recommendations may risk long-term fishery

sustainability. To address this uncertainty, the Plan Team recommends: 1) increase funding so that surveys are not cancelled; and 2) modify harvest rules so that more tiers (especially 3 and 5) account for assessment uncertainty. The Plan Team specifically is concerned about species that rely on the Aleutian Islands trawl survey for biomass estimates, including Atka mackerel, walleye pollock, Pacific cod, and Pacific Ocean perch.

Economic Summary of the BSAI Commercial Groundfish Fisheries in 2008 – 2009: A Decomposition of the Change in First- Wholesale Revenues

According to data taken from the 2010 Economics SAFE report, first-wholesale revenues from the processing and production of Alaska groundfish in the BSAI dropped from $2.0 billion in 2008 to $1.5 billion in 2009, a decrease of 26 percent. During that same time-period, the total quantity of groundfish products from the BSAI decreased from 622,000 t to 589,000 t, a difference of 33,000 t. These changes in the BSAI mirror conditions for first wholesale revenues from Alaska groundfish fisheries overall which declined by 25.8 percent in 2009 relative to 2008 levels.

By species, negative price and quantity effects for pollock in 2008-09 dominate results of the first-wholesale revenue decomposition in the BSAI with a net effect of -$354 million, which was exacerbated by substantial negative price effect for Pacific cod of -$132 million (Fig. 4). By product group, the results for pollock show up primarily as negative price and quantity effects for surimi, with a net effect of -$307 million. The negative price effect for cod in the BSAI was expressed through a strong negative price effect of -$140 million in the whole head & gut product group. This negative price effect was offset to some degree by a positive quantity effect of $31.1 million in the BSAI whole head & gut product group, driven mainly by a positive quantity effect of $12.4 million for Atka mackerel.

Overall, the BSAI had negative quantity and price effects in the decomposition of the 2008-09 change in first-wholesale revenues. To summarize, the negative net effects were -$520 million for the BSAI, which implies that 87.5 percent of the total decrease of $594 million in Alaska groundfish first-wholesale revenues in 2008-09 is attributable to the BSAI. The difference of -32,600 t in processed groundfish products from the BSAI, a decrease of 5.2 percent relative to 2008, was 75.2 percent of the total change in processed products from Alaska groundfish fisheries in 2008-09. In comparison, the change was -10.3 percent between 2007-08 in processed groundfish products from the BSAI, and first wholesale revenues increased by 9.0 percent.

The first decomposition is by the species groups used in the Economics 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 (2009 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.

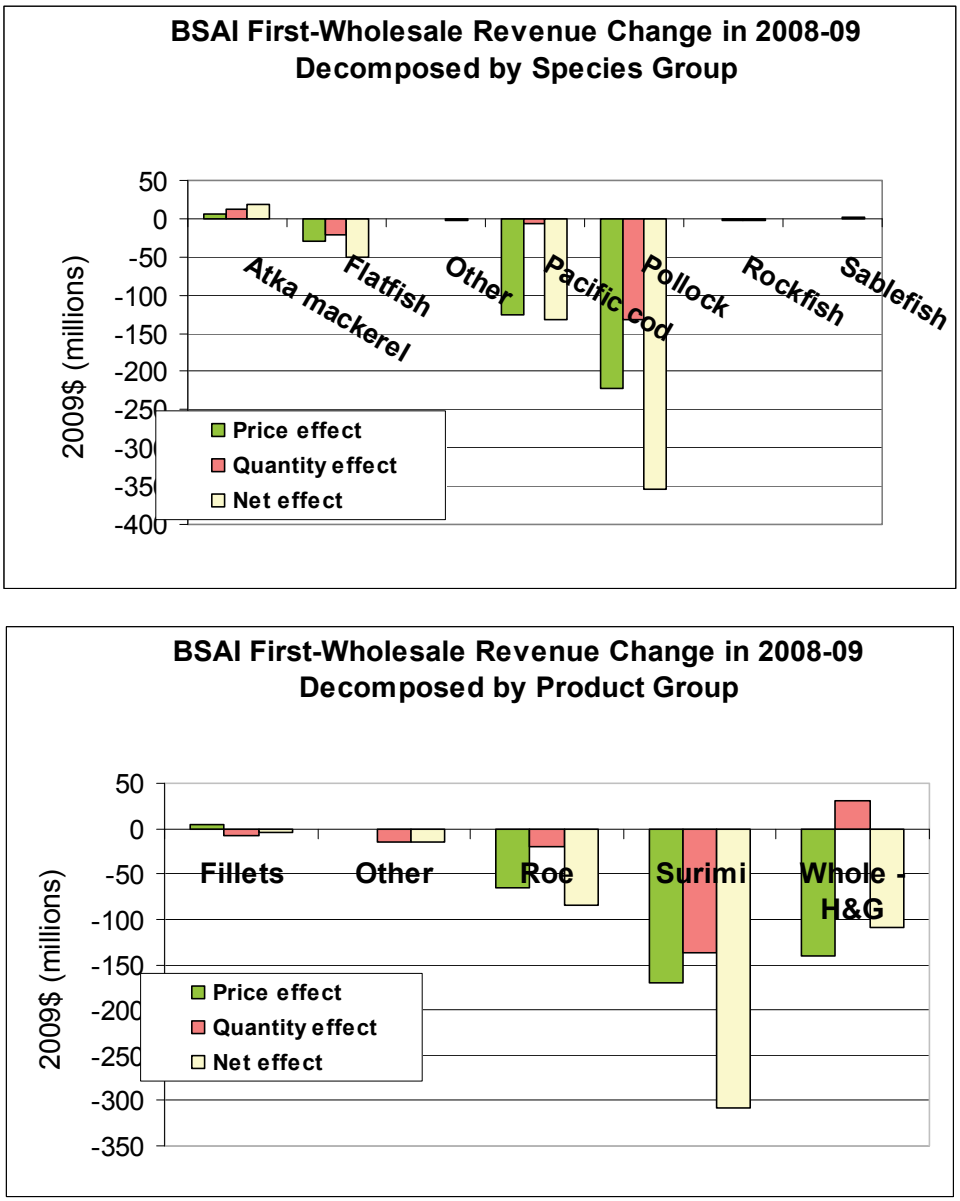


Figure 4. Decomposition of the change in first-wholesale revenues from 2008-09 in the BSAI area.

Stock Status Summaries

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 OFL and ABC for 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Age 3+ Biomass	OFL	ABC	TAC	Catch
Eastern Bering Sea	2009	6,240,000	977,000	815,000	815,000	810,743
	2010	4,620,000	918,000	813,000	813,000	809,238
	2011	9,620,000	2,450,000	1,270,000	n/a	n/a
	2012	11,300,000	3,170,000	1,600,000	n/a	n/a
Aleutian Islands	2009	197,000	34,000	28,200	19,000	1,779
	2010	307,000	40,000	33,100	19,000	1,266
	2011	242,000	44,500	36,700	n/a	n/a
	2012	n/a	50,400	41,600	n/a	n/a
Bogoslof	2009	292,000	58,400	7,970	10	73
	2010	110,000	22,000	156	50	131
	2011	110,000	22,000	156	n/a	n/a
	2012	110,000	22,000	156	n/a	n/a

Eastern Bering Sea

Changes from previous assessment

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

- Updated total catch for 2009 and a preliminary estimate of the 2010 catch.
- Updated age composition data and weight-at-age data from the 2009 fishery.
- Updated age composition data from the 2009 acoustic-trawl survey.
- Age composition data from the 2010 NMFS bottom trawl survey.
- Preliminary age composition from the 2010 acoustic-trawl survey (based on the age-length key from this year's bottom trawl survey, supplemented with 100 otoliths from this year's acoustic-trawl survey).
- Biomass estimates from the 2010 bottom trawl survey and the 2010 acoustic-trawl survey. The estimate from the bottom trawl survey was 3.75 million t, up 64 percent from the 2009 estimate, but still below average for the 1987-2010 time series. The estimate from the acoustic-trawl survey was 2.32 million t, up 151 percent from the 2009 estimate, but still below average for the 1979-2010 time series.
- Annual estimates of relative precision for the acoustic-trawl survey abundance data from 1994-2010 (previous assessments assumed a constant CV of 20 percent for these data).
- The only change to the final model was exclusion of the three most recent year classes from the data used to estimate the stock-recruitment relationship. Two changes were included in exploratory model runs, but not the final model: 1) Use of an ageing error matrix. 2) Use of a new acoustic index derived from opportunistic acoustic recordings from the fishing vessels chartered to conduct the bottom trawl survey, which has been shown to be consistent with the acoustic-trawl survey data and will be used in future assessments to provide mid-water abundance estimates during off-years for the acoustic-trawl survey.

Spawning biomass and stock status trends

Generally speaking, estimates of biomass from this year's assessment are higher than those from last year's assessment, particularly for the most recent part of the time series. For example, estimates of age 3+ biomass

from this year's assessment are within 3 percent of those from last year's assessment for the period 2000-2003 and within 9 percent for the period 2004-2008, but they are 31 percent and 43 percent higher for 2009 and 2010, respectively.

Spawning biomass for 2008 was the lowest since 1980, but has increased steadily since then, with a further increase of 30 percent projected from 2010 to 2011. The 2008 low was the result of extremely poor recruitments from the 2002-2005 year classes. Recent and projected increases are fueled by strong recruitments from the 2006 and 2008 year classes (it should be noted, however, that the strength of the 2008 year class is still highly uncertain). Spawning biomass is estimated to be 4 percent below B_{MSY} in 2010, and projected to be 25 percent above B_{MSY} in 2011.

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 Plan Team concurs with the assessment authors' conclusion that the tier 1 reference points continue to be reliably estimated, although the Plan Team would like to see more explicit criteria established for making this determination.

The updated estimate of B_{MSY} from the present assessment is 1.95 million t. Projected spawning biomass for 2011 is 2.44 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 0.564, up 51 percent from last year's value of 0.373. The harvest ratio of 0.564 is multiplied by the geometric mean of the projected fishable biomass for 2011 (3.82 million t) to obtain the maximum permissible ABC for 2011, which is 2.15 million t, up 164 percent from the 2010 ABC and up 94 percent from the 2011 ABC projected in last year's assessment.

The authors recommend setting ABCs for 2011 and 2012 below the maximum permissible level, specifically, at values corresponding to the average harvest rate over the most recent five complete years (0.33). Projected harvests at this rate results in ABCs for 2011 and 2012 equal to 1.27 million t and 1.60 million t, respectively. The Plan Team agreed with the authors' recommended ABCs well below the maximum permissible is the large gap in the age structure created by poor recruitments from the 2002-2005 year classes. While the Plan Team has recommended ABCs in excess of 2 million t in previous years when biomass was very high, the stock contained multiple large cohorts in those years, whereas about half of next year's catch is likely to come from a single year cohort (2006). Because recruitment is largely driven by environmental conditions, the Plan Team also felt that it would be advisable to not take full advantage of the present large biomass as a hedge against the possibility that the environment might return to the conditions that produced poor recruitment during the 2002-2005 period.

The OFL harvest ratio under tier 1a is 0.640, 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 2011 gives the OFL for 2011, which is 2.45 million t. The current projection for OFL in 2012 given a 2011 catch of 1.27 million t is 3.17 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

Multiple sources of information indicate that EBS pollock biomass is increasing. Relative abundance of euphausiids, a key item in the diet of pollock, increased for several years through 2009. This indicates that pollock prey is generally abundant, while the slight downturn in euphausiid abundance observed in 2010 should be monitored to determine if top-down control resulting from increased pollock abundance may be occurring.

The current draft of the Steller sea lion Biological Opinion does not indicate that reductions in the EBS pollock ABC are necessary to avoid jeopardizing the recovery of species listed under the ESA.

Aleutian Islands

Changes from previous assessment

The new data in the model consists of updated catch information -- 2010 catch estimates and updated values for 2003 through 2009, catch at age data from the 2007 and 2008 Aleutian Islands Cooperative Acoustic Survey Study, and the 2010 Aleutian Islands bottom trawl survey biomass estimate. In this year's assessment, the model adopted last year by the Plan Team and SSC was presented, along with one other model. The only difference is that the latter model includes an ageing error matrix.

Spawning biomass and stock status trends

This year's assessment estimates that spawning biomass reached a minimum level of about $B_{22\%}$ in 1999, then increased steadily through 2006 to a level around $B_{33\%}$, and remained fairly close to that level through the present. 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, and the 2000 year class was the first to exceed the median level since the 1993 year class. Spawning biomass for 2011 is projected to be 80,900 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 Plan Team concurs and supports continued use of the reference model with the addition of an ageing error matrix (Model A1_AE) for evaluating stock status and recommending ABC. The reference model estimates $B_{40\%}$ at a value of 108,000 t, placing the AI pollock stock in sub-tier "b" of tier 3. Under tier 3b, with $F_{40\%}$=0.35, the maximum permissible ABC is 36,700 t for 2011. The Plan Team recommends setting 2011 ABC at this level. Following the tier 3b formula with $F_{35\%}$=0.44, OFL for 2011 is 44,500 t. Given a 2011 catch of 19,000 t, the maximum permissible ABC is 35,600 for 2012 and the projected OFL is 43,300 t. If the 2011 catch is only 1,090 t (i.e., equal to the five year average), the 2012 maximum permissible ABC would be 41,600 and the 2012 OFL would be 50,400 t. The Plan Team recommends setting 2012 ABC at this level.

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

Changes from previous assessment

The 2009 Bogoslof pollock acoustic-trawl survey resulted in the lowest estimate of biomass (110,000 t) in the region since the acoustic-trawl survey began in 1988. There was no survey in 2010. The next survey is planned for 2011.

Spawning biomass and stock status trends

Survey biomass estimates since 2000 have all been lower than estimates prior to 2000, ranging from a low of 110,000 t in 2009 to a high of 301,000 t in 2000.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that this stock qualifies for management under tier 5. Traditionally, the ABC for this stock has been set using a formula similar to the tier 3 formula, but substituting a reference biomass level of 2 million t for $B_{40\%}$. The Plan Team concurs with the authors' recommendation to continue this practice. Given $F_{40\%}$=0.27, this results in F_{ABC}=0.0014 and a 2011 ABC of 156 t. The projected ABC for 2012 is the same.

Following the tier 5 formula with M=0.20, OFL for 2011 is 22,000 t. The OFL for 2012 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010. *the federal TAC is reduced from the ABC level to account for State water harvests.

Area	Year	Age 3+ biomass	OFL	ABC	TAC*	Catch
BSAI	2009	1,260,000	212,000	182,000	176,540	175,746
	2010	1,140,000	205,000	174,000	168,780	159,012
	2011	1,560,000	272,000	235,000	NA	NA
	2012	1,750,000	329,000	281,000	NA	NA

Changes in assessment data

All survey and commercial data series on CPUE, catch at age, and catch at length were updated. The 2010 Eastern Bering Sea trawl survey showed a 100 percent increase in biomass over 2009.

Change in assessment methods

The cod assessments in the GOA and BSAI have been the object of a great deal of scrutiny and development over the last five years. The accuracy of age readings for this stock has been a continuing concern, mainly because the mean size at age from age readings does not match the first three clear modes of cod length frequencies in the Bering Sea trawl survey. Other issues have been the natural mortality rate, the trawl survey catchability coefficient, the modeling of commercial selectivity (variable or not, asymptotic or not, fishery by fishery), and the modeling of growth (constant, cohort-specific, year-specific). In 2010 there were two rounds of model proposals, trials, and reviews by the Plan Teams and SSC (May/June and September/October) that produced the three candidate models (A, B, and C) for the 2011 OFL/ABC specifications. Model A was the 2009 preferred model, whose main features were:

(i) Natural mortality $M = 0.34$ fixed externally.

(ii) Length-specific commercial selectivities, estimated in blocks of years, some forced to be asymptotic. Commercial age compositions fitted where available (only one record is available), length compositions where not. Commercial CPUE not fitted.

(iii) Age-specific trawl survey selectivity with annually varying left limb. Trawl survey age composition and CPUE fitted. The average product of catchability and selectivity of 60-80 cm fish required to be 0.47 based on a small set of data from archival tag recoveries.

(iv) IPHC longline survey length compositions (not CPUE) fitted.

(v) Cohort-specific growth parameters, with the standard deviation of length at age estimated externally.

(vi) Aging bias of +0.4 years at ages 2+ estimated by profiling and accounted for.

(vii) Input standard deviations of a number of parameters estimated iteratively so as to match output standard deviations.

Model B was the same as Model A with some incremental modifications, viz:

(i) Smaller length bins (1 cm instead of 3 and 5) to make full use of the length data.

(ii) Five fishery seasons were modeled instead of 3.

(iii) A single growth schedule was fitted.

(iv) the few fishery length-at-age data and age composition data were left out.

(v) IPHC survey length data were left out.

(vi) Parameter values estimated iteratively in the 2009 assessment were carried over to Model B.

Model C was the same as Model B but all age composition and length-at-age data were left out because of concern about ageing bias.

Author and Team evaluation of alternative models

All model fits to EBS survey abundance were good. All models produced similar estimates of EBS trawl survey selectivity at age, although the estimates from Model C appeared to be shifted by one year relative to Models A and B. Historical abundance estimates for all models were similar. All models fitted the catch length compositions well. Models A and B fitted the age compositions well.

Model A approximated the modes in EBS survey length frequencies reasonably well, but Model B did so less well. Model C matched the modes very closely but at ages that were higher by a year because the fitted growth schedule was unconstrained. The author explained that this could happen because there were no age or size-at-age data whatsoever-in the model, so the model could fit the data with length-at-age, survey selectivity at age, and cohort strengths shifted relative to Models A and B. This anomaly could probably be fixed in a future assessment.

The author adopted a number of criteria for choosing a best model, according to which Model B was better than Model A (better bin and season structure, more parsimonious), and Model C was disqualified because of the anomalous length-at-age in the EBS. (the impossibly high abundance estimates from Model C in the GOA also influenced the decision.) the BSAI and GOA Teams both agreed with the author's choice of Model B and his rationale.

Tier determination/ Plan Team discussion and resulting ABC and OFL recommendations

$B_{40\%}$ for this stock is estimated to be 384,000 t and projected spawning biomass in 2011 according to Model B is 358,000 t, so this stock is assigned to tier 3b. While there remains some concern about the value of trawl survey catchability used in the assessment, neither the author nor the Team saw any compelling reason to recommend OFL or ABC values lower than prescribed by the standard control rule. The current values of $F_{35\%}$ and $F_{40\%}$ are 0.31 and 0.26, respectively; the tier 3b adjusted values are 0.29 and 0.25, respectively.

Status determination

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

Spawning biomass and stock status trends

Recent catches have been well below OFL. The stock is not overfished, or being overfished. The 2006 and 2008 year classes appear to be strong, and stock abundance is expected to increase substantially in the near term.

Ecosystem considerations

No special features were identified that would require adjustments to the recommended ABCs and reference points.

Area apportionment

At present, the ABC of Pacific cod is not apportioned between the EBS and AI. A simple comparison of catches and relative survey abundance shows that the exploitation rate in the Aleutian Islands has been about twice that in the Bering Sea. The Team is in favor of implementing an area apportionment that would equalize the exploitation rates. The SSC has recommended that the stock be managed under a combined BSAI OFL and separate BS and AI ABCs in the near future.

3. Sablefish

Status and catch specifications (t) of sablefish 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Age 4+ Biomass	OFL	ABC	TAC	Catch
Bering Sea	2009	39,000	3,210	2,720	2,720	891
	2010	38,000	3,310	2,790	2,790	721
	2011	37,000	3,360	2,850	n/a	n/a
	2012	35,000	3,080	2,610	n/a	n/a
Aleutian Islands	2009	28,000	2,600	2,200	2,200	1,096
	2010	27,000	2,450	2,070	2,070	1,049
	2011	25,000	2,250	1,900	n/a	n/a
	2012	23,000	2,060	1,740	n/a	n/a

Changes from previous assessment

The assessment model incorporates the following new data into the model:

- relative abundance and length data from the 2010 longline survey
- relative abundance and length data from the 2009 longline and trawl fisheries
- age data from the 2009 longline survey and longline fishery
- updated 2009 catch and estimated 2010 catch.

Longline survey relative population weight (RPW) were eliminated from the model; only relative population numbers (RPN) from longline surveys were fit. The survey abundance index increased 13 percent from 2009 to 2010 and follows a 16 percent decrease between 2006 and 2009. The fishery abundance index was down 17 percent from 2008 to 2009 (2010 data not yet available).

Spawning biomass and stock status trends

Spawning biomass has increased from a low of 30 percent of unfished biomass in 2002 to a projected 37 percent in 2011. The 1997 year class has been an important contributor to the population but has been reduced and should comprise 10 percent of the 2011 spawning biomass. The 2000 year class appears to be larger than the 1997 year class, and is now 95 percent mature and should comprise 24 percent of the spawning biomass in 2011. The 2002 year class is beginning to show signs of strength and will comprise 9 percent of spawning biomass in 2011, when 86 percent of the individuals will be mature.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Sablefish are managed under tier 3. Reference points are calculated using recruitments from 1979-2008. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from this assessment are 110,108 t (combined across the EBS, AI, and GOA), 0.097, and 0.115, respectively. Projected female spawning biomass (combined areas) for 2011 is 102,139 t (90 percent of $B_{40\%}$), placing sablefish in sub-tier "b" of tier 3. The maximum permissible value of F_{ABC} under tier 3b is 0.089, which translates into a 2011 ABC (combined areas) of 16,000 t. The OFL fishing mortality rate is 0.106 which translates into a 2011 OFL (combined areas) of 19,000 t.

Area allocations

Using established procedures for determining area apportionments, the Bering Sea OFL and ABC for 2011 are 3,360 t and 2,850 t and for 2012 are 3,080 t and 2,610 t. The Aleutian Islands OFL and ABC for 2011 are 2,250 t and 1,900 t and for 2012 are 2,060 t and 1,740 t.

Status determination

Sablefish is not being subjected to overfishing, is not overfished, and is not 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Age 6+ Biomass	OFL	ABC	TAC	Catch
BSAI	2009	1,870,000	224,000	210,000	210,000	107,513
	2010	1,960,000	234,000	219,000	219,000	114,600
	2011	1,960,000	262,000	239,000	NA	NA
	2012	1,980,000	266,000	242,000	NA	NA

Changes from previous assessment

Changes to the input data for this year's assessment include:

- 2009 fishery and survey age compositions
- 2010 trawl survey biomass point estimate and standard error
- estimates of the discarded and retained portions of the 2009 catch
- estimate of total catch through the end of 2010.

This year's EBS bottom trawl survey resulted in a biomass estimate of 2,370,000 t, compared to last year's survey biomass of 1,740,000 t (an increase of 36 percent).

Spawning biomass and stock status trends

The projected female spawning biomass estimate for 2011 is 587,000 t. Based on the most recent time series of estimated female spawning biomass, the projected 2011 female spawning biomass estimate continues the generally monotonic decline in model estimates of spawning biomass exhibited since 1994. Above average recruitment from the 1995 and 1999 year-classes is expected to maintain the abundance of yellowfin sole at a level above $B_{40\%}$ for the next several years. Projections suggest a stable female spawning biomass in the near future if the fishing mortality rate continues at the same level as the average of the past 5 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. Accordingly, yellowfin sole qualify for management under tier 1; however, the Plan Team would like to see more explicit criteria established for making this determination. The estimate of B_{MSY} from the present assessment is 374,000 t. The 1978-2003 spawner recruit data were used this year as the basis to determine the tier 1 harvest recommendation. This provided an $F_{ABC} = F_{harmonic}$ mean of $F_{MSY} = 0.12$. The current value of $F_{OFL} = F_{MSY}$ is 0.13. The product of the harmonic mean of F_{MSY} and the geometric mean of the 2011 biomass estimate produces the author- and Plan Team-recommended 2011 ABC of 239,000 t and the corresponding product using the arithmetic mean produces the 2011 OFL of 262,000 t. For 2011, the corresponding quantities are 242,000 t and 266,000 t, respectively.

The Team discussed the potential merits and ramifications of different approaches to estimating time-varying fishery selectivity. The author estimated time-varying selectivity on an annual basis. This was contrasted with the approach used for some other species, such as Pacific Ocean perch in which fishery selectivity was estimated in 4-year blocks. For population projections, the selectivity from the most recent year was used by the author.

Status determination

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

Ecosystem Considerations summary

The assessment contains an ecosystem feature that represents catchability of the EBS shelf trawl survey as an exponential function of average annual bottom temperature.

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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Age 1+ Bio.	OFL	Subarea	ABC	TAC	Catch
BSAI	2009	105,000	14,900		7,380	7,380	4,512
				EBS	5,090	5,090	2,249
				AI	2,290	2,290	2,263
BSAI	2010	61,100	7,460		6,120	6,120	3,589
				EBS	4,220	4,220	1,706
				AI	1,900	1,900	1,883
BSAI	2011	74,000	7,220		6,140	n/a	n/a
				EBS	4,590	n/a	n/a
				AI	1,550	n/a	n/a
BSAI	2012	69,700	6,760		5,750	n/a	n/a
				EBS	4,300	n/a	n/a
				AI	1,450	n/a	n/a

Changes from previous assessment

This year's Greenland turbot assessment model included:

- updated 2009 and 2010 catch data
- 2010 EBS shelf and slope survey biomasses (shelf survey biomass was 24,000 t; more than double the 2009 biomass)
- length composition estimates
- 2010 AI survey data were evaluated for changes in relative abundance between regions.

As with last year's assessment Stock Synthesis 3 (SS3) was used for modeling Greenland turbot this year. However, rather than using individual estimates of recruitment for the 1960s, a separate expected value period from 1960-1969 was assumed for recruitment.

Spawning biomass and stock status trends

The projected 2011 female spawning biomass is 45,500 t. Compared to the 2010 spawning biomass of 40,000 t. This represents an increase and a reversal of the general decline that had been prevalent since the mid-1970s. While spawning biomass continues to decline, age 0 recruitment appears to have improved substantially in 2008 and 2009.

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. Greenland turbot therefore qualifies for management under tier 3.

The Plan Team discussed indicators suggesting that the long-term decreasing abundance of Greenland turbot may finally be ending, including the marked rise in trawl survey biomass and the very large influx of new recruits. Given these changes and the model results the Plan Team agreed with the author's ABC and OFL recommendations.

Updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 28,400 t, 0.25, and 0.29, respectively. Projected spawning biomass for 2011 is 45,500 t, placing Greenland turbot in sub-tier "a" of tier

3. The maximum permissible value of F_{ABC} under this tier translates into a maximum permissible ABC of 6,140 t for 2011 and 5,750 t for 2012. In keeping with past management, the Plan Team agrees with the authors that ABC be apportioned on the basis of 75 percent EBS and 25 percent AI. The OFLs for 2011 and 2012 under the tier 3a formula are 7,220 percent and 6,760 t, respectively.

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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010. Catch for 2009/2010 includes Kamchatka flounder.

Area	Year	Age 1+ Bio.	OFL	ABC	TAC	Catch
BSAI	2009	1,140,000	190,000	156,000	75,000	30,419
	2010	1,120,160	190,800	156,300	75,000	38,098
	2011	1,120,000	186,000	153,000	n/a	n/a
	2012	1,130,000	191,000	157,000	n/a	n/a

Changes from previous assessment

Input data of the present assessment includes arrowtooth flounder since the SSC agreed with Plan Team recommendations in September to manage Kamchatka flounder under separate harvest specifications. New input data include:

- fishery catch and discards for 2009 and through 15 October 2010
- 2010 shelf, slope and Aleutian Islands surveys size composition and biomass point-estimates and standard errors.

The current model includes the Aleutian Islands, Bering Sea slope and Bering Sea shelf. The biomass is modeled with 76 percent of the stock on the shelf, 14 percent in the Aleutian Islands and 10 percent on the Bering Sea slope. Examination of Bering Sea shelf survey biomass estimates indicate that some of the annual variability seemed to positively co-vary with bottom water temperature.

Spawning biomass and stock status trends

The 2010 stock assessment model resulted in a 2011 biomass projection of 1,120,000 t. This is a small increase from the value of 1,100,000t projected in last year's assessment for 2010. There is a long-term trend of increasing arrowtooth flounder biomass in the EBS. If the harvest rate remains close to the recent average, this trend is expected to continue for the next few years as strong recruitment was observed in the early part of this decade.

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 was assessed for management under tier 3. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 280,000 t, 0.23, and 0.29, respectively. Given that the projected 2011 spawning biomass of 806,000 t exceeds $B_{40\%}$, the Team's ABC and OFL recommendations for 2011 were calculated under sub-tier "a" of tier 3. The Team recommends setting F_{ABC} at the $F_{40\%}$ (0.23) level, which is the maximum permissible level under tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2011 ABC of 153,000 t. The OFL fishing mortality rate under tier 3a is $F_{35\%}$ (0.29), which translates to a 2011 OFL of 186,000 t.

As there is little to no fishery for arrowtooth flounder, the model is mostly driven by the survey data. More female arrowtooth flounder are caught than males in the surveys, resulting in estimates of differential mortality for males and females. With fixed female M=0.2, the run with male M=0.35 provides a reasonable fit to all the data components and is consistent with observations of differences in sex ratios observed from trawl surveys.

The maximum shelf survey selectivity for males occurs at 0.93 for age 8 fish. The base model includes Aleutian Islands data again this year.

Status determination

Arrowtooth flounder is a largely unexploited stock in the BSAI. Arrowtooth flounder will be managed on its own (i.e., as something other than a constituent stock of the former arrowtooth/Kamchatka complex) for the first time in 2011. Strictly speaking, therefore, there is no arrowtooth-only OFL against which annual catch of arrowtooth can be compared. However, given that arrowtooth accounted for the vast majority of the biomass in the arrowtooth/Kamchatka complex, it could be argued that the OFL for the complex should be viewed as a proxy for an arrowtooth-only OFL, in which case it would be concluded that arrowtooth is not being subjected to overfishing. Arrowtooth flounder is not overfished and is not approaching an overfished condition.

Ecosystem Considerations summary

As opposed to the Gulf of Alaska, Arrowtooth flounder are not at the top of the food chain on the eastern Bering Sea shelf. Arrowtooth flounder in the Bering Sea are an occasional prey in the diets of groundfish in the Bering Sea, being eaten by Pacific cod, walleye pollock, Alaska skates, and sleeper sharks. However, given the large biomass of these species in the Bering Sea overall, these occasionally recorded events translate into considerable total mortality for the population in the Bering Sea ecosystem.

A 30-yr ecosystem simulation provided interesting results. Examining the effects of arrowtooth flounder on other species showed that a decrease of arrowtooth flounder by 10 percent decreased arrowtooth flounder adults and juveniles, slightly increased flathead sole and produced a negligible effect on pollock. If arrowtooth flounder increased by 50 percent, the result could be significantly different, as seen in the GOA simulation. Currently both Pacific cod and arrowtooth flounder are negatively affecting pollock biomass.

Arrowtooth flounder is a potential competitor to seals because their food sources are roughly the same. The impact of arrowtooth flounder on seals has not been studied and may be investigated in the near future.

The assessment contains an ecosystem feature that represents catchability of the EBS shelf trawl survey as an exponential function of average annual bottom temperature.

6b. 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Age 1+ Bio.	OFL	ABC	TAC	Catch
BSAI	2011	129,000	23,600	17,700	n/a	n/a
	2012	129,000	23,600	17,700	n/a	n/a

Prior to this assessment, this species was a constituent of the arrowtooth flounder/Kamchatka flounder complex. Due to the recent development of a targeted fishery on Kamchatka flounder it is no longer appropriate to manage this species as part of the former complex due to potential disproportionate harvest since the complex ABC exceeds the estimated biomass of Kamchatka flounder.

Changes from previous assessment

The data used in this assessment includes estimates of total catch and bottom trawl survey biomass estimates from the Bering Sea shelf, slope and Aleutian Islands surveys.

Spawning biomass and stock status trends

This is the first year to conduct a separate stock assessment of Kamchatka flounder. Spawning biomass is not available. Kamchatka flounder have a widespread distribution along the deeper waters of the Bering Sea/Aleutian Islands region and are believed to be at a high level as discerned from the increases in survey estimates from the time-series of Bering Sea shelf, slope and Aleutian Islands surveys. The 2010 combined estimate of total biomass from the three surveys is 128,800 t. Exploitation rates estimated for 2008-2010 have steadily increased from 5 percent in 2008, to 10 percent in 2009, and 15 percent in 2010.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Given the limited amount of biological information available for Kamchatka flounder, they are qualified to be managed under tier 5 of Amendment 56 to the BSAI groundfish management plan, and thus have harvest recommendations which are directly calculated from estimates of biomass and natural mortality. The tier 5 formula for calculating maximum permissible ABC is: maxABC = 0.75 x M x average biomass. ABC calculated from this formula is sensitive to the fluctuations in annual biomass estimated from bottom trawl surveys (shelf survey CV is 10%, Aleutians CV = 30%). In order to lessen this effect, annual estimates of Kamchatka flounder abundance (using trawl survey estimates when they are available and filling in missing years with the average of the closest previous and future year which bracket the missing year) from the three surveys were summed and then ABC was calculated using running averages which ranged from 3 to the 7 most recent years (all with M = 0.2). ABC estimates from these five methods indicate that the effect of annual variability on the estimate of ABC and OFL can be dampened by including more years in the estimation calculation, which was particularly evident in the years of biomass increase from the past five years (Fig. 6.5-6 and table 6.5-3). The seven year moving average is chosen for the ABC and OFL calculations for 2011 since it has the most resilience to the trawl survey variability and gives estimates which are close to the other moving averages. The recommended 2011 F_{OFL}, F_{ABC}, OFL, and ABC are 0.20, 0.15, 23,600 t, and 17,700 t, with a biomass estimate of 129,000 t.

Status Determination

Kamchatka flounder will be managed on its own (i.e., as something other than a constituent stock of the former arrowtooth/Kamchatka complex) for the first time in 2011. Therefore, there is no OFL against which annual catch can be compared, meaning that the status of Kamchatka flounder with respect to overfishing is undefined. Assuming that Kamchatka flounder will be managed under tier 5, it is not possible to determine whether this stock is overfished or whether it is approaching an overfished condition.

Ecosystem Considerations

Kamchatka flounder have rarely been found in the stomachs of other groundfish species in samples collected by the Alaska Fisheries Science Center. Pollock was the most important prey item for all sizes of Kamchatka flounder, ranging from 56 to 86 percent of the total stomach content weight. An examination of diet overlap with arrowtooth flounder indicated that these two congeneric species basically consume the same resources. The populations of arrowtooth flounder which have occupied the outer shelf and slope areas of the Bering Sea over the past twenty years for summertime feeding do not appear food-limited. These populations have fluctuated due to the variability in recruitment success which suggests that the primary infaunal food source has been at an adequate level to sustain the arrowtooth flounder resource. Changes in the physical environment which may affect Kamchatka flounder distribution patterns, recruitment success, and migration timing and patterns are catalogued in the Ecosystem Considerations Appendix of this SAFE report. Habitat quality may be enhanced during years and warmer bottom water temperatures with reduced ice cover (higher metabolism with more active feeding). Environmental factors important to juvenile survival are presently not well known.

7. 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Age 2+ Bio	OFL	ABC	TAC	Catch
BSAI	2009	1,630,000	301,000	296,000	90,000	48,593
	2010	1,570,000	243,000	240,000	90,000	53,111
	2011	1,870,000	248,000	224,000	n/a	n/a
	2012	1,860,000	243,000	219,000	n/a	n/a

Changes from previous assessment

Changes to input data in this analysis include:

- 2009 fishery age composition;
- 2009 survey age composition
- 2010 trawl survey biomass point estimate and standard error
- updated fishery catch and discards for 2009
- fishery catch and discards through 26 September 2010.

The major change to the model is implementation of time-varying, sex-specific fishery selectivity.

Spawning biomass and stock status trends

The stock assessment model resulted in a 2011 age-2+ biomass estimate of 1,870,000 t. This was an increase in the biomass estimate compared to the 2011 estimate of 1,580,000 t obtained in last year's assessment. The rock sole stock is expected to remain stable or increase because of good recruitment from the 2000- 2005 year classes.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that northern rock sole qualifies as a tier 1 stock. In past years, one difficulty with applying the tier 1 formulae to rock sole is that the harmonic and arithmetic means of the F_{MSY} distribution are extremely close, resulting in little buffer between recommendations of ABC and OFL. This closeness results from estimates of F_{MSY} that are highly certain. The use of a time-varying fishery selectivity increased the buffer between ABC and OFL from 1.4 percent in 2009 to 9.6 percent in 2010.

The tier 1 2011 ABC harvest recommendation is 224,000 t ($F_{ABC} = 0.13$) and a 2010 OFL of 248,000 t ($F_{OFL} = F_{MSY} = 0.15$). Because of the implementation of the time-varying fishery selectivity this year there was a 24,000 t difference between the ABC and OFL levels, an increase of 20,000 t over the difference estimated in the 2009 assessment.

Status determination

This is a stable fishery that lightly exploits the stock because it is constrained by prohibited species catch limits and the BSAI optimum yield limit. Usually the fishery only takes a small portion of the northern rock sole ABC. Northern rock sole is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition. The exploitation rate is about 0.03.

8. 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
BSAI	2009	834,000	83,800	71,400	60,000	19,558
	2010	785,000	83,100	69,200	60,000	19,863
	2011	791,000	83,300	69,300	n/a	n/a
	2012	786,000	82,100	68,300	n/a	n/a

Changes from previous assessment

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

- 2009 fishery catch data was updated and the 2010 catch through September 25, 2010 was added to the assessment.
- Sex-specific size compositions from the 2010 fishery, based on observer data, were added to the assessment. Fishery size compositions from 2009 were updated.

- estimated survey biomass and standard error from the 2010 EBS trawl survey were added to the assessment.
- Sex-specific size compositions from the 2010 EBS trawl survey were added to the assessment.
- Sex-specific age compositions from the 2009 EBS trawl survey were added to the assessment.
- mean bottom temperature from the 2010 EBS trawl survey was added to the assessment.

The preferred model is identical to that selected in last year's assessment.

Spawning biomass and stock status trends

Spawning biomass declined continuously from a high of 328,000 t in 1997 to a minimum of 240,000 t in 2009 and 2010. The projected 2011 and 2012 values are 241,000 t and 237,000 t, respectively. The 2001, 2003, and 2007 year classes are estimated to be above average, but recruitments from 1988-2007 on average have been much lower than recruitments from 1974-1987.

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 $B_{40\%}$=134,000 t, $F_{40\%}$=0.28, and $F_{35\%}$=0.34. Because projected spawning biomass for 2011 (241,000 t) is above $B_{40\%}$, flathead sole is in sub-tier "a" of tier 3. The authors and Plan Team recommend setting ABCs for 2011 and 2012 at the maximum permissible values under tier 3a, which are 69,300 t and 68,300 t, respectively. The 2011 and 2012 OFLs under tier 3a are 83,300 t and 82,100 t, respectively.

Status determination

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

9. 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Age 3 + Bio	OFL	ABC	TAC	Catch
BSAI	2009	1,500,000	298,000	232,000	50,000	13,698
	2010	2,257,000	278,000	224,000	50,000	15,771
	2011	780,000	79,100	65,100	n/a	n/a
	2012	788,000	83,800	69,100	n/a	n/a

Changes from previous assessment (to include model changes as well as new data incorporated)

Input data included:

- updated 2010 survey catch
- fishery catch through 15 October 2010
- 2010 trawl survey biomass estimate and standard error
- 2010 length composition of survey catch
- 2009 survey age composition

Sex-specific natural mortality was included in the split-sex model developed last year. Natural mortality was estimated for each sex in this year's assessment at a value of 0.13, replacing the previous literature-derived value of 0.25. This halving of the natural mortality rate from last year's assessment lowered the current and historic estimates of total and female spawning biomass and recruitment.

Spawning biomass and stock status trends

Female spawning biomass decreased from 1985 to 1998, and has been relatively stable since then. Total biomass peaked in 1984, then decreased through 2001, and has increased steadily since. The increase in total biomass is expected to continue. The shelf survey biomass has been fairly steady since the mid-1980s.

Recruitment has been increasing since the mid-1990s, with exceptionally strong age-3 recruitment from the 2001 and 2002 year classes. This good recruitment will support the increasing trend in this stock.

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 3a. The updated point estimates are $B_{40\%}$ = 178,000 t, $F_{40\%}$ = 0.15, and $F_{35\%}$ = 0.19. As a consequence of the reduced M used in the model, these are values are now in the range expected for flatfishes. Given that the projected 2011 spawning biomass of 319,000 t exceeds $B_{40\%}$, the ABC and OFL recommendations for 2011 were calculated under sub-tier "a" of tier 3. Projected harvesting at the $F_{40\%}$ level gives a 2011 ABC of 65,100 t. The OFL was determined from the tier 3a formula, which gives a 2011 OFL of 79,100 t.

The estimated total biomass of Alaska plaice is now much lower than in the past because of the new estimates of natural mortality. The ABC is about one-third that of 2010.

Status determination

Alaska plaice is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition. There is no targeted fishery for this species as there is no market. The total exploitation rate is quite low for Alaska plaice as it is caught only as incidental catch and is mostly discarded.

10.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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Total Bio.	OFL	ABC	TAC	Catch
BSAI	2009	121,000	23,100	17,400	17,400	2,155
	2010	121,000	23,000	17,300	17,300	2,179
	2011	127,000	19,500	14,500	n/a	n/a
	2012	127,000	19,500	14,500	n/a	n/a

Changes from previous assessment

The species currently collected in the "other flatfish" category in the Eastern Bering Sea survey are Arctic flounder, butter sole, curlfin sole, deepsea sole, Dover sole, English sole, longhead dab, Pacific sand dab, petrale sole, rex sole, roughscale sole, sand sole, slender sole, starry flounder, and Sakhalin sole. The species currently collected in the "other flatfish" category in the Aleutian Islands survey are Dover sole, rex sole, starry flounder, butter sole and English sole. Starry flounder, rex sole and butter sole comprise the majority of the species caught with a negligible amount of other species caught. Starry flounder continues to dominate the shelf survey biomass in the EBS and rex sole is the most abundant "other" flatfish in the Aleutian Islands.

The assessment incorporates:

- 2010 total catch and discard through 16 October 2010
- 2010 EBS and AI trawl survey data.

Because the natural mortality for Alaska plaice was changed to 0.13, the natural mortality rate for species other than Dover and rex sole was changed from 0.20 to 0.15.

Spawning biomass and stock status trends

Because this complex is managed under tier 5, no models are available from which to predict future trends. Changes in survey biomass per species are noted over time. For example, there is no consistent trend in the survey biomass of EBS butter sole over time. The 1982 estimate was 182 t compared to the 2010 estimate of 1,750 t, with fluctuations as high as 6,340 t in 1986 and as low as 37 t in 1983. EBS starry flounder biomass increased from 7,780 t in 1982 to 80,400 t in 2010. This estimate has fluctuated over time, though there has been an upward trend. Conversely, EBS longhead dab has decreased from 104,000 t in 1982 to 11,600 t in 2010. Habitat and depth preference may affect the apparent changes in abundance, i.e., longhead dab are found

in inshore waters that are not normally sampled by the survey. Thus distributional changes, onshore-offshore or north-south might affect the survey biomass estimates (Table 10.5).

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) in the GOA SAFE document are used, along with a value of 0.15 for all other species in the complex. Projected harvesting at the 0.75 M level (average F_{ABC} = 0.13), gives a 2011-2012 ABC of 14,500 t for the "other flatfish" species. The corresponding 2011-2012 OFLs (average F_{OFL} = 0.17) are 19,500 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.

Before the implementation of Amendment 80, this group of fisheries is usually closed for trawl gear prior to attainment of TAC because of the bycatch of Pacific halibut, a prohibited species. With the implementation of Amendment 80, a higher TAC for other flatfishes was assigned for 2008, though there was not a higher catch taken in 2009 or 2010. The 2010 fishery is still open as of this writing.

11.Pacific Ocean Perch (POP)

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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Age 3+ Bio	OFL	Subarea	ABC	TAC	Catch
BSAI	2009	402,000	22,300		18,800	18,800	15,347
				EBS	3,820	3,820	623
				Eastern AI	4,200	4,200	4,037
				Central AI	4,260	4,260	4,277
				Western AI	6,520	6,520	6,411
BSAI	2010	403,000	22,400		18,860	18,860	15,503
				EBS	3,830	3,830	1,204
				Eastern AI	4,220	4,220	4,033
				Central AI	4,270	4,270	4,033
				Western AI	6,540	6,540	6,234
BSAI	2011	601,000	36,300		24,700	n/a	n/a
				EBS	5,710	n/a	n/a
				Eastern AI	5,660	n/a	n/a
				Central AI	4,960	n/a	n/a
				Western AI	8,370	n/a	n/a
BSAI	2012	583,000	34,300		24,700	n/a	n/a
				EBS	5,710	n/a	n/a
				Eastern AI	5,660	n/a	n/a
				Central AI	4,960	n/a	n/a
				Western AI	8,370	n/a	n/a

Changes from previous assessment

New data includes:

- 2010 AI survey biomass estimate and length composition
- 2006, 2007, and 2008 fishery age compositions.
- 2009 fishery length composition was included in the assessment.

The model configuration for the 2008 assessment estimated annual varying selectivity. For the 2010 assessment, fishery selectivity was set to vary between 4-year blocks of time. The growth parameters and age-length conversion matrix were re-estimated. The years in which recruitment for recent year classes is not estimated was reduced from 7 to 3.

The AI trawl survey biomass estimate for 2010 was a substantial increase (46%) from the last AI survey in 2006.

Spawning biomass and stock status trends

The biomass estimates and harvest recommendations below are substantially increased from the last full assessment in 2008, and result from not only a large survey biomass estimate in 2010 but also the increasing trend in survey biomass estimates since 2002 and the estimated strong recruitments of the 1994-2000 cohorts. The substantial increase in estimated biomass from the most recent full assessment can also be attributed to the four-year gap between the 2006 and 2010 trawl surveys occurring during a period of apparently increasing biomass.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, thereby qualifying Pacific ocean perch for management under tier 3. The current estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ are 158,000 t, 0.061, and 0.074 respectively. The Plan Team was concerned about a substantial shift in the estimate of catchability that was based on compositional data, not just a large survey biomass estimate. This resulted in a scale change for the entire time series of biomass and recruitment. Given that the authors' ABC recommendation was such a substantial increase from the 2009 assessment (61%) and POP are a long-lived species, the Plan Team recommended a stair-step approach to raising the ABC, where the ABC would be increased halfway to the authors' recommended 2011 ABC until a new Aleutian Islands survey is conducted in 2012. The estimate of the 2011 spawning biomass is much greater than $B_{40\%}$ (225,000 t > 158,000 t). Therefore POP is in tier 3a. For this tier, F_{ABC} is constrained to be $\leq F_{40\%}$, and F_{OFL} is constrained to equal $F_{35\%}$. The 2011 and 2012 ABCs associated with the $F_{40\%}$ level of 0.061 are 30,400 t and 28,800 t, respectively. The Plan Team recommended a stair-step value for 2011 and 2012 halfway between the 2010 ABC and the maximum permissible value for 2011, which is 24,700 t. The 2011 and 2012 OFLs under tier 3a are 36,300 t and 34,300 t, respectively.

Area apportionment

The Team agrees with the author's recommendation that ABCs be set regionally based on the proportions of combined survey biomass. For 2011-2012, this procedure apportions the ABC as follows: EBS = 5,710 t, Eastern Aleutians (Area 541) = 5,660 t, Central Aleutians (Area 542) = 4,960 t, Western Aleutians (Area 543) = 8,370 t. The OFL is not regionally apportioned.

Status determination

Pacific Ocean perch is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

12. 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
BSAI	2009	200,000	8,540	7,160	7,160	3,111
	2010	203,000	8,640	7,240	7,240	4,039
	2011	201,000	10,600	8,670	n/a	n/a
	2012	197,000	10,400	8,330	n/a	n/a

Changes from previous assessment

The 2010 survey was the first new survey since 2006. New data includes updated 2009 catch data and preliminary 2010 catch data.

Spawning biomass and stock status trends

Age 3+ biomass has been on an upward trend since 2002. Spawning biomass has been increasing slowly and almost continuously 1977. Spawning biomass is projected to be 71,500 t in 2011.

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 $B_{40\%}$ (55,300 t), $F_{40\%}$ (0.058), and $F_{35\%}$ (0.071). Because the female spawning biomass of 71,500 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 is 8,670 t, which is the authors' and Plan Team's recommendation for the 2011 ABC. Under tier 3a, the 2011 OFL is 10,600 t for the Bering Sea/Aleutian Islands combined. The Team continues to recommend setting a combined BSAI OFL and ABC. As the catch has routinely been lower than the ABC, a catch of 4,500 t was assumed as the 2010 catch in order to make projections to 2011. The recommended ABC and OFL for 2012 are 8,330 t and 10,400 t, respectively.

Status determination

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

13. Blackspotted/Rougheye rockfish complex

Status and catch specifications (t) blackspotted/rougheye rockfishes 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area/subarea	Year	Total Bio[1].	OFL	ABC	TAC	Catch
BSAI	2009	19,000	660	539	539	194
	2010	21,200	669	547	547	2,022
	2011	24,200	549	454	n/a	n/a
	2012	24,700	563	465	n/a	n/a
Western and Central AI	2011			234		
	2012			240		
Eastern AI and EBS	2011			220		
	2012			225		

[1] Total biomass from AI age-structured projection model, and survey biomass estimates from EBS.

Derivation of area apportionment for the AI subareas	Area		
	WAI	CAI	EAI
Weighted average biomass (2004, 2006, 2010)	1,172	4,220	4,275
Proportion of AI biomass	12.1%	43.7%	44.2%

Changes from previous assessment

New data include:

- 2010 AI survey
- 2008 fishery age composition
- 2009 fishery length composition
- 1983 and 2010 survey length compositions

The 1998 year-class data appears strong in the 2004 and 2006 survey age data and leads to the high estimate of recruitment for this cohort. This estimate has changed substantially since the 2008 assessment with the inclusion of 2009 fishery and 2010 survey length composition data. In general, recent estimates of recruitment (post-1995 year classes) have high estimation error because they have been incompletely observed in the fishery and survey data. However, the high estimate of recruitment for the 1998 year class has a large effect on the estimate of $B_{40\%}$. Given the uncertainty in these recent recruitments and their influence on $B_{40\%}$, the authors considered various options: i) adjusting the input weight on the 2009 fishery and 2010 survey length compositions; ii) adjusting the input variance of recruitment residuals; and iii) excluding recent high uncertain recruitment estimates from the computation of $B_{40\%}$. The Plan Team decided to use only the recruitment estimates of the 1977-1995 year classes in the calculation of $B_{40\%}$ because of the high uncertainty of the estimates of succeeding year classes.

Spawning biomass and stock status trend

Total biomass for 2011 was estimated at a value of 24,200 t, up slightly from 2010. In last year's assessment, spawning biomass was estimated to have trended slowly upward since 1998, but was projected to decline slightly after 2009. In this year's assessment, spawning biomass is projected to continue increasing. Projected spawning biomass for 2011 (AI only) is 5,800 t.

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 $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$. Because the female spawning biomass of 5,800 t is greater than $B_{40\%}$, (4,740 t, AI only), sub-tier "a" would be applicable, giving $F_{OFL} = 0.041$ and $maxF_{ABC} = 0.034$. Under tier 3a, the maximum permissible 2011 and 2012 ABCs are 454 t and 465 t, respectively (EBS and AI combined), which are the Plan Team's recommended values. Under tier 3a, the 2011 and 2012 OFLs are 549 t and 563 t, respectively, for the Bering Sea/Aleutian Islands combined.

Status determination

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

Area allocations

In the September, 2010, Plan Team meeting several options for allocating the ABC within the BSAI were proposed. The Plan Team recommends allocating the ABC to two areas: 1) Western and Central AI area, and 2) Eastern AI and EBS area. The rationale for this recommendation is that the available information for blackspotted rockfish indicates an isolation by distance pattern without clear physical breaks in stock structure, and this division of the ABCs results in management areas that are more consistent with the available information on stock structure. Although the current pattern of harvest does indicate disproportionate harvesting within the western Aleutian Islands, the Plan Team did not feel the scale of harvests in this area warranted a separate western AI ABC at this time.

14. 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Survey Bio.	OFL	ABC	TAC	Catch
BSAI	2009	17,200	516	387	387	205
	2010	17,200	516	387	387	252
	2011	17,500	524	393	n/a	n/a
	2012	17,500	524	393		

Changes from previous assessment

There were no changes to the assessment methodology in 2010. New data in this year's assessment includes:

- 2010 Aleutian Islands and EBS slope trawl survey
- catch estimates were updated for 2009 and added for 2010.

Spawning biomass and stock status trends

Estimated shortraker rockfish biomass is 17,500 t, which is a slight increase from the 2009 assessment biomass estimate of 17,200 t. Overall, total biomass has trended slowly downward from 28,900 t in 1980.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has previously determined that reliable estimates only of biomass and natural mortality exist for shortraker rockfish, qualifying the species for management under tier 5. The tier 5 biomass estimate is based on a surplus production model. The Plan Team recommends setting F_{ABC} at the maximum permissible level under tier 5, which is 75% of M. The accepted value of M for this stock is 0.03 for shortraker rockfish, resulting in a $maxF_{ABC}$ value of 0.023. The biomass estimate for 2011 is 17,500 t for shortraker rockfish, leading to a 2011 and 2012 BSAI OFLs of 524 t and ABCs of 393 t.

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.

15.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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Survey Biomass	OFL	ABC	TAC	Catch
BSAI	2009	39,200	1,380	1,040	1,040	609
	2010	39,200	1,380	1,040	1,040	676
	2011	48,900	1,700	1,280	n/a	n/a
	2012	48,900	1,700	1,280	n/a	n/a
EBS	2009	21,100	n/a	485	485	204
	2010	21,100	n/a	485	485	179
	2011	28,600	n/a	710	n/a	n/a
	2012	28,600	n/a	710	n/a	n/a
AI	2009	18,100	n/a	555	555	405
	2010	18,100	n/a	555	555	497
	2011	20,900	n/a	570	n/a	n/a
	2012	20,900	n/a	570	n/a	n/a

Changes from previous assessment

New data in this year's assessment includes 2010 AI and EBS slope trawl survey biomass estimates.

The assessment uses a three survey weighted average to estimate biomass similar to the methodology used in the Gulf of Alaska rockfish assessments. This was deemed an appropriate compromise between smoothing variability and emphasizing the most recent information.

Spawning biomass and stock status trends

Trends in spawning biomass are unknown. Stock biomass, as measured by trawl surveys of the Aleutian Islands and the EBS slope, has increased since the 2008 assessment.

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 ($F_{ABC} = 0.75M$). Multiplying these rates with the best estimates of SST and other "other rockfish" biomass yields 2011 and 2012 ABCs of 710 t in the EBS and 570 t in the AI. The Plan 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 1,700 t for 2011 and 2012.

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.

16. 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Age 3+ Biomass	OFL	ABC	TAC	Catch
BSAI	2009	411,000	99,400	83,800	76,400	72,806
	2010	389,000	88,200	74,000	74,000	68,368
	2011	438,000	101,000	85,300		
	2012		92,200	77,900	n/a	n/a
EAI/EBS	2011			40,300	n/a	n/a
CAI				24,000	n/a	n/a
WAI				21,000	n/a	n/a
EAI/EBS	2012			36,800	n/a	n/a
CAI				21,900	n/a	n/a
WAI				19,200	n/a	n/a

Changes from previous assessment

The following changes were made to the input data used in this assessment model:

- fishery catch data were updated.
- 2009 fishery age composition data were included.
- 2009 fishery catch- and weight-at-age values were added.
- 2010 AI survey data were included (biomass, length and age compositions, weight-at-age values)
- 2010 selectivity vector (equivalent to the estimated vector for 2000-2009) was used for projections.
- For 2011 and 2012, the authors assumed that 64 percent of the BSAI-wide ABC is likely to be taken under proposed Steller sea lion Reasonable and Prudent Alternatives (SSL RPAs). This percentage was applied to the 2011 maximum permissible ABC, and that amount was assumed to be caught in order to estimate the 2012 ABCs and OFL values.
- apportionment scheme which is based on the most recent 4-survey weighted average (2002, 2004, 2006, and 2010) is updated to include the 2010 survey biomass distribution.
- distribution of survey biomass for area 541 used in the apportionment calculations was updated to include the southern Bering Sea area, which is consistent with the assessment and fishery management of that area for Atka mackerel.

There were no significant changes in assessment methodology. However, a refinement was made to the change-points (shift to one year later) for the blocks of years with constant selectivity which corresponds approximately to the foreign fishery, the joint venture fishery, the domestic fishery prior to Steller sea lion regulations, and the domestic fishery with Steller sea lion regulations.

Spawning biomass and stock status trends

The projected female spawning biomass for 2011 using the catch levels in the proposed SSL RPAs is 146,000 t which is 56 percent of unfished spawning biomass and above $B_{40\%}$ (104,000 t). The 2011 estimate of spawning biomass is up 31 percent from last year's estimate for 2010 (111,000 t).

The projected age 3+ biomass at the beginning of 2011 is 438,000 t, up 13 percent from last year's estimate for 2009. This is due to increases (17 percent, 17 percent, 22 percent, and 12 percent from the 2009 assessment) in the estimated magnitudes of the 1999, 2000, 2001, and 2006 year classes, respectively, with the addition of the 2009 fishery age data into the model. In addition, mean recruitment from 1978 through 2008 increased 10 percent over last year's estimate (from 1978-2007), which increased all biological reference point biomass levels ($B_{100\%}$, $B_{40\%}$, and $B_{35\%}$) by approximately 10 percent.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The projected female spawning biomass under the SSL RPA harvest strategy is estimated to be 56 percent of unfished spawning biomass in 2011 and above $B_{40\%}$, thereby placing BSAI Atka mackerel in tier 3a**.** The projected 2011 yield (ABC) at $F_{40\%}$= 0.38 is 85,300 t, up 15 percent from last year's estimate for 2010. The projected 2011 overfishing level at $F_{35\%}$ = 0.47 is 101,000 t, up 15 percent from last year's estimate for 2010.

Atka mackerel female spawning biomass in 2012 (131,000 t) is projected to remain above $B_{40\%}$. The projected 2012 yield (ABC) under tier 3a ($F_{40\%}$= 0.38) and the proposed SSL RPAs is 77,900 t; the projected 2012 overfishing level at $F_{35\%}$ = 0.47 and the proposed SSL RPAs is 92,200 t. The population is projected to remain above $B_{40\%}$ through 2023 assuming the catch reductions contained in the proposed SSL RPAs occur and remain in place.

Status determination

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

Area apportionment

Amendment 28 of the Bering Sea/Aleutian Islands Fishery Management Plan divided the Aleutian Islands subarea into 3 districts at 177° E and 177° W longitude, providing the mechanism to apportion the Aleutian Atka mackerel TACs. The Council used a 4-survey weighted average to apportion the 2010 ABC, and the authors recommend using the same method but updating the survey data to include the 2010 (and drop the 2000) Aleutian Island bottom trawl survey biomass estimates to apportion the 2011 and 2012 ABCs. The recommended ABC apportionment by subarea for both 2011 and 2012 is 47.3 percent for Area 541 and the southern Bering Sea region, 28.1 percent for Area 542, and 24.6 percent for Area 543.

Ecosystem Considerations

Atka mackerel is the most common prey item of the endangered western Steller sea lion throughout the year in the Aleutian Islands. Analyses of historic fishery CPUE revealed that the fishery may create temporary localized depletions of Atka mackerel, and fishery harvest rates in localized areas may have been high enough to affect prey availability of Steller sea lions. The objectives of having areas closed to Atka mackerel fishing around Steller sea lion haulouts and rookeries, and time-area ABC allocations are to maintain sufficient prey for the recovery of Steller sea lions in the Aleutian Islands while also harvesting Atka mackerel. The stock assessment indicates that the abundance of Atka mackerel is high, but decreasing, and recently peaked due to four back-to-back strong year classes and an extraordinarily strong 1999 year class which still persists in the population. Nevertheless, Steller sea lion surveys conducted in 2008 indicate that counts of adults and juveniles in the central and western Aleutian Islands (west of Samalga Pass) declined 16 percent and 30 percent, respectively, between 2004 and 2008. This contrasts with populations in the eastern Aleutian Islands (between Samalga and Unimak Passes) which increased 7 percent in this same time period. Pup production (most recently assessed in 2010) continues to decline at rookeries west of 178°W (Tanaga Island), while to the east, it was either stable or has increased since 2005. The proposed SSL RPAs, if enacted, will prohibit any retention of Atka mackerel in area 543 (the western Aleutian Islands, where the SSL population is declining at ~7 percent per year); prohibit directed mackerel fishing in most of SSL critical habitat in area 542 (all except an area between 178-179°W (Tanaga Pass) which will have catch and effort restrictions); set the area 542 Atka

mackerel TAC to no more than 47 percent of the 542 ABC; retain the critical habitat closure in area 541; and close the entire eastern Bering Sea to directed fishing for Atka mackerel.

17. Squid

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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2009	n/a	2,620	1,970	1,970	360
	2010	n/a	2,620	1,970	1,970	402
	2011	n/a	2,620	1,970	n/a	n/a
	2012	n/a	2,620	1,970	n/a	n/a

The assessment this year included:

- updated 2009 and 2010 catch data
- 2010 EBS shelf, EBS slope, and AI trawl survey biomass estimates

Overall, the groundfish surveys do not provide a reliable biomass estimate. Using tier 6 criteria, the recommended ABC for BSAI squid for 2011 is the maximum permissible level, calculated as 0.75 times the average catch from the reference period of 1978-1995, or 1,970 t; the recommended OFL for squid in 2011 is calculated as the average catch from 1978-1995, or 2,620 t. The ABC and OFL are unchanged from last year. The author included new information in the assessment that described the seasonal pattern of incidental squid catches.

Status determination

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

18a 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Age0+Biomass	OFL	ABC	TAC	Catch
BSAI	2009	634,000	n/a	n/a	n/a	20,599
	2010	608,000	n/a	n/a	n/a	16,419
	2011	612,000	37,800	31,500	n/a	n/a
	2012	597,000	37,200	31,000	n/a	n/a

In 2010, the age-structured model approved by the SSC was used to set harvest specifications for Alaska skate. The "other skate" species remain within tier 5. The assessments include:

- Updated 2009 and preliminary 2010 catch
- 2010 EBS shelf, EBS slope, and AI survey data
- fishery and survey length compositions

The Team accepted the model with Alaska skates under tier 3a ($maxF_{ABC} = F_{40\%} = 0.077$ for a 2011 ABC of 24,400 t; $F_{OFL} = F_{35\%} = 0.090$ for a 2011 OFL of 28,300 t). The Plan Team agreed with the authors' recommendation to continue to assess the "other skate" component within tier 5 (2011 ABC = 7,100 t and 2011 OFL = 9,470 t based on an M of 0.10). The "other skate" biomass was estimated as the average of the 3 most recent surveys compared to the 9-year average used in previous assessment. Skate OFLs for 2011 and

2012 total 37,800 t and 37,200 t, respectively. Skate ABCs for 2011 and 2012 total 31,500 t and 31,000 t, respectively.

Status determination

The skate complex will be managed on its own (i.e., as something other than a constituent group of the former "other species" complex) for the first time in 2011. Therefore, there is no OFL against which annual catch can be compared, meaning that the status of the skate complex with respect to overfishing is undefined. Alaska skate, which may be viewed as an indicator stock for the complex, is not overfished and is not approaching an overfished condition.

18b 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2009	n/a	n/a	n/a	n/a	144
	2010	n/a	n/a	n/a	n/a	47
	2011	n/a	1,360	1,020	n/a	n/a
	2012	n/a	1,360	1,020	n/a	n/a

Assessment data

The bulk of the shark catch (>70 t) in the BSAI is sleeper sharks, taken mainly in the pollock and Pacific cod fisheries. Small numbers of salmon sharks are taken in the pollock fishery, but they are pelagic and not very vulnerable to any of the groundfish fisheries. Few dogfish sharks appear this far north. In the period 1997-2010 the average annual catch of all sharks was 500 t. Catches have been below average in the last few years (table above).

Trawl survey data do not provide reliable estimates of abundance of sharks. Sharks are seldom caught in BSAI trawl surveys except for the Bering Sea slope survey, where sleeper sharks occur in about 10 percent of hauls. They are also taken in the Bering sea shelf and Aleutians surveys, but rarely. Averaging the swept area estimates of sleeper sharks in all surveys over the last ten years produces a value of about 10,000 t, which is likely an underestimate.

Tier determination and OFL/ABC recommendation

The SSC has placed sharks in tier 6, where OFL is based on historical catches. The Team recommends setting OFL at the maximum catch during the period 1997-2007 (1360 t, taken in 2002), and ABC at 75% of OFL, which is 1,020 t. The Plan Team felt that separating sharks into its own management category provided sufficient conservation for this group at this point and that adopting an OFL based on average catch was not necessary given that this group is caught incidentally.

If a tier 5 OFL were set for sleeper sharks it would be the product of natural mortality (0.097) and biomass (at least 10,000 t) or 970 t. This is not a usable number but at least it provides some assurance that the tier 6 OFL and ABC are not too high.

Status determination

The shark complex will be managed on its own (i.e., as something other than a constituent group of the former "other species" complex) for the first time in 2011. Therefore, there is no OFL against which annual catch can be compared, meaning that the status of the shark complex with respect to overfishing is undefined. It is not possible to determine whether the shark complex is overfished or whether it is approaching an overfished condition because it is managed under tier 6.

18c 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2009	n/a	n/a	n/a	n/a	72
	2010	n/a	n/a	n/a	n/a	149
	2011	n/a	528	396	n/a	n/a
	2012	n/a	528	396	n/a	n/a

Giant Pacific octopus is the most abundant on the Bering Sea shelf and commercial catch of at least seven species found in the BSAI. The biomass estimates for octopuses from the trawl surveys are not reliable. Octopuses are commonly caught in pot and trawl fisheries, especially in the Pacific cod pot fishery. The assessment authors computed ABC and OFL values using tier 6 average and maximum 1997-2007 catch. The Plan Team felt that separating octopus into its own management category provided sufficient conservation for this group at this point and that adopting an OFL based on average catch was not necessary given that this group is caught incidentally.

Status determination

The octopus complex will be managed on its own (i.e., as something other than a constituent group of the former "other species" complex) for the first time in 2011. Therefore, there is no OFL against which annual catch can be compared, meaning that the status of the octopus complex with respect to overfishing is undefined. 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.

18d 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 2011 and 2012 are those recommended by the Plan Team. Catch data are current through November 6, 2010.

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	2009	234,000	n/a	n/a	n/a	7,039
	2010	226,000	n/a	n/a	n/a	5,168
	2011	208,000	58,300	43,700	n/a	n/a
	2012	208,000	58,300	43,700	n/a	n/a

The sculpin complex assessment is a straightforward update from last year. New data include:

- 2010 catch data
- 2010 Bering Sea shelf, Bering Sea slope, and Aleutian Islands survey biomass data.

Since further life-history information became available last year, the authors have recommended the use of separate *M* estimates for 7 species, and different *M* estimates for the EBS and AI. The individual *M* estimates were evaluated in the previous year and no changes were noted for this year. The Plan Team recommended ABCs based on species specific ABCs summed to a total for the group. The total (Tier 5) sculpin recommended ABCs and OFLs for 2011-2012 are 43,700 t and 58,300 t, respectively.

Status determination

The sculpin complex will be managed on its own (i.e., as something other than a constituent group of the former "other species" complex) for the first time in 2011. Therefore, there is no OFL against which annual catch can be compared, meaning that the status of the sculpin complex with respect to overfishing is undefined.

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.

Appendix 1: Grenadiers

A full assessment of the grenadier assemblage is provided in Appendix 1; while not required, it is provided to assist the Council in its pending decision of whether to include the assemblage in the groundfish FMPs. Seven species of grenadiers are known to occur in Alaska. The giant grenadier is the most abundant and has the shallowest depth distribution on the continental slope. The assessment focused on the giant grenadier as it is the most common grenadier caught in both the commercial fishery and longline and trawl surveys. Pacific grenadiers and popeye grenadiers are occasionally caught. Grenadier species are not included in the BSAI and GOA Groundfish FMPs; however, the Teams recommend that the grenadier assemblage be moved into a managed category so that annual catch limits can be established.

Because grenadiers are outside the FMPs and reporting for this assemblage is not required no catch statistics exist. Catches have been estimated, however, based on observer data or the NMFS Alaska Region Catch Accounting System. The estimated annual catches of grenadiers in Alaska for the years 1997-2010 have ranged between ~11,000-21,000 t, with an average for this period of ~16,000 t. Highest catches have consistently been in the GOA, followed generally by the EBS and then the AI. By region, annual catches have ranged between ~6,000-15,000 t in the GOA, ~2,000-5,000 t in the EBS, and ~1,000-4,000 t in the AI. Most of the catch occurs in longline and pot fisheries.

If included in the fishery in the FMPs, tier 5 determinations would result in the following OFLs and ABCs. Compared to the 2008 assessment, the OFLs and ABCs for the EBS, AI, and GOA have increased by 14 percent, 17 percent, and 22 percent, respectively. These increases are due to biomass increases in the three most recent trawl surveys in the EBS and GOA. The BSAI grenadier TAC would count against the 2 million t optimum yield.

Area	OFL	ABC
EBS	46,200	34,600
AI	89,000	66,800
GOA	46,600	35,000

Table 1. BSAI Groundfish Plan Team Recommendations for final OFL and ABC (metric tons) harvest specifications for 2011 and 2012.

		2010				2011		2012	
Species	Area	OFL	ABC	TAC	Catch	OFL	ABC	OFL	ABC
Pollock	EBS	918,000	813,000	813,000	809,238	2,450,000	1,270,000	3,170,000	1,600,000
	AI	40,000	33,100	19,000	1,266	44,500	36,700	50,400	41,600
	Bogoslof	22,000	156	50	131	22,000	156	22,000	156
Pacific cod	BSAI	205,000	174,000	168,780	159,012	272,000	235,000	329,000	281,000
Sablefish	BS	3,310	2,790	2,790	721	3,360	2,850	3,080	2,610
	AI	2,450	2,070	2,070	1,049	2,250	1,900	2,060	1,740
Yellowfin sole	BSAI	234,000	219,000	219,000	114,600	262,000	239,000	266,000	242,000
Greenland turbot	Total	7,460	6,120	6,120	3,589	7,220	6,140	6,760	5,750
	BS	n/a	4,220	4,220	1,706	n/a	4,590	n/a	4,300
	AI	n/a	1,900	1,900	1,883	n/a	1,550	n/a	1,450
Arrowtooth flounder	BSAI	191,000	156,000	75,000	38,098	186,000	153,000	191,000	157,000
Kamchatka flounder	BSAI	n/a	n/a	n/a	n/a	23,600	17,700	23,600	17,700
Northern rock sole	BSAI	243,000	240,000	90,000	53,111	248,000	224,000	243,000	219,000
Flathead sole	BSAI	83,100	69,200	60,000	19,863	83,300	69,300	82,100	68,300
Alaska plaice	BSAI	278,000	224,000	50,000	15,771	79,100	65,100	83,800	69,100
Other flatfish	BSAI	23,000	17,300	17,300	2,179	19,500	14,500	19,500	14,500
Pacific ocean perch	BSAI	22,400	18,860	18,860	16,567	36,300	24,700	34,300	24,700
	BS	n/a	3,830	3,830	2,267	n/a	5,710	n/a	5,710
	EAI	n/a	4,220	4,220	4,033	n/a	5,660	n/a	5,660
	CAI	n/a	4,270	4,270	4,033	n/a	4,960	n/a	4,960
	WAI	n/a	6,540	6,540	6,234	n/a	8,370	n/a	8,370
Northern rockfish	BSAI	8,640	7,240	7,240	4,039	10,600	8,670	10,400	8,330
Blackspotted/ Rougheye rockfish	BSAI	669	547	547	232	549	454	563	465
	EBS/EAI	n/a	n/a	n/a	n/a	n/a	234	n/a	240
	CAI/WAI	n/a	n/a	n/a	n/a	n/a	220	n/a	225
Shortraker rockfish	BSAI	516	387	387	252	524	393	524	393
Other rockfish	BSAI	1,380	1,040	1,040	676	1,700	1,280	1,700	1,280
	BS	n/a	485	485	179	n/a	710	n/a	710
	AI	n/a	555	555	497	n/a	570	n/a	570
Atka mackerel	Total	88,200	74,000	74,000	68,643	101,000	85,300	92,200	77,900
	EAI/BS	n/a	23,800	23,800	23,599	n/a	40,300	n/a	36,800
	CAI	n/a	29,600	29,600	26,387	n/a	24,000	n/a	21,900
	WAI	n/a	20,600	20,600	18,657	n/a	21,000	n/a	19,200
Squid	BSAI	2,620	1,970	1,970	402	2,620	1,970	2,620	1,970
Other species	BSAI	88,200	61,100	50,000	21,783	n/a	n/a	n/a	n/a
Skate	BSAI	n/a	n/a	n/a	16,419	37,800	31,500	37,200	31,000
Shark	BSAI	n/a	n/a	n/a	47	1,360	1,020	1,360	1,020
Octopus	BSAI	n/a	n/a	n/a	149	528	396	528	396
Sculpin	BSAI	n/a	n/a	n/a	5,168	58,300	43,700	58,300	43,700
Total	BSAI	2,462,945	2,121,880	1,677,154	1,331,222	3,954,111	2,534,729	4,731,995	2,911,610

Notes: New (highlighted text) in 2011: 1) Kamchatka flounder category, 2) subarea specifications for Blackspotted/Rougheye rockfishes, and 3) separate Skate, Shark, Octopus, and Sculpin assemblage specifications replaces "Other Species" category; 2010 catches through November 6, 2010 from AKR Catch Accounting.

Table 2. Groundfish catches (metric tons) in the eastern Bering Sea, 1958-2010.

Year	Pollock	Pacific Cod	Sable Fish	Yellowfin Sole	Greenland Turbot	Arrowtooth Flounder/a	Rock Sole/c	Other Flatfish	Flathead sole	Alaska Plaice
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	20,165	14,699	
1996	1,189,296	209,201	629	129,509	4,699	13,280	46,775	18,529	17,334	
1997	1,115,268	209,475	547	166,681	6,589	8,580	67,249	22,957	20,656	
1998	1,101,428	160,681	586	101,310	8,303	14,985	33,221	15,355	24,550	
1999	889,589	134,647	646	67,307	5,205	9,827	39,934	15,515	18,534	
2000	1,132,736	151,372	742	84,057	5,888	12,071	49,186	16,453	20,342	
2001	1,387,452	142,452	863	63,563	4,252	12,836	28,949	9,930	17,757	
2002	1,481,815	166,552	1,143	74,956	3,150	10,821	40,700	2,588	15,464	
2003	1,492,039	174,687	1,039	81,050	2,565	13,667	36,375	2,922	14,132	10,118
2004	1,480,543	183,283	1,038	75,501	1,825	17,333	47,862	4,755	17,354	7,888
2005	1,483,286	182,938	1,064	94,382	2,140	13,408	36,814	4,566	16,074	11,194
2006	1,486,648	168,265	1,036	99,134	1,452	11,911	35,878	3,123	17,934	17,318
2007	1,354,492	140,079	1,173	120,966	1,481	11,080	36,364	5,764	19,086	19,522
2008	990,576	139,604	1,125	148,894	1,925	19,357	50,935	3,578	24,520	17,377
2009	810,743	147,166	891	107,512	2,249	19,676	48,145	2,131	19,535	13,944
2010/d	809,238	131,446	721	114,600	1,706	14,319	52,534	2,139	19,834	15,771

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

d/ Data through November 6, 2010. Note: Numbers don't include fish taken for research.

Table 2. (continued) Groundfish catches (metric tons) in the eastern Bering Sea, 1958-2010.

Year	POP complex/b	Pacific OceanPerch	Northern Rockfish	Shortraker Rockfish	Rougheye Rockfish	Other Rockfish	Atka Mackerel	Squid	Other Species	Total (AllSpecies)
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		4,926	35,902	1,168,144
1978	2,221					2,614	831	6,886	61,537	1,302,509
1979	1,723					2,108	1,985	4,286	38,767	1,159,547
1980	1,097					459	4,955	4,040	34,633	1,221,944
1981	1,222					356	3,027	4,182	35,651	1,259,666
1982	224					276	328	3,838	18,200	1,211,483
1983	221					220	141	3,470	15,465	1,280,285
1984	1,569					176	57	2,824	8,508	1,458,299
1985	784					92	4	1,611	11,503	1,649,109
1986	560					102	12	848	10,471	1,633,911
1987	930					474	12	108	8,569	1,639,121
1988	1,047					341	428	414	12,206	1,810,470
1989	2,017					192	3,126	300	4,993	1,630,382
1990	5,639					384	480	460	5,698	1,644,109
1991	4,744					396	2,265	544	16,285	1,647,455
1992	3,309					675	2,610	819	29,993	1,831,954
1993	3,763					190	201	597	21,413	1,674,406
1994	1,907					261	190	502	23,430	1,818,628
1995	1,210					629	340	364	20,928	1,745,893
1996	2,635					364	780	1,080	19,717	1,653,828
1997	1,060					161	171	1,438	20,997	1,641,829
1998	1,134					203	901	891	23,156	1,486,704
1999	609					135	2,008	393	17,045	1,201,394
2000	704					239	239	375	23,098	1,497,502
2001	1,148					296	264	1,761	23,148	1,694,671
2002	858					401	572	1,334	26,639	1,826,993
2003	1,391					336	6,362	1,246	26,986	1,864,915
2004		731	116	119	24	318	7,159	1,000	27,496	1,874,344
2005		879	112	108	12	178	3,540	1,170	28,066	1,879,931
2006		1,042	247	48	7	157	3,175	1,403	24,865	1,873,644
2007		870	69	113	10	219	3,021	1,175	24,779	1,740,263
2008		513	22	58	29	209	398	1,493	27,063	1,427,676
2009		623	48	83	12	204	244	269	25,358	1,198,833
2010/d		1,204	30	112	23	179	137	298	19,279	1,183,570

b/ Includes POP shortraker, rougheye, northern, and sharpchin.
c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in other flatfish catch statistics.
d/ Data through November 6, 2010. Note: Numbers don't include fish taken for research.

Table 3. Groundfish catches (metric tons) in the Aleutian Islands, 1962-2010.

Year	Pollock	Pacific Cod	Sable Fish	Yellowfin Sole	Greenland Turbot	Arrowtooth Flounder/a	Rock Sole/c	Other Flatfish	Flathead Sole	Alaska Plaice
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	31	16	
1996	28,933	31,389	720	654	1,677	1,330	371	51	10	
1997	26,872	25,166	779	234	1,077	1,071	271	7	32	
1998	23,821	34,964	595	5	821	694	446	35	19	
1999	965	27,714	565	13	422	746	577	20	34	
2000	1,244	39,684	1,048	13	1,086	1,157	480	32	80	
2001	824	34,207	1,074	15	1,060	1,220	526	43	54	
2002	1,177	30,801	1,118	29	485	1,032	1,165	39	111	
2003	1,653	32,459	1,009	0	965	913	964	32	49	
2004	1,158	28,869	955	9	434	818	818	33	38	0
2005	1,621	22,694	1,481	2	468	834	549	26	34	0
2006	1,745	24,210	1,132	4	534	1,475	578	36	39	0
2007	2,519	34,045	1,149	2	522	834	762	26	33	0
2008	1,278	31,056	894	0	827	2,527	342	46	18	0
2009	1,779	28,580	1,096	1	2,263	10,743	571	45	23	0
2010/d	1,266	27,566	1,049	0	1,883	23,779	577	40	29	0

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1964-69.
b/ Includes POP shortraker, rougheye, northern, and sharpchin rockfish until 2004.
c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in other flatfish catch statistics.
d/ Data through November 6, 2010. Note: Numbers don't include fish taken for research.

Table 3. (continued) Groundfish catches (metric tons) in the Aleutian Islands, 1962-2010.

Year	Pacific Ocean Perch Complex/b	Pacific Ocean Perch	Northern Rockfish	Shortraker Rockfish	Rougheye Rockfish	Other Rockfish	Atka Mackerel	Squid	Other Species	Total (All Species)
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	1,808	16,170	67,348
1978	5,286					921	23,418	2,085	12,436	61,092
1979	5,487					4,517	21,279	2,252	12,934	75,195
1980	4,700					420	15,533	2,332	13,028	108,531
1981	3,622					328	16,661	1,763	7,274	104,199
1982	1,014					2,114	19,546	1,201	5,167	98,233
1983	280					1,045	11,585	510	3,675	94,617
1984	631					56	35,998	343	1,670	147,022
1985	308					99	37,856	9	2,050	113,310
1986	286					169	31,978	20	1,509	96,259
1987	1,004					147	30,049	23	1,155	81,364
1988	1,979					278	21,656	3	437	77,383
1989	2,706					481	14,868	6	108	186,494
1990	14,650					864	21,725	11	627	124,886
1991	2,545					549	22,258	30	91	117,942
1992	10,277					3,689	46,831	61	3,081	164,513
1993	13,375					495	65,805	85	2,540	179,659
1994	16,959					301	69,401	86	1,102	175,614
1995	14,734					220	81,214	95	1,273	183,862
1996	20,443					278	103,087	87	1,720	190,750
1997	15,687					307	65,668	323	1,555	139,049
1998	13,729					385	56,195	25	2,448	134,182
1999	17,619					630	51,636	9	1,633	102,583
2000	14,893					601	46,990	8	3,010	110,326
2001	15,587					610	61,296	5	4,029	120,550
2002	14,996					551	44,722	10	1,980	98,216
2003	18,765					401	52,988	36	1,326	111,560
2004		11,165	4,567	123	185	337	53,405	14	1,866	104,794
2005		9,548	3,852	62	78	286	58,474	17	1,417	101,442
2006		11,826	3,582	165	196	425	58,719	15	1,943	106,624
2007		17,581	3,946	210	157	433	55,742	13	2,049	120,023
2008		16,923	3,265	108	185	388	57,690	49	2,315	117,910
2009		14,724	3,064	122	197	405	72,563	91	2,496	138,763
2010/d		14,299	4,009	140	209	497	68,496	104	2,503	146,446

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1964-69.
b/ Includes POP shortraker, rougheye, northern, and sharpchin rockfish until 2004.
c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in other flatfish catch statistics.
d/ Data through November 6, 2010. Note: Numbers don't include fish taken for research.

Table 4. Groundfish catches (metric tons) in the Bering Sea and Aleutian Islands, 1954-2010.

Year	Pollock	Pacific Cod	Sable Fish	Yellowfin Sole	Greenland Turbot	Arrowtooth Flounder/a	Rock Sole/c	Other Flatfish	Flathead sole	Alaska Plaice	Pacific Ocean Perch Complex/b
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	6,100
1961	0	0	15,627	553,742	57,348	0	0	0		0	47,000
1962	0	0	25,989	420,703	58,226	0	0	0		0	20,100
1963	0	0	14,370	85,810	31,572	0	0	35,643		0	45,300
1964	174,792	13,649	5,086	111,177	34,233	0	0	30,604		0	116,200
1965	230,551	15,170	6,087	53,810	10,047	0	0	11,686		0	125,900
1966	261,678	18,354	10,846	102,353	13,105	0	0	24,864		0	106,100
1967	550,362	32,357	13,350	162,228	24,263	0	0	32,109		0	75,500
1968	702,181	58,191	6,047	84,189	35,445	0	0	29,647		0	76,400
1969	862,789	50,571	17,682	167,134	36,257	0	0	34,749		0	53,300
1970	1,256,565	70,377	12,985	133,079	19,976	12,872	0	64,690		0	76,800
1971	1,743,763	45,132	18,042	160,399	42,214	19,373	0	92,452		0	31,600
1972	1,874,534	43,340	16,289	47,856	77,384	14,446	0	76,813		0	38,900
1973	1,758,919	54,363	8,859	78,240	63,946	12,922	0	43,919		0	15,500
1974	1,588,390	63,841	6,735	42,235	78,442	24,668	0	37,357		0	36,400
1975	1,356,736	54,389	4,513	64,690	67,789	21,616	0	20,393		0	25,200
1976	1,177,822	54,671	4,582	56,221	62,590	19,176	0	21,746		0	28,900
1977	985,995	36,597	4,615	58,373	30,161	11,489	0	14,393		0	10,734
1978	985,713	45,838	2,013	138,433	42,189	10,140	0	21,040		0	7,507
1979	923,385	39,354	2,158	99,017	41,409	14,357	0	19,724		0	7,210
1980	1,016,435	51,649	2,480	87,391	52,553	18,364	0	20,406		0	5,797
1981	1,029,021	62,458	3,137	97,301	57,321	17,113	0	23,428		0	4,844
1982	1,013,942	56,566	4,139	95,712	52,122	11,518	0	23,809		0	1,238
1983	1,041,389	93,167	3,368	108,385	47,558	13,969	0	30,454		0	501
1984	1,180,617	133,160	3,328	159,526	23,120	9,452	0	44,286		0	2,200
1985	1,238,489	145,426	3,796	227,107	14,731	7,375	0	71,179		0	1,092
1986	1,235,090	140,887	6,546	208,597	9,864	6,903	0	76,328		0	846
1987	1,266,317	157,746	8,012	181,429	9,599	4,539	0	50,372		0	1,934
1988	1,271,000	197,891	6,608	223,156	7,108	5,883	0	137,418		0	3,026
1989	1,386,000	168,918	4,500	153,165	8,822	3,222	0	63,452		0	4,723
1990	1,426,000	171,008	4,445	80,584	9,620	4,232	0	22,568		0	20,289
1991	1,346,464	172,158	3,199	96,135	6,878	13,686	46,681	30,489		0	7,289
1992	1,438,412	206,129	2,104	146,946	2,770	11,980	51,956	34,825		0	13,586
1993	1,358,758	167,390	2,747	105,809	8,468	9,298	64,260	28,871		0	17,138
1994	1,421,402	196,572	2,470	144,544	10,379	14,377	60,584	29,775		0	18,866
1995	1,329,503	245,030	2,048	124,752	8,193	9,283	55,028	20,196	14,715	0	15,944
1996	1,218,229	240,590	1,349	130,163	6,376	14,610	47,146	18,580	17,344	0	23,078
1997	1,142,140	234,641	1,326	166,915	7,666	9,651	67,520	22,964	20,688	0	16,747
1998	1,125,249	195,645	1,181	101,315	9,124	15,679	33,667	15,390	24,569	0	14,863
1999	890,554	162,361	1,211	67,320	5,627	10,573	40,511	15,535	18,568	0	18,228
2000	1,133,980	191,056	1,790	84,070	6,974	13,228	49,666	16,485	20,422	0	15,597
2001	1,388,276	176,659	1,937	63,578	5,312	14,056	29,475	9,973	17,811	0	16,735
2002	1,482,992	197,353	2,261	74,985	3,635	11,853	41,865	2,627	15,575	0	15,854
2003	1,493,692	207,146	2,048	81,050	3,530	14,580	37,339	2,954	14,181	10,118	20,156
2004	1,481,701	212,152	1,993	75,510	2,259	18,151	48,680	4,788	17,392	7,888	
2005	1,484,907	205,632	2,545	94,384	2,608	14,242	37,363	4,592	16,108	11,194	
2006	1,488,393	192,475	2,168	99,138	1,986	13,386	36,456	3,160	17,973	17,318	0
2007	1,357,011	174,124	2,322	120,968	2,003	11,914	37,126	5,790	19,119	19,522	
2008	991,854	170,660	2,018	148,894	2,751	21,884	51,277	3,624	24,538	17,377	
2009	812,522	175,746	1,987	107,513	4,512	30,419	48,716	2,176	19,558	13,944	
2010/d	810,504	159,012	1,770	114,600	3,589	38,098	53,111	2,179	19,863	15,771	

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69.
b/ Includes POP shortraker, rougheye, northern, and sharpchin.
c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in other flatfish catch statistics.
d/ Data through November 6, 2010. Note: Numbers don't include fish taken for research.

Table 4. (continued) Groundfish catches (metric tons) in the Bering Sea and Aleutian Islands, 1954-2010.

Year	Northern Rockfish	Shortraker Rockfish	Rougheye Rockfish	Other Rockfish	Atka Mackerel	Squid	Other Species	Total (All Species)
1954	0	0	0	0	0	0	0	12,562
1955	0	0	0	0	0	0	0	14,690
1956	0	0	0	0	0	0	0	24,697
1957	0	0	0	0	0	0	0	24,145
1958	0	0	0	0	0	0	147	51,401
1959	0	0	0	0	0	0	380	221,647
1960	0	0	0	0	0	0	0	500,907
1961	0	0	0	0	0	0	0	673,717
1962	0	0	0	0	0	0	0	525,018
1963	0	0	0	0	0	0	0	212,695
1964	0	0	0	0	0	0	802	486,543
1965	0	0	0	0	0	0	2,986	456,237
1966	0	0	0	0	0	0	2,370	539,670
1967	0	0	0	0	0	0	12,920	903,089
1968	0	0	0	0	0	0	31,006	1,023,106
1969	0	0	0	0	0	0	13,547	1,236,029
1970	0	0	0	0	949	0	25,966	1,674,259
1971	0	0	0	0	0	0	16,469	2,169,444
1972	0	0	0	0	5,907	0	33,340	2,228,809
1973	0	0	0	0	1,712	0	60,070	2,098,450
1974	0	0	0	0	1,377	0	69,987	1,949,432
1975	0	0	0	0	13,326	0	63,133	1,691,785
1976	0	0	0	0	13,126	0	33,196	1,472,030
1977	0	0	0	3,354	20,975	6,734	52,072	1,235,492
1978	0	0	0	3,535	24,249	8,971	73,973	1,363,601
1979	0	0	0	6,625	23,264	6,538	51,701	1,234,742
1980	0	0	0	879	20,488	6,372	47,661	1,330,475
1981	0	0	0	684	19,688	5,945	42,925	1,363,865
1982	0	0	0	2,390	19,874	5,039	23,367	1,309,716
1983	0	0	0	1,265	11,726	3,980	19,140	1,374,902
1984	0	0	0	232	36,055	3,167	10,178	1,605,321
1985	0	0	0	191	37,860	1,620	13,553	1,762,419
1986	0	0	0	271	31,990	868	11,980	1,730,170
1987	0	0	0	621	30,061	131	9,724	1,720,485
1988	0	0	0	619	22,084	417	12,643	1,887,853
1989	0	0	0	673	17,994	306	5,101	1,816,876
1990	0	0	0	1,248	22,205	471	6,325	1,768,995
1991	0	0	0	945	24,523	574	16,376	1,765,397
1992	0	0	0	4,364	49,441	880	33,074	1,996,467
1993	0	0	0	685	66,006	682	23,953	1,854,065
1994	0	0	0	562	69,591	588	24,532	1,994,242
1995	0	0	0	849	81,554	459	22,201	1,929,755
1996	0	0	0	642	103,867	1,167	21,437	1,844,578
1997	0	0	0	468	65,839	1,761	22,552	1,780,878
1998	0	0	0	588	57,096	916	25,604	1,620,886
1999	0	0	0	765	53,644	402	18,678	1,303,977
2000	0	0	0	840	47,229	383	26,108	1,607,828
2001	0	0	0	906	61,560	1,766	27,177	1,815,221
2002	0	0	0	952	45,294	1,344	28,619	1,925,209
2003	0	0	0	737	59,350	1,282	28,312	1,976,475
2004	4,684	242	209	655	60,564	1,014	29,362	1,979,138
2005	3,964	170	90	464	62,014	1,187	29,483	1,981,372
2006	3,829	213	203	582	61,894	1,418	26,808	1,980,268
2007	4,015	323	167	652	58,763	1,188	26,828	1,860,286
2008	3,287	166	214	597	58,088	1,542	29,378	1,545,586
2009	3,112	205	209	609	72,807	360	27,854	1,337,596
2010/d	4,039	252	232	676	68,633	402	21,782	1,330,016

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69.
b/ Includes POP shortraker, rougheye, northern, and sharpchin.
c/ Rock sole prior to 1991 and flathead sole prior to 1995 are included in other flatfish catch statistics.
d/ Data through November 6, 2010. Note: Numbers don't include fish taken for research.

Table 5. Summary of stock abundance (biomass), overfishing level (OFL), acceptable biological catch (ABC), the fishing mortality rate corresponding to ABC (FABC), and the fishing mortality rate corresponding to OFL (FOFL) for the eastern Bering Sea (EBS), Aleutian Islands (AI), and Bogoslof district as projected for 2011 and 2012. "Biomass" corresponds to projected January abundance for the age+ range reported in the summary. Stock-specific biomass, OFL, and ABC are in metric tons, reported to three significant digits (four digits are used, if necessary, when a stock-specific ABC is apportioned among areas on a percentage basis). Fishing mortality rates are reported to two significant digits. If a specification is based on both Tier 3 and Tier 5, the fishing mortality rates correspond to the Tier 3 portion. For Tier 5 complexes, the fishing mortality rates are weighted averages of species-specific rates.

			2011					2012			
Species or Complex	**Tier**	**Area**	**Biomass**	**OFL**	**ABC**	**F_{OFL}**	**F_{ABC}**	**OFL**	**ABC**	**F_{OFL}**	**F_{ABC}**
Pollock	1a	EBS	9,620,000	2,450,000	1,270,000	0.64	0.33	3,170,000	1,600,000	0.64	0.33
	3b	AI	242,000	44,500	36,700	0.31	0.26	50,400	41,600	0.31	0.26
	5	Bogoslof	110,000	22,000	156	0.20	0.0014	22,000	156	0.20	0.0014
Pacific cod	3b	BSAI	1,560,000	272,000	235,000	0.29	0.25	329,000	281,000	0.31	0.26
Sablefish	3b	BS	37,000	3,360	2,850	0.11	0.089	3,080	2,610	0.11	0.089
		AI	25,000	2,250	1,900	0.11	0.089	2,060	1,740	0.11	0.089
Yellowfin sole	1a	BSAI	1,960,000	262,000	239,000	0.13	0.12	266,000	242,000	0.13	0.12
Greenland turbot	3a	Total	74,000	7,220	6,140	0.30	0.25	6,760	5,750	0.30	0.25
		EBS			4,590				4,300		
		AI			1,550				1,450		
Arrowtooth flounder	3a	BSAI	1,120,000	186,000	153,000	0.29	0.23	191,000	157,000	0.29	0.23
Kamchatka flounder	5	BSAI	129,000	23,600	17,700	0.20	0.15	23,600	17,700	0.20	0.15
Northern rock sole	1a	BSAI	1,870,000	248,000	224,000	0.15	0.13	243,000	219,000	0.15	0.13
Flathead sole	3a	BSAI	791,000	83,300	69,300	0.34	0.28	82,100	68,300	0.34	0.28
Alaska plaice	3a	BSAI	780,000	79,100	65,100	0.19	0.15	83,800	69,100	0.19	0.15
Other flatfish	5	BSAI	127,000	19,500	14,500	0.15	0.11	19,500	14,500	0.15	0.11
Pacific Ocean perch	3a	Total	601,000	36,300	24,700	0.074	0.050	34,300	24,700	0.074	0.052
		EBS			5,710				5,710		
		EAI			5,660				5,660		
		CAI			4,960				4,960		
		WAI			8,370				8,370		
Northern rockfish	3a	BSAI	201,000	10,600	8,670	0.071	0.058	10,400	8,330	0.071	0.058
Blackspotted/Rougheye	3a/5	Total	24,200	549	454	0.041	0.035	563	465	0.041	0.035
		EBS/EAI			234				240		
		CAI/WAI			220				225		
Shortraker	5	BSAI	17,500	524	393	0.030	0.025	524	393	0.030	0.025
Other rockfish	5	Total	48,900	1,700	1,280	0.030	0.023	1,700	1,280	0.030	0.023
		EBS			710				710		
		AI			570				570		
Atka mackerel	3a	Total	438,000	101,000	85,300	0.47	0.38	92,200	77,900	0.47	0.38
		EBS/EAI			40,300				36,800		
		CAI			24,000				21,900		
		WAI			21,000				19,200		
Squid	6	BSAI	n/a	2,620	1,970	n/a	n/a	2,620	1,970	n/a	n/a
Skate	3a/5	BSAI	612,000	37,800	31,500	0.090	0.077	37,200	31,000	0.090	0.077
Shark	6	BSAI	n/a	1,360	1,020	n/a	n/a	1,360	1,020	n/a	n/a
Octopus	6	BSAI	n/a	528	396	n/a	n/a	528	396	n/a	n/a
Sculpin	5	BSAI	208,000	58,300	43,700	0.28	0.21	58,300	43,700	0.28	0.21
Total		BSAI	20,595,600	3,954,111	2,534,729			4,731,995	2,911,610		

Table 6. Summary of groundfish tier designations under Amendment 56, maximum permissible ABC fishing mortality rate (max FABC), the Plan Team's recommended tier designation, ABC fishing mortality rate (FABC), 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 2011-2012. Stock-specific max ABC and ABC are in metric tons, reported to three significant digits (four significant digits are used when a stock-specific ABC is apportioned among areas on a percentage basis). Fishing mortality rates are reported to two significant digits.

Species or Complex		**Pollock**	
	Area	**EBS**	**Bogoslof**
2011	**Tier**	1a	5
	max F_{ABC}	0.56	0.15
	F_{ABC}	0.33	0.0014
	max ABC	2,150,000	16,500
	ABC	1,270,000	156
	% Red.	41%	99%
2012	**Tier**	1a	5
	max F_{ABC}	0.56	0.15
	F_{ABC}	0.33	0.0014
	max ABC	2,260,000	16,500
	ABC	1,600,000	156
	% Red.	29%	99%

Table 7. Species included in assessments for the 2010 BSAI SAFE Report.

Chapter	Common name	Scientific name	Count
1	**Walleye Pollock**		1
2	**Pacific cod**		1
3	**Sablefish**		1
4	**Yellowfin sole**	Limanda aspera	1
5	**Greenland turbot**	Reinhardtius hippoglossoides	1
6	**Arrowtooth flounder**	Atherestes stomias	2
6b	Kamchatka flounder	Atherestes evermanni	
7	**Northern rock sole**	Lepidopsetta polyxystra n. sp.	2
	Southern rock sole	Lepidopsetta bilineata	
8	**Flathead sole**	Hippoglossoides classodon	2
	Bering flounder	Hippoglossoides robustus	
9	**Alaska plaice**	Pleuronectes quadrituberculatus	1
10	**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	
11	**Pacific Ocean perch**	Sebastes alutus	1
12	**Northern rockfish**	Sebastes polyspinus	1
13	Blackspotted/Rougheye		2
	Blackspotted rockfish		
	Rougheye rockfish	Sebastes aleutianus	
14	Shortraker rockfish	Sebastes borealis	1
15	**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	
16	**Atka mackerel**	Pleurogrammus monopterygius	1

Chapter	Common name	Scientific name	Count
17	**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	
18a	**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	
18b	**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	
18c	**Octopuses**		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	

Chapter	Common name	Scientific name	Count
18d	**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	
	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	
	Total Species		**133**