

**APPENDIX B**

**STOCK ASSESSMENT AND FISHERY EVALUATION REPORT**

**FOR THE GROUND FISH RESOURCES  
OF THE GULF OF ALASKA**

**Compiled by**

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# Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska

## Table of Contents

Summary .....	3
Introduction .....	3
Overview of Stock Assessments .....	10
 Stock Assessment Section	
1. Walleye pollock .....	53
2. Pacific cod .....	157
3. Sablefish .....	329
4. Shallow water flatfish .....	469
5. Deep water flatfish .....	527
6. Rex sole .....	531
7. Arrowtooth flounder .....	535
8. Flathead sole .....	539
9. Pacific ocean perch .....	543
10. Northern rockfish .....	547
11. Shortraker and other slope rockfish .....	551
12. Pelagic shelf rockfish .....	557
13. Rougheye and blackspotted rockfish .....	563
14. Demersal shelf rockfish .....	589
15. Thornyhead rockfish .....	597
16. Atka mackerel .....	601
17. Skates .....	605
18a. Squid .....	663
18b. Sharks .....	695
18c. Octopus .....	745
18d. Sculpins .....	777
Appendix 1: Grenadiers .....	797
Appendix 2: Forage fish .....	847
Ecosystem Considerations .....	Bound separately
Economic Status of Groundfish Fisheries off Alaska .....	Bound separately

# Summary

by

The Plan Team for the Groundfish Fisheries of the Gulf of Alaska

## 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 reports are intended to summarize the best available scientific information concerning the past, present, and possible future condition of the stocks and fisheries under federal management. The FMPs for the groundfish fisheries managed by the Council require that drafts of the SAFE reports be produced each year in time for the December North Pacific Fishery Management Council (Council) meetings.

The SAFE report for the Gulf of Alaska (GOA) groundfish fisheries is compiled by the Plan Team for the Gulf of Alaska Groundfish FMP from chapters contributed by scientists at NMFS Alaska Fisheries Science Center (AFSC) and the Alaska Department of Fish and Game (ADF&G). The stock assessment section includes recommended acceptable biological catch (ABC) levels for each stock and stock complex managed under the FMP. The ABC recommendations, together with social and economic factors, are considered by the Council in determining total allowable catches (TACs) and other management strategies for the fisheries.

The GOA Groundfish Plan Team met in Seattle on November 15-19<sup>th</sup>, 2010 to review the status of stocks of twenty species or species groups that are managed under the FMP. The Plan Team review was based on presentations by ADF&G and NMFS AFSC scientists with opportunity for public comment and input. Members of the Plan Team who compiled the SAFE report were James Ianelli and Diana Stram (co-chairs), Sarah Gaichas, Sandra Lowe, Chris Lunsford, Jon Heifetz, Kristen Green, Tom Pearson, Nick Sagalkin, Mike Dalton, Nancy Friday, Leslie Slater, and Paul Spencer. Ken Goldman, Steve Hare and Bob Foy were unable to attend.

## Background Information

### *Management Areas and Species*

The Gulf of Alaska (GOA) management area lies within the 200-mile U.S. Exclusive Economic Zone (EEZ) of the United States (Figure 1). Formerly, five categories of finfishes and invertebrates were designated for management purposes: target species, other species, prohibited species, forage fish species and non-specified species. Effective for the 2011 fisheries, these categories have been revised in Amendments 96 and 87 to the FMPs for Groundfish of the Bering Sea/Aleutian Islands (BSAI) and Gulf of Alaska (GOA), respectively. This action was necessary to comply with requirements of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) to prevent overfishing, achieve optimum yield, and to comply with statutory requirements for annual catch limits (ACLs) and accountability measures (AMs). Species and species groups must be identified “in the fishery” for which ACLs and AMs are required. An ecosystem component (EC) is also included in the FMPs for species and species groups that are not

- 1) targeted for harvest
- 2) likely to become overfished or subject to overfishing, and
- 3) generally retained for sale or personal use.

The effects of the proposed action amended the GOA and BSAI groundfish FMPs to:

- 1) identify and manage target groundfish stocks “in the fishery”

- 2) eliminate the “other species” category and manage (GOA) squids, (BSAI and GOA) sculpins, (BSAI and GOA) sharks, and (BSAI and GOA) octopuses separately “in the fishery”;
- 3) manage prohibited species and forage fish species in the ecosystem component category; and
- 4) remove the non-specified species outside of the FMPs.

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.

In the Fishery:

- 1) Target species – are those species that support 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 total allowable catch (TAC) is established annually for each target species or species assemblage. Catch of each species must be recorded and reported. This category includes walleye pollock, Pacific cod, sablefish, shallow and deep water flatfish, rex sole, flathead sole, arrowtooth flounder, Pacific ocean perch, shortraker rockfish, rougheye/blackspotted rockfish, northern rockfish, “other slope” rockfish, pelagic shelf rockfish, demersal shelf rockfish, thornyhead rockfish, Atka mackerel, squid, sculpin, sharks, octopus, and skates.

Ecosystem Component:

- 2) 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.
- 3) Forage fish species – are those species listed in the table 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.

The following lists the GOA stocks within these FMP species categories:

<b>In the Fishery</b>	
Target Species <sup>2</sup>	Walleye pollock, Pacific cod, Sablefish, Flatfish (shallow-water flatfish, deep-water flatfish, rex sole, flathead sole, arrowtooth flounder), Rockfish (Pacific ocean perch, northern rockfish, shortraker and rougheye rockfish, other slope rockfish, pelagic shelf rockfish, demersal shelf rockfish <sup>3</sup> , thornyhead rockfish), Atka mackerel, Skates (big skates, longnose skates, and other skates), Squids, Sculpins, Sharks, Octopus
<b>Ecosystem Component</b>	
Prohibited Species <sup>1</sup>	Pacific halibut, Pacific herring, Pacific salmon, Steelhead trout, King crab, Tanner crab
Forage Fish Species <sup>4</sup>	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)

<sup>1</sup>Must be immediately returned to the sea

<sup>2</sup>TAC for each listing. Species and species groups may or may not be targets of directed fisheries.

<sup>3</sup>Management delegated to the State of Alaska

<sup>4</sup>Management measures for forage fish are established in regulations implementing the FMP

This SAFE report describes stock status of target and non-target species in the fishery, and the forage fish category of the ecosystem component. Although grenadiers are no longer in the GOA FMP, an assessment is provided in Appendix 1 for the future if grenadiers should be moved back into the FMP.

A species or species group from within the fishery category may be split out and assigned an appropriate harvest level. Similarly, species in the fishery category may be combined and a single harvest level assigned to the new aggregate species group. The harvest level for demersal shelf rockfish in the Eastern Regulatory Area is specified by the Council each year. However, management of this fishery is deferred to the State of Alaska with Council oversight.

The GOA FMP recognizes single species and species complex management strategies. Single species specifications are set for stocks individually, recognizing that different harvesting sectors catch an array of species. In the Gulf of Alaska these species include Pacific cod, pollock, sablefish, Pacific ocean perch, flathead sole, rex sole, arrowtooth flounder, northern rockfish, shortraker rockfish, Atka mackerel, big skates, and longnose skates. Other groundfish species that are usually caught in groups have been managed as complexes (also called assemblages). For example, other slope rockfish, rougheye and blackspotted rockfish, pelagic shelf rockfish, demersal shelf rockfish, thornyhead rockfish, deep water flatfish, shallow water flatfish, and other skates have been managed as complexes. Beginning in 2011, squids, sculpins, octopus, and sharks are managed within complexes.

The FMP authorizes splitting species, or groups of species, from the complexes for purposes of promoting the goals and objectives of the FMP. Atka mackerel was split out from “other species” beginning in 1994. In 1998, black and blue rockfish were removed from the GOA FMP and management was deferred to ADF&G. Beginning in 1999, osmerids (eulachon, capelin and other smelts) were removed from the “other species” category and placed in a separate forage fish category. In 2004, Amendment 63 to the FMP was approved which moved skates from the other species category into a target species category whereby individual OFLs and ABCs for skate species and complexes could be established.

Groundfish catches are managed against TAC specifications for the EEZ and near coastal waters of the GOA. State of Alaska internal water groundfish populations are typically not covered by NMFS surveys and catches from internal water fisheries generally not counted against the TAC. The Team has

recommended that these catches represent fish outside of the assessed region, and should not be counted against an ABC or TAC. Beginning in 2000, the pollock assessment incorporated the ADF&G survey pollock biomass, therefore, the Plan Team acknowledged that it is appropriate to reduce the Western (W), Central (C) and West Yakutat (WY) combined GOA pollock ABC by the anticipated Prince William Sound (PWS) harvest level for the State fishery. Therefore, the 2011 PWS GHLL of 1,650 t should be deducted from the W/C/WY pollock ABC before area apportionments are made.

The Plan Team has provided subarea ABC recommendations on a case-by-case basis since 1998 based on the following rationale. The Plan Team recommended splitting the EGOA ABC for species/complexes that would be disproportionately harvested from the West Yakutat area by trawl gear. The Team did not split EGOA ABCs for species that were prosecuted by multi-gear fisheries or harvested as bycatch. For those species where a subarea ABC split was deemed appropriate, two approaches were examined. The point estimate for WY biomass distribution based on survey results was recommended for seven species/complexes to determine the WY and East Yakutat/Southeast Outside subarea ABC splits. For some species/complexes, a range was recommended bounded by the point estimate and the upper end of the 95% confidence limit from all three surveys. The rationale for providing a range was based on a desire to incorporate the variance surrounding the distribution of biomass for those species/complexes that could potentially be constrained by the recommended ABC splits.

<b>No Split</b>	<b>Split, Point Estimate</b>	<b>Split, Upper 95% CI</b>
Pacific cod	Pollock	Pacific ocean perch
Atka mackerel	Sablefish	Pelagic shelf rockfish
Shortraker rockfish	Deep-water flatfish	
Rougheye/blackspotted rockfish	Shallow-water flatfish	
Thornyhead	Rex sole	
Northern rockfish	Arrowtooth flounder	
Demersal shelf rockfish	Flathead sole	
All skates	Other slope rockfish	

### *New data summary*

Since the Stock Assessment and Fishery Evaluation Report (SAFE) for 2010 was issued (NPFMC 2009), the following new information has been incorporated in the stock assessments:

- 1) **Pollock:** (a) Total fishery catch from the 2009 fishery and preliminary catch estimates for the 2010 fishery, (b) age composition from the 2009 fishery; (c) biomass and age compositions from the 2010 Shelikof Strait echo integration trawl (EIT) survey, (d) age composition from the 2009 bottom trawl survey, and (e) 2010 biomass and length composition from the ADF&G crab/groundfish trawl survey.
- 2) **Pacific cod:** (a) Catch data for 2004-2009 were updated, and preliminary catch data for 2010 were incorporated (b) commercial fishery size composition data for 2009 were updated, and preliminary size composition data from the 2010 commercial fisheries were incorporated, (c) age composition and mean-length-at-age data from the 2009 bottom trawl survey were incorporated into some models, (d) age composition data from the 2008 January-May longline fishery were removed from two of the models, (e) mean length at age data from the 2008 January-May longline fishery were removed from two of the models, (f) seasonal catch per unit effort (CPUE) data for the trawl, longline, and pot fisheries from 2009 were updated, and preliminary catch rates for the trawl, longline, and pot fisheries from 2010 were incorporated, and (g) size composition data from the State-managed Pacific cod fishery for 1997-2009 were updated, and preliminary size composition data from the 2010 State-managed fishery were incorporated.
- 3) **Sablefish:** (a) Relative abundance and length data from the 2010 longline survey, (b) relative abundance and length data from the 2009 longline and trawl fisheries, (c) age data from the 2009 longline survey and 2009 longline fishery, and (d) as recommended in the 2009 CIE review and

2010 sablefish modeling workshop, elimination of the longline survey's relative population weight (RPW) indices to avoid double use of the survey information.

- 4) Flatfish: Flatfish have been moved to a biennial stock assessment schedule to coincide with new survey data. Full assessments were presented last year which included 2009 GOA bottom trawl survey information. Executive summaries are presented this year with updated catch, last year's key assessment parameters, any significant new information available in the interim, and projections for this year. New information since the last assessment includes:
- 5) Shallow-water flatfish: (a) updated catch information for 2009 and preliminary 2010 data and (b) an appendix with a preliminary age-structured assessment of northern and southern rock sole. This assessment was initially presented for review at the September, 2010 Plan Team meeting, and is appended to the shallow-water executive summary (with no changes) for further review<sup>9</sup>
- 6) Deepwater flatfish: (a) updated catch data for 2008 and preliminary 2010 catches, (b) updated projections for Dover sole.
- 7) Rex sole: (a) Updated fishery catch data for 2009 and an estimate of year end catch for 2010, and (b) updated projections.
- 8) Arrowtooth flounder: (a) updated catch for 2009 and preliminary 2010 catch, and (b) updated projections.
- 9) Flathead sole: (a) updated fishery catch data for 2009 and an estimate of year end catch for 2010, and (b) updated projections.
- 10) Rockfish: Rockfish have been moved to a biennial stock assessment schedule to coincide with new survey data. Full assessments were presented last year which included 2009 GOA bottom trawl survey information. Executive summaries are presented this year with updated catch, last year's key assessment parameters, any significant new information available in the interim, and projections for this year. New information since the last assessment includes:
- 11) Pacific ocean perch: (a) updated 2009 catch data and preliminary 2010 catch data, and (b) updated projections.
- 12) Northern rockfish: (a) updated 2009 catch data and preliminary 2010 catch data, and (b) updated projections.
- 13) Rougheye and blackspotted rockfish: (a) updated 2009 catch data and preliminary 2010 catch data, and (b) updated projections.
- 14) Shortraker and other slope rockfish: (a) updated 2009 catch data and preliminary 2010 catch data.
- 15) Pelagic shelf rockfish: (a) updated 2009 catch data and preliminary 2010 catch data, and (b) updated projections.
- 16) Demersal shelf rockfish: (a) updated catch information for Southeast Outside Subdistrict (SEO) and (b) updated average weights for yelloweye rockfish catch from all four management areas in SEO.
- 17) Thornyheads: (a) updated 2009 catch data and preliminary 2010 catch data, and (b) relative population numbers and weights from the 2010 longline survey.
- 18) Atka mackerel: Atka mackerel have been moved to a biennial stock assessment schedule to coincide with new survey data. The last complete assessment was presented in 2009. An executive summary is presented this year with rollover values for 2011 and 2012. New information since the last assessment includes: (a) updated 2009 and partial 2010 catch data, and (b) age data from the 2009 GOA bottom trawl survey.
- 19) Skates: Although skates have been moved to a biennial stock assessment schedule to coincide with new survey data, a full assessment is presented this year for the implementation of Annual Catch Limits (ACL). New information since the last assessment includes: (a) updated 2009 and partial 2010 catch data, and (b) removal of the estimates of halibut IFQ bycatch previously reported as an interagency working group is currently developing methods of estimating bycatch in the halibut IFQ fisheries.
- 20) Formerly, the other species complex in the GOA contained the following species: sculpins, squids, sharks, and octopus. Under Amendment 87 to the GOA FMP, the other species category no longer

exists and these species complexes have all been determined to be “in the fishery”, which, according to guidelines on Annual Catch Limits developed by NMFS, require annual harvest specifications (ABC and OFL levels). This year full assessments are presented in the SAFE report to be used for the setting of harvest specifications for sculpins, squids, sharks, and octopus.

- 21) Sculpins: (a) catch and retention data within the GOA fisheries have been updated with complete 2009 and partial 2010 data, (b) estimates of  $M$  from recent life history studies on sculpins in the Bering Sea/Aleutian Islands (BSAI) have been used, and (c) consistent with the BSAI sculpin assessment, an  $M$  for the sculpin complex as a whole has been incorporated that is a weighted average of  $M$ s for those species with recent data available.
- 22) Squid: (a) updated 2003-2008 catch data due to changes in the Catch Accounting system, (b) updated 2009 catch and preliminary 2010 catch data; (b) new maps and analyses of squid catch distributions.
- 23) Octopus: (a) updated 2009 catch and preliminary 2010 catch data, (b) updated results from observer special projects including data from 2009 on the condition of octopus discards, (c) updated life history information, and (d) summary of new octopus research underway.
- 24) Sharks: (a) total catch for GOA sharks from 2003-2009 updated due to changes to Catch Accounting System, (b) preliminary 2010 catch data, (c) analyses of spatial patterns in the observed fishery and survey catch data, and (d) alternatives to the average catch history Tier 6 method are presented.
- 25) Groundfish, generally: Updated catch data from the NMFS Observer Program and Regional Office for 2009 and through November 6<sup>th</sup>, 2010.

### *Biological Reference Points*

A number of biological reference points are used in this SAFE. Among these are the fishing mortality rate ( $F$ ) and stock biomass level ( $B$ ) associated with MSY ( $F_{MSY}$  and  $B_{MSY}$ , respectively). Fishing mortality rates reduce the level of spawning biomass per recruit to some percentage  $P$  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 GOA Groundfish FMP, approved by the Council in June 1998, defines ABC and OFL for the GOA groundfish fisheries. The new 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 stock 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  $\alpha$  is set at a default value of 0.05, with the understanding that the SSC may establish a different value for a specific stock or stock complex as merited by the best available scientific information. For tiers (2-4), a



designation of the form “ $F_{X\%}$ ” refers to the F associated with an equilibrium level of spawning per recruit (SPR) equal to X% of the equilibrium level of spawning per recruit in the absence of any fishing. If reliable information sufficient to characterize the entire maturity schedule of a species is not available, the SSC may choose to view SPR calculations based on a knife-edge maturity assumption as reliable. For tier (3), the term  $B_{40\%}$  refers to the long-term average biomass that would be expected under average recruitment and  $F=F_{40\%}$ .

<b>Tier</b>	<p>1) Information available: <i>Reliable point estimates of B and <math>B_{MSY}</math> and reliable pdf of <math>F_{MSY}</math>.</i></p> <p>1a) Stock status: <math>B/B_{MSY} &gt; 1</math>  <math>F_{OFL} = \mu_A</math>, the arithmetic mean of the pdf  <math>F_{ABC} \leq \mu_H</math>, the harmonic mean of the pdf</p> <p>1b) Stock status: <math>\alpha &lt; B/B_{MSY} \leq 1</math>  <math>F_{OFL} = \mu_A \times (B/B_{MSY} - \alpha)/(1 - \alpha)</math>  <math>F_{ABC} \leq \mu_H \times (B/B_{MSY} - \alpha)/(1 - \alpha)</math></p> <p>1c) Stock status: <math>B/B_{MSY} \leq \alpha</math>  <math>F_{OFL} = 0</math>  <math>F_{ABC} = 0</math></p> <p>2) Information available: <i>Reliable point estimates of B, <math>B_{MSY}</math>, <math>F_{MSY}</math>, <math>F_{35\%}</math>, and <math>F_{40\%}</math>.</i></p> <p>2a) Stock status: <math>B/B_{MSY} &gt; 1</math>  <math>F_{OFL} = F_{MSY}</math>  <math>F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%})</math></p> <p>2b) Stock status: <math>\alpha &lt; B/B_{MSY} \leq 1</math>  <math>F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)</math>  <math>F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)</math></p> <p>2c) Stock status: <math>B/B_{MSY} \leq \alpha</math>  <math>F_{OFL} = 0</math>  <math>F_{ABC} = 0</math></p> <p>3) Information available: <i>Reliable point estimates of B, <math>B_{40\%}</math>, <math>F_{35\%}</math>, and <math>F_{40\%}</math>.</i></p> <p>3a) Stock status: <math>B/B_{40\%} &gt; 1</math>  <math>F_{OFL} = F_{35\%}</math>  <math>F_{ABC} \leq F_{40\%}</math></p> <p>3b) Stock status: <math>\alpha &lt; B/B_{40\%} \leq 1</math>  <math>F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)</math>  <math>F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)</math></p> <p>3c) Stock status: <math>B/B_{40\%} \leq \alpha</math>  <math>F_{OFL} = 0</math>  <math>F_{ABC} = 0</math></p> <p>4) Information available: <i>Reliable point estimates of B, <math>F_{35\%}</math>, and <math>F_{40\%}</math>.</i>  <math>F_{OFL} = F_{35\%}</math>  <math>F_{ABC} \leq F_{40\%}</math></p> <p>5) Information available: <i>Reliable point estimates of B and natural mortality rate M.</i>  <math>F_{OFL} = M</math>  <math>F_{ABC} \leq 0.75 \times M</math></p> <p>6) Information available: <i>Reliable catch history from 1978 through 1995.</i>  <math>OFL =</math> the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information  <math>ABC \leq 0.75 \times OFL</math></p>
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Overfished or approaching an overfished condition is determined for all age-structured stock assessments by comparison of the stock level in relation to its MSY level according to the following two harvest scenarios (Note for Tier 3 stocks, the MSY level is defined as  $B_{35\%}$ ):

Overfished (listed in each assessment as 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 ½ of its MSY level in 2010 and above its MSY level in 2020 under this scenario, then the stock is not overfished.)

Approaching an overfished condition (listed in each assessment as 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.)

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.

## Overview of Stock Assessments

The current status of individual groundfish stocks managed under the FMP is summarized in this section. The abundances of Pacific cod, Dover sole, flathead sole, arrowtooth flounder, Pacific ocean perch, roughey and blackspotted rockfish, northern rockfish, and dusky rockfish are above target stock size. The abundances of pollock and sablefish are below target stock size (Fig. 2). The target biomass levels for other deep-water flatfish, shallow-water flatfish, rex sole, shortraker rockfish, demersal shelf rockfish, other pelagic shelf rockfish, other slope rockfish, thornyhead rockfish, Atka mackerel, skates, sculpins, squid, octopus, and sharks are unknown.

### Summary and Use of Terms

Tables 1 and 2 provide a summary of the current status of the groundfish stocks, including catch statistics, ABCs, and TACs for 2010, and recommendations for ABCs and overfishing levels (OFLs) for 2011 and 2012. The added year was included to assist NMFS management since the TAC setting process allows for a period of up to two years to review harvest specifications. Fishing mortality rates ( $F$ ) and OFLs used to set these specifications are listed in Table 3. ABCs and TACs are specified for each of the Gulf of Alaska regulatory areas illustrated in Figure 1. Table 4 provides a list of species for which the ABC recommendations are below the maximum permissible. Table 5 provides historical groundfish catches in the GOA, 1956-2010.

The sum of the preliminary 2011, 2012 ABCs for target species are 587,525 t (2011), 601,394 t (2012) which are within the FMP-approved optimum yield (OY) of 116,000 - 800,000 t for the Gulf of Alaska. The sum of 2011 and 2012 OFLs are 723,929 t and 743,424 t, respectively. The Team notes that because of halibut bycatch mortality considerations in the high-biomass flatfish fisheries, an overall OY for 2011 will be considerably under this upper limit. For perspective, the sum of the 2010 TACs was 242,727 t, and the sum of the ABCs was 516,055 t.

The following conventions in this SAFE are used:

- (1) "Fishing mortality rate" refers to the full-selection  $F$  (i.e., the rate that applies to fish of fully selected sizes or ages). A full-selection  $F$  should be interpreted in the context of the selectivity schedule to which it applies.
- (2) For consistency and comparability, "exploitable biomass" refers to projected age+ biomass, which is the total biomass of all cohorts greater than or equal to some minimum age. The minimum age varies from species to species and generally corresponds to the age of recruitment listed in the stock assessment. Trawl survey data may be used as a proxy for age+ biomass. The minimum age (or size), and the source of the exploitable biomass values are defined in the summaries. These values of exploitable biomass may differ from listed in the corresponding stock assessments if the technical definition is used (which requires multiplying biomass at age by selectivity at age and summing over all ages). In those models assuming knife-edge recruitment, age+ biomass and the technical definitions of exploitable biomass are equivalent.
- (3) The values listed as 2009 and 2010 ABCs correspond to the values (in metric tons, abbreviated "t") approved by NMFS. The Council TAC recommendations for pollock were modified to accommodate revised area apportionments in the measures implemented by NMFS to mitigate pollock fishery interactions with Steller sea lions and for Pacific cod removals by the State water fishery of not more

than 25% of the Federal TAC. The values listed for 2011 and 2012 correspond to the Plan Team recommendations.

- (4) The exploitable biomass for 2009 and 2010 that are reported in the following summaries were estimated by the assessments in those years. Comparisons of the projected 2011 biomass with previous years' levels should be made with biomass levels from the revised hindcast reported in each assessment.
- (5) The values used for 2011 and 2012 were either rolled over (typically for Tiers 4-6) or based on updated projections. Note that projection values often assume catches and hence their values are likely to change (as are the Tiers 4-6 numbers when new data become available).

### *Two year OFL and ABC Determinations*

Amendment 48/48 to the GOA and BSAI Groundfish FMPs, implemented in 2005, made two significant changes with respect to the stock assessment process. First, annual assessments are no longer required for rockfishes, flatfish, and Atka mackerel since new data during years when no groundfish surveys are conducted are limited. For example, since 2010 was an off-year for the NMFS GOA groundfish trawl survey, only summaries for these species were produced.

The second significant change is that the proposed and final specifications are for a period of at least two years. This requires providing ABC and OFL levels for 2011 and 2012 (Table 1). 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 and 5 the latest survey data (2009) was used. Tier 6 stocks may have alternatives based on updated catch information.

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 data from 2011 surveys are anticipated and a re-evaluation on the status of stocks will improve on the current available information for recommendations.

### **Economic Summary of the GOA Commercial Groundfish Fisheries in 2008-09: 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 Gulf of Alaska (GOA) dropped from \$305.6 million in 2008 to \$231.3 million in 2009, a decrease of -24.3% (Fig. 3). During that same time-period, the total quantity of groundfish products from the GOA decreased from 77.8 thousand tons to 67.1 thousand metric tons, a difference of -10.8 thousand tons. These changes in the GOA reflect conditions for first wholesale revenues from Alaska groundfish fisheries overall which declined by -25.8% in 2009 relative to 2008 levels.

By species, negative price and quantity effects for Pacific cod in 2008-09 dominate results of the first-wholesale revenue decomposition in the GOA, with a net effect of -\$46.6 million, which was exacerbated by negative price and quantity effects for pollock of -\$3.6 million and -\$9.5 million, respectively. There was a modest positive price effect for sablefish of \$5.0 million but it was not large enough to offset the negative quantity effect of -\$11.2 million. By product group, results for cod and pollock show up primarily as negative price and quantity effects for the whole head & gut product group. In fact, every product group exhibited negative price effects for 2008-09 in the GOA.

Overall, the GOA 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 -\$74.3 million for the GOA, which implies that 12.5% of the total decrease of -\$594.1 million in Alaska groundfish first-wholesale revenues in 2008-09 is attributable to the GOA. The difference of -10.8 thousand metric tons in processed groundfish products from the GOA, a decrease of -13.8% relative to 2008, was 24.8% of the total change in processed products from Alaska groundfish fisheries in 2008-09. In comparison, the change between

2007-08 was less than 1% in processed groundfish products from the GOA, and first wholesale revenues increased by 10.7%.

### **Ecosystem Considerations-Gulf of Alaska**

A summary of the ecosystem considerations chapter highlighting recent GOA trends is provided below. In this off-year, we do not include a summary of the explicit incorporation of ecosystem assessment data and modeling results in specific stock assessment chapters, because most chapters are executive summaries. Additional information is available in individual stock assessment chapters and the ecosystem considerations chapter.

The ecosystem considerations chapter consists of three sections: ecosystem assessment, ecosystem status indicators, and ecosystem-based management indices and information. The ecosystem assessment section, introduced in 2003, combines information from the stock assessment chapters with the two other sections of this chapter to summarize the climate and fishery effects. This year a new synthetic ecosystem assessment was completed for the Eastern Bering Sea. Next year with the completion of a new GOA survey we hope to follow a similar process to develop an ecosystem assessment for the GOA. Until then, we summarize GOA contributions to the ecosystem considerations chapter below.

*New trends highlighted in the 2010 ecosystem considerations chapter include:*

- Physical conditions: El Nino prevailed in winter 2009-10 but is shifting to La Nina in winter 2010-11. In 2009, the eddy kinetic energy in the GOA was estimated to be lower than average, reducing cross shelf transport, but has increased in 2010. There were shallow mixed layer depths along the continental shelf during winter 2009-2010, but during summer 2010 mixed layer depths were deeper than normal.
- These conditions may have reduced cross-shelf transport of nutrients, heat, and salinity, and more tightly confined phytoplankton biomass to the GOA shelf during 2009. In 2010, stronger eddy energy may have led to increased transport and extended phytoplankton biomass off the shelf.
- Shelf-spawning species (flathead sole, southern rock sole, and starry flounder) were all found to be negatively impacted by strong eddy activity along the shelf break off Kodiak, so the eddy kinetic energy indicator above suggests that the biomass of these species may have been smaller in 2007 relative to 2009.
- Mesozooplankton abundance in the eastern North Pacific appeared close to average in 2009 and spring 2010. 2009 appeared to have been a transition year from cold to neutral or perhaps warm mesozooplankton community composition in the oceanic GOA.
- Eulachon continues to experience its highest observed catch rates in the most recent ADF&G small mesh surveys, although overall forage biomass remains low compared with the 1970s and 1980s. Southeast Alaska herring continue to increase, with 2008 and 2009 estimated to have the highest spawning biomass in 25 years, and some indications of older spawning fish.
- An experimental combined annual index of juvenile Fish Creek chum salmon growth and temperature change may be a predictor of recruitment strength in sablefish. A similar index using Karluk River sockeye salmon and temperature change shows promise for pollock.
- ADF&G trawl surveys were still flatfish dominated and total biomass increased slightly in 2009.
- Steller sea lion 2000s non-pup trends have been increasing at 5% per year in the eastern GOA, have remained stable in the central GOA, and have been increasing at 4% per year in the western GOA.
- GOA total catch remained close to the long term mean in 2009. Bottom trawl effort showed no recent trend, while pelagic trawl, longline and pot effort showed declining recent trends. Discards remained below the long term mean with no recent trend. The number of vessels fishing in Alaska has declined slightly from 2008, continuing a longer term downward trend.

### *Other Plan Team discussions*

Next year the GOA might have an updated synthetic Ecosystem Assessment similar to the one done this year for the EBS (as adjusted by Council recommendations/comments). To that end, potential “Hot Topics” were identified related to ESA listed species in the GOA. During the pollock presentation, the Plan Teams received a report about increased Chinook salmon bycatch in the 2010 GOA pollock fishery which initiated a Section 7 Consultation with the NMFS Northwest Region. This topic will be discussed by the Council in December, and it was suggested that background information on Alaskan and West Coast Chinook stocks may be analyzed in the GOA ecosystem assessment. During the forage fish presentation, the author noted that the southern distinct population segment (DPS) of eulachon which resides off BC and the West Coast of the US was listed as threatened under the ESA. In addition, Cook Inlet belugas were listed as endangered under the ESA in 2008.

### *Ecosystem considerations for individual species:*

Two of the three full stock assessments incorporated information from the GOA ECOPATH model (Aydin et al. 2007): walleye pollock, has since 2005, and in 2007 the sablefish section summarized diet data. However, these sections were not updated this year. The Plan Team noted that sharks and rockfish assessments may benefit by having updated ecosystem sections for 2011.

### **1. Walleye Pollock**

Status and catch specifications (t) of pollock and projections for 2011 and 2012. 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<sup>th</sup> 2010. Note that the projections for 2012 are subject to change in 2011. The 2011 and 2012 ABCs for the western gulf (W/C/WYK) stock have been reduced by 1,650 t to accommodate the anticipated Prince William Sound GHL.

<b>Area</b>	<b>Year</b>	<b>Age 3+ Bio.</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
GOA	2009	675,749	69,630	49,900	49,900	42,389
	2010	797,638	115,536	84,745	84,745	75,189
	2011	934,788	130,356	96,215		
	2012		163,356	121,649		
W/C/WYK	2009	638,950	58,590	41,620	41,620	42,389
	2010	756,550	103,210	75,500	75,500	75,189
	2011	893,700	118,030	86,970		
	2012		151,030	112,404		
EYK/SEO	2009	36,799	11,040	8,280	8,280	0
	2010	41,088	12,326	9,245	9,245	0
	2011	41,088	12,326	9,245		
	2012		12,326	9,245		

### *Changes from previous assessment*

The age-structured model developed using AD Model Builder and used for GOA W/C/WYK pollock assessments in 1999-2009 is unchanged. This year’s pollock chapter features the following new data: (1) 2009 total catch and catch at age from the fishery, (2) 2010 biomass and age composition from the Shelikof Strait EIT survey, (3) 2009 age composition from the NMFS bottom trawl survey, and (4) 2010 biomass and length composition from the ADF&G crab/groundfish trawl survey. Model fits to fishery age composition data were good in most years. The fit of Shelikof Strait EIT survey age composition

show large residuals at age 2 and age 3 in 2006-2009 due to inconsistencies between the initial estimates of abundance and subsequent information about the magnitude of these year classes. Model fits are similar to previous assessments, and general trends in survey time series fit reasonably well. The model was unable to fit all the 2009 survey estimates simultaneously. All survey time series in the last two years (2009 and 2010) indicate an increase, but the magnitudes differ.

### *Spawning biomass and stock status trends*

The 2010 biomass estimate of Shelikof Strait fish  $\geq 43$  cm (a proxy for spawning biomass) increased 2.5 times from the 2009 estimate due to increased recruitment to the spawning population. Additional EIT surveys in winter 2010 covered the Shumagin Islands spawning area, Sanak Gully, Morzhovoi Bay, Pavlov Bay, Chirikof, and Marmot Bay. In comparison to 2009, biomass estimates were lower in the western Gulf of Alaska, and generally higher in the central Gulf of Alaska. An exploratory survey along the Kenai Peninsula and through Prince William Sound found significant quantities of pollock. The discovery of significant pre-spawning aggregations along the Kenai Peninsula is difficult to interpret at the population level because it is unclear whether these aggregations have always been present at this level of abundance, or whether they represent an eastward shift in spawning. In 2010 the ADF&G crab/groundfish survey biomass estimate decreased 15% from 2009, but increased approximately 60% from the mean of the previous three years (2006-2008).

This year, the model estimate of the 2007 year class was 0.794 billion recruits (which is 13% higher than average recruitment). This is in contrast to last year's initial estimate which was 1.7 times the average recruitment. Since additional information is available on the magnitude of this year class, it is appropriate to use the model estimate rather than assuming that it was equal to average recruitment.

The Plan Team concurred with the author's choice to use the standard model projection and the more conservative adjusted  $F_{40\%}$  harvest rate. While there are some elements of risk-aversion in this recommendation, such as fixing trawl catchability at 1.0, our recommendation is to delay treating those elements until an ABC framework is in place that deals explicitly with scientific uncertainty.

The model estimate of spawning biomass in 2011 is 198,767 t, which is 28.8% of unfished spawning biomass. The  $B_{40\%}$  estimate is 276,000 t. This represents an 11% increase from the 2009 assessment, and reflects both the increase in mean weight at age during spawning and an increase in average recruitment. Estimates of 2011 stock status indicate that spawning biomass will increase but remain below  $B_{40\%}$ .

### *Status determination*

Pollock are not overfished nor are they approaching an overfished condition. Catches remain below levels where overfishing would be a concern.

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

Because model estimated 2011 female spawning biomass is below  $B_{40\%}$ , the W/C/WYK Gulf of Alaska pollock are in Tier 3b. The Plan Team accepted the author's recommendation to reduce  $F_{ABC}$  from the maximum permissible using the "constant buffer" approach (first accepted in the 2001 GOA pollock assessment). The projected 2011 age-3+ biomass estimate is 893,700 t (for the W/C/WYK areas). Markov Chain Monte Carlo analysis indicated the probability of the stock being below  $B_{20\%}$  will be negligible in all years. Therefore, the ABC for 2011 based on this precautionary model configuration and adjusted harvest control rule is 88,620 t ( $F_{ABC} = 0.12$ ) for GOA waters west of 140°W longitude. **The ABC is 86,970 for 2011** (reduced by 1,650 t to account for the Prince William Sound GHL). The 2011 OFL under Tier 3b is 118,030 t ( $F_{OFL} = 0.16$ ).

Southeast Alaska pollock are in Tier 5 and the ABC and OFL recommendations are based on natural mortality (0.30) and the biomass from the 2009 survey. The biomass from the 2009 NMFS bottom trawl survey increased to 41,088 t. This results in a **2011 ABC of 9,245 t**, and a **2011 OFL of 12,326 t**.

### *Ecosystem Considerations*

There were no additions to the pollock stock assessment ecosystem considerations section this year. Previous results suggested that high predation mortality plus conservative fishing mortality might exceed GOA pollock production at present, and that this condition may have been in place since the late 1980's or early 1990s.

### *Area apportionment*

The assessment was updated to include the most recent data available for area apportionments within each season (Appendix C of the GOA pollock chapter). Area apportionments, reduced by 1,650 t for the State of Alaska managed pollock fishery in Prince William Sound, are tabulated below:

Area apportionments (reduced by 1,650 t) for 2011 and 2012 pollock ABCs for the Gulf of Alaska (t).						
Year	610	620	630	640	650	
	W	Central	Central	W. Yakutat	E. Yak/SE	Total
2011	27,031	37,365	20,235	2,339	9,245	96,215
2012	34,932	48,293	26,155	3,024	9,245	121,649

## **2. Pacific cod**

Status and catch specifications (t) of Pacific cod and projections for 2011 and 2012. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch includes the federally reported catch (Federal and parallel state fisheries catch; excluding state waters only fishery inside 3-miles) and is current through November 6<sup>th</sup> 2010.

Area	Year	Biomass	OFL	ABC	TAC	Catch
GOA	2009	520,000	66,600	55,300	41,807	39,397
	2010	701,200	94,100	79,100	59,563	58,660
	2011	428,000	102,600	86,800		
	2012		92,300	78,200		

### *Changes from previous assessments*

Three models were included in the GOA Pacific cod assessment which were developed from a set of models presented in the preliminary assessment presented to the Plan Team in September 2010. Model A is identical to the model accepted by the GOA Plan Team and SSC in 2009. Model B includes the following changes: 1) exclusion of data on fishery age composition and mean length at age; 2) use of 1 cm bins for the length composition (replacing the combination of 3 cm and 5 cm bins); 3) partition of catch into five seasons (between which fishing mortality can change) and fishery selectivity into three seasons (two of which span multiple catch seasons); and 4) removal of cohort-specific growth. Model C includes all the changes in model B, plus removal of all mean length at age data and age composition data and use of a length-based rather than age-based maturity ogive.

### *Spawning biomass and stock status trends*

Model B results produced an estimated 2011 spawning biomass of 124,100 t, or 48% of unfished spawning biomass. The  $B_{40\%}$  estimate was 102,500 t. Model B estimates of spawning biomass indicate a slight decline in subsequent years. This is in contrast to last year's assessment which projected an increase in biomass. In the current assessment, recent year classes (2006 – 2008) are estimated to be substantially lower than in last year's assessment.

### *Status determination*

Pacific cod are not overfished nor are they approaching an overfished condition. Catches remain well below levels where overfishing would be a concern.

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

The Plan Team accepts the author's preferred model (Model B) and therefore recommends Tier 3 for this stock. The model estimate of 2011 spawning biomass exceeds  $B_{40\%}$ , thus Gulf of Alaska Pacific cod are in Tier 3a. The Plan Team accepted the author's recommendation to use the maximum permissible F value from Tier 3a. The projected 2011 age-3+ biomass estimate is 428,000 t. The probability of the stock being below  $B_{20\%}$  was estimated to be less than 1% in 2011 and subsequent years. **Therefore, the ABC for 2011 is 86,800 t ( $F_{ABC}=0.42$ ). The 2011 OFL under Tier 3a is 102,600 t ( $F_{OFL} = 0.51$ ).**

### *Plan Team discussions and recommendations*

The authors used the following criteria for selection of the final model: 1) full use of the information content in the size compositions; 2) statistical justification of the fishery seasonal structure; 3) model parsimony; and 4) "plausible" estimates of biomass. Models B and C are preferable to Model A with regard to the first three criteria. However, Model C estimates biomass to be approximately 2.5 times that for either Models A or B, with an estimate of total biomass in the late 1970s in excess of 2 million tons. The authors concluded that the fishery would have expanded more rapidly if the biomass in the 1970s had been this large, and thus selected Model B as the preferred model.

The Plan Team concurred with the author that Model B is the preferred model to provide management advice but had several concerns. One feature of both the 2009 and 2010 models is complex trawl survey selectivity patterns, where all parameters of the 27-plus cm trawl survey were allowed to vary between each post-1993 survey year (except for the most recent year). However, given that the trawl survey has been conducted with consistent methods over this period, the Team was concerned with the variability in estimated selectivity. The Plan Team recognizes that temporally-varying survey selectivity was introduced to improve the residual pattern in the fit to the survey abundance. However, it seems plausible that the occurrence of poor residual patterns in the fit to the survey abundance with more conventional survey selectivity patterns may represent some inconsistencies between the fits to other data components and/or model specification. The Plan Team encourages the authors to conduct additional research to identify and document any such inconsistencies. For example, using selectivity deviations as in the EBS cod model may provide greater stability between survey years than having them freely estimated.

The Team noted large differences between this year's assessment and that from 2009. For example, the total biomass decreased substantially, the  $F_{ABC}$  also was lower but spawning biomass increased as did ABC. Some of these differences were attributed to different demographic schedules extracted from stock synthesis for the standard projection model from one year to the next. When such large, somewhat counter-intuitive changes are evident, the Team encourages the authors to describe the causes for the differences.

The GOA model shows a lack of fit to the sub-27 cm trawl survey abundance in 2009, which is composed primarily of 1-year olds. Given that there is little other information regarding the abundance the sub-27 cm survey, it is counter-intuitive that the model estimate is substantially different from the observed data. Notwithstanding the large coefficient of variation on this data point, one might expect that there would be a large number of three-year old fish observed in the forthcoming 2011 survey (given the high number of 1-year olds in the 2009 survey) which is counter to the model estimate. In general, the Plan Team recommends that the authors identify the causal mechanisms for lack of correspondence between model estimates and data.

The author discussed the possibility of estimating ageing bias within the model. The Team is concerned that this will increase the complexity and potentially complicate interpretation of results from an already highly complex model, but encourages exploration on this topic. In particular, we encourage continued



research to obtain GOA-specific data that would provide information on age-determination errors and potential biases.

The Plan Team commends the senior author’s attention to detail and in particular, the careful responses to the SSC and Plan Team recommendations.

*Ecosystem considerations*

There was no new information presented for ecosystem considerations in this year’s assessment.

*Area apportionment*

Consistent with previous years, apportionment of the 2011 and 2012 ABCs is based on the average of the estimated biomass in the three most recent trawl surveys. The 2011-2012 ABC apportionments are the following:

<b>Apportionment</b>		<b>2011</b>	<b>2012</b>
West	35%	30,380	27,370
Central	62%	53,816	48,484
East	3%	2,604	2,346
<b>Total</b>		<b>86,800</b>	<b>78,200</b>

**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 11/06/2010.					
<b>Year</b>	<b>Age 4+ Biomass</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
2009	149,000	13,190	11,160	11,160	10,910
2010	140,000	12,270	10,370	10,370	9,998
2011	149,000	13,340	11,290		
2012		12,232	10,345		

*Changes from previous assessment*

As in previous assessments, sablefish are treated as a single Alaska-wide stock covering the BSAI and GOA using a split sex age structured model. The split sex model approach was fully implemented beginning in 2006 and was deemed appropriate given differences in growth between males and females. The assessment model incorporates the following new data: relative abundance and length data from the 2010 longline survey, relative abundance and length data from the 2009 longline and trawl fisheries, and age data from the 2009 longline survey and longline fishery. A CIE review was conducted in 2009 and a modeling workshop was conducted in 2010. The input data and model were changed based on the review and workshop. The longline surveys’ relative population weight (RPW) was removed, so that only relative population numbers (RPN) from longline surveys are fit. Because this index was removed, the variance assumptions (data weightings) were adjusted using the standard deviation of the normalized residuals (SDNR). The authors feel this improved the balance between likelihood components.

*Spawning biomass and stock status trends*

The fishery abundance index was down 17% from 2008 to 2009 (the 2010 data are not available yet). The survey abundance index increased 13% from 2009 to 2010 following a 16% decrease from 2006 to 2009. Spawning biomass is projected to be lower from 2011 to 2014, and then stabilize. Projected 2011 spawning biomass is 37% of unfished spawning biomass. Spawning biomass has increased from a low of 30% of unfished biomass in 2002 to 37% projected for 2011. The 1997 year class has been an important contributor to the population but has been reduced and should comprise 10% of the 2011 spawning

biomass. The 2000 year class appears to be larger than the 1997 year class, and is now 95% mature and should comprise 24% of the spawning biomass in 2011. The 2002 year class is beginning to show signs of strength and will comprise 9% of spawning biomass in 2011 and is 86% mature.

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

The accepted model and projections indicate that this stock qualifies for management under Tier 3b. The updated point estimate of  $B_{40\%}$  is 110,108 t (**combined across the EBS, AI, and GOA**). Projected spawning biomass (combined areas) for 2010 is 102,139 t (93% of  $B_{40\%}$ ), placing sablefish in Tier 3b.

The maximum permissible value of  $F_{ABC}$  under Tier 3b is 0.089, resulting in a 2011 GOA ABC of 11,290 t. The recommended 2011 ABC is 9% higher than the 2010 ABC of 10,370 t. The OFL fishing mortality rate under Tier 3b is 0.106 resulting in a GOA OFL of 13,340 t.

#### *Status determination*

Alaska sablefish are not overfished nor are they approaching an overfished condition. Catches remain well below levels where overfishing would be a concern.

#### *Additional Plan Team recommendations*

While there were some questions about whether standardized advice was being given to all assessment authors with respect to index reweighting, in general the Plan Teams felt the approach in Model 3 was a good one, and represented an improvement in the assessment. In particular, the improvement in the retrospective pattern was considered a good outcome.

The Plan Teams supported the authors' plan to develop a research assessment model to explore upcoming issues (including data reweighting, new time series, movement, etc.) while using the current model for assessments. The Plan Teams also supported the plan to address concerns with data used in the current model, including: continued research on accounting for the effects of whale depredation in the abundance indices, working with the fishing industry to improve modeling of fishery CPUE indices, and looking at tagging data to estimate movement and improve apportionment methods.

#### *Ecosystem Considerations*

The ecosystem considerations section of the assessment was not updated, but still includes preliminary results of first-order trophic interactions for sablefish from the ECOPATH model. Results from sampling in 2005 are presented in the document and updated information on prey of sablefish is provided. The Teams noted that a large-scale ecosystem research program is starting up in the GOA which will have a specific sablefish recruitment component.

#### *Area apportionment*

A 5-year exponential weighting of longline survey and fishery relative abundance indices (the survey index is weighted double the fishery index) may be used to apportion the combined 2011 ABC among regions, resulting in the following values: 2,850 t for EBS, 1,900 t for AI, and 11,290 t for GOA. Relative to 2010, apportionments to the EBS and the GOA increased by 2 % and 9% respectively, while AI decreased 8%.

Using the survey/fishery based apportionment scheme described above, the 2011 OFL is apportioned among regions and results in the following values: 3,360 t for EBS, 2,250 t for AI, and 13,340 t for GOA. These values represent a slight decrease from 2010 OFL levels for the AI and a slight increase for the EBS and GOA.

GOA area apportionments of sablefish ABC's for 2011 and 2012 (includes allocation of 5% of combined EGOA ABC to West Yakutat)					
Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2011	1,620	4,740	1,990	2,940	11,290
2012	1,484	4,343	1,818	2,700	10,345

#### 4. Shallow water flatfish

Status and catch specifications (t) of shallow water flatfish and projections for 2011 and 2012. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/06/2010.

Year	Biomass	OFL	ABC	TAC	Catch
2009	436,590	74,364	60,989	19,972	8,483
2010	398,961	67,768	56,242	20,062	5,410
2011	398,961	67,768	56,242	-	-
2012	-	67,768	56,242		

##### *Changes from previous assessment*

The shallow water flatfish complex is made up of northern rock sole, southern rock sole, yellowfin sole, butter sole, starry flounder, English sole, sand sole, Alaska plaice and other minor species. This is an off-year for the assessment cycle therefore an executive summary only is provided. New data for the shallow water flatfish complex from the 2009 assessment included final total catch from 2009, current catch for 2010.

##### *Spawning biomass and stock status trends*

Stock status for shallow water flatfish is based on the NMFS bottom trawl survey (triennial from 1984 to 1999 and biennial from 1999 to 2009). Survey abundance estimates for the shallow-water complex were lower in 2009 compared to 2007; decreasing by 37,630 t. By species, abundance estimates increased between 2007 and 2009 for southern rock sole and English sole, while all other species in the complex (northern rock sole, yellowfin sole, butter sole, starry flounder, sand sole and Alaska plaice) showed decreases in abundance.

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

Northern and southern rock sole are managed in Tier 4 while other shallow water flatfish are in Tier 5, since maturity data are not available. The  $F_{ABC}$  and  $F_{OFL}$  values for southern rock sole were estimated as:  $F_{40\%}=0.162$  and  $F_{35\%}=0.192$ , respectively. For northern rock sole the values are:  $F_{40\%}=0.204$  and  $F_{35\%}=0.245$ . Other flatfish ABCs were estimated with  $F_{ABC}=0.75 M$  and  $F_{OFL}=M$ .

The ABC and OFL for 2011 and 2012 shallow-water flatfish are rolled over from the 2011 specifications. The GOA Plan Team agrees with authors recommended ABC for the shallow water flatfish complex which was equivalent to maximum permissible ABC.

A model is under development for northern and southern rock sole. The draft assessment is provided as an appendix to the shallow water flatfish chapter and was reviewed by the Team in September. The Team will review this assessment again in 2011 in order to consider its use in the 2012-2013 specifications cycle. Northern and southern rock sole would still remain within the shallow water complex. The Team would like to see the potential species-specific ABCs compared with species-specific catch since 2003. Also, the practice of using the same natural mortality rate for all species requires clearer justification. Development of species-specific M's (and by gender if possible) is encouraged.

### Status determination

Information is insufficient to determine stock status relative to overfished criteria. Catch levels for this complex remain below the TAC and below levels where overfishing would be a concern.

### Ecosystem Considerations summary

No ecosystem considerations section of the assessment was included in the off-year assessment.

### Area apportionment

Area apportionments of shallow water flatfish ABC's (using  $F_{40\%} = F_{ABC}$ ) for 2011 and 2012 are based on the fraction of the 2009 survey biomass in each area:

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2011	23,681	29,999	1,228	1,334	56,242
2012	23,681	29,999	1,228	1,334	56,242

## 5. Deep water flatfish complex (Dover sole and others)

Status and catch specifications (t) of deep water flatfish (*Dover sole and others*) and projections for 2011 and 2012. Biomass for each year corresponds to the estimate given when the ABC was determined. Catch data in this table are current through 11/6/2010.

Year	Biomass	OFL	ABC	TAC	Catch
2009	133,025	11,578	9,168	9,168	466
2010	89,682	7,680	6,190	6,190	502
2011	89,691	7,823	6,305		
2012		8,046	6,486		

### Changes from previous assessment

The deep water flatfish complex is comprised of Dover sole, Greenland turbot, and deep sea sole. Dover Sole are in Tier 3a while both Greenland turbot and deep sea sole are in Tier 6. Dover sole are managed as a part of the deep water flatfish complex and an age-structured model is used for ABC recommendations.

New data for the deep water flatfish (*excluding Dover sole*) assessment from last year included the updated 2009 catch and estimated 2010 catch. New information available to update the Dover sole projection model consists of the total catch for 2009 (458 t) and the current catch for 2010 (457 t as of Sept. 25, 2010). To run the projection model to predict ABC's for 2011 and 2012, estimates are required for the total catches in 2010 and 2011. The estimated final catch for 2010 (514 t) was also used as the estimate for the final 2011 catch.

### Spawning biomass and stock status trends

Dover sole female spawning biomass peaked in 1991 and declined until 2005. The spawning biomass trend is currently increasing slightly.

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

The Tier 6 calculation (based on average catch from 1978-1995) for the deep water flatfish complex (*excluding Dover sole*) ABC is 183 t and the OFL is 244 t. These values were calculated by adding the ABC and OFLs for Greenland turbot and deepsea sole and apply for 2011 and 2012 ABC and OFLs.

For the Dover sole Tier 3a assessment the 2011 ABC using  $F_{40\%}=0.119$  is 6,122 and 6,303 t for 2012. The 2011 OFL using  $F_{35\%}=0.149$  is 7,579 t and 7,802 t for the 2012 OFL.

The GOA Plan Team agrees with the authors' recommended 2010 and 2011 ABC's and OFL's for the deep water flatfish complex.

*Status determination*

Catch levels for this complex remain below the TAC and therefore overfishing is not a concern. Catch levels of Dover sole have been declining since the 1990s, although catch increased slightly last year.

*Ecosystem Considerations summary*

Dover sole are benthic feeders and little is known about prey species abundance trends. Little is known about the ecological role of Greenland turbot and deepsea sole in the GOA.

*Area apportionment*

Area apportionments of deep water flatfish (*excluding Dover sole*) are based on proportions of historical catch. The recommended ABC area apportionment percentages are identical to last year, because there is no new survey information.

Area apportionments of deep water flatfish ( <i>Dover sole and others</i> ) ABC's for 2011 and 2012 (using $F_{40\%}$ ) are based on the fraction of the 2009 survey biomass in each area.					
Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2011	529	2,919	2,083	774	6,305
2012	541	3,004	2,144	797	6,486

**6. Rex Sole**

Status and catch specifications (t) of rex sole and projections for 2011 and 2012. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/06/2010.

Year	Biomass	OFL	ABC*	TAC	Catch
2009	81,572	11,756	8,996	8,996	4,753
2010	88,221	12,714	9,729	9,729	3,387
2011	86,729	12,499	9,565		
2012		12,279	9,396		

\*ABC values are calculated using the catch equation applied to beginning year biomass values estimated by authors' age structured model.

*Changes from previous assessment*

Similar to previous years, rex sole are assessed using an age-structured model first presented in 2004. The authors' and Team's preferred model used here is the base model used in 2009. New data include the updated 2009 catch and an estimated 2010 catch.

*Spawning biomass and stock status trends*

Estimates of total biomass (2011-2012) were obtained using the methods from 2009. Biomass estimates decreased from 88,221 t in 2010 to 86,729 t in 2011. The model indicates total biomass had been increasing since 2000 but projects that age 3+ biomass and female spawning biomass will decrease slightly from 2010 to 2011.

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

In 2005, the Plan Team adopted a Tier 5 approach (using model estimated adult biomass) for rex sole ABC recommendations due to unreliable estimates of  $F_{40\%}$  and  $F_{35\%}$ . Using  $F_{ABC} = 0.75M = 0.128$  results in a 2011 ABC of 9,565 t. The 2011 OFL using  $F_{OFL} = M = 0.17$  is 12,499 t. The 2011 ABC and OFL were projected by setting 2009 catch equal to 4,753 t.

### *Status determination*

Catch levels for this stock remain below the TAC and therefore overfishing is not a concern.

### *Ecosystem Considerations summary*

Rex sole are benthic feeders and little is known about prey species abundance trends. Major predators are longnose skates and arrowtooth flounder. The Team noted that an unusually large proportion of GOA Tanner crab bycatch was taken in the 2009 rex sole fishery.

### *Area apportionment*

Area apportionments of rex sole ABC's for 2011 and 2012 are based on the fraction of the 2009 survey biomass in each area.

	<b>Western</b>	<b>Central</b>	<b>West Yakutat</b>	<b>East Yakutat/SE</b>	<b>Total</b>
2011	1,517	6,294	868	886	9,565
2012	1,490	6,184	853	869	9,396

## **7. Arrowtooth flounder**

Status and catch specifications (t) of arrowtooth flounder and projections for 2011 and 2012. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data in this table are current through 11/06/2010.

Year	Biomass	OFL	ABC	TAC	Catch
2009	2,155,780	261,022	221,512	43,000	24,937
2010	2,139,000	254,271	215,882	43,000	23,015
2011	2,121,440	251,068	213,150		
2012		248,576	211,027		

### *Changes from previous assessment*

New data includes updated 2009 catch and an estimated 2010 catch.

### *Spawning biomass and stock status trends*

The estimated age 3+ biomass from the model increased by an order of magnitude since 1961 and peaked at about 2.2 million t in 2006. Since then the stock has stabilized. Female spawning biomass in 2011 is estimated to be 1,246,660 t, a 1% increase from the projected biomass from the 2009 assessment.

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

Arrowtooth flounder has been determined to fall under Tier 3a. The 2011 ABC using  $F_{40\%}=0.183$  is 213,150 t. The 2011 OFL using  $F_{35\%}=0.219$  is 251,068 t. The 2011 ABC and OFL were projected by setting 2009 catch equal to 24,937 t. The final catch for 2010 was estimated by dividing the current catch by the ratio of the catch in the same week in 2009 as the current catch to the final 2009 catch. The estimated final catch for 2010 (22,300 t) was also used as the estimate for the final 2011 catch. Based on the updated projection model results, the recommended ABC and OFL for 2011 are 213,150 t and 251,068 t, respectively.

The GOA Plan Team agrees with authors recommended ABC for arrowtooth flounder which was equivalent to maximum permissible ABC.

### *Status determination*

The stock is not overfished nor approaching an overfished condition. Catch levels for this stock remain below the TAC and below levels where overfishing would be a concern.

### *Ecosystem Considerations summary*

The ecosystem considerations section was updated in 2007 to include an expanded appendix of trends and model-based information on the role of arrowtooth flounder in the GOA ecosystem. Arrowtooth flounder continue to play an important role in the Gulf of Alaska ecosystem as a predator and competitor.

### *Area apportionment*

Area apportionments of arrowtooth flounder ABC's for 2011 and 2012 are based on the fraction of the 2009 survey biomass in each area.

<b>Year</b>	<b>Western</b>	<b>Central</b>	<b>West Yakutat</b>	<b>East Yakutat/SE</b>	<b>Total</b>
2011	34,137	144,559	22,551	11,723	213,150
2012	33,975	143,119	22,327	11,606	211,027

## **8. Flathead sole**

Status and catch specifications (t) of flathead sole and projections for 2011 and 2012. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data in this table are current through 11/06/2010.

<b>Year</b>	<b>Biomass</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
2009	323,937	57,911	46,464	11,181	3,658
2010	328,611	59,213	47,355	10,411	3,458
2011	325,357	61,412	49,133		
2012		63,202	50,591		

### *Changes from previous assessment*

Flathead sole are assessed with an age-structured model first presented in the 2005 assessment. New data includes updated 2009 catch and an estimated 2010 catch.

### *Spawning biomass and stock status trends*

Projected female spawning biomass is estimated to increase slightly.

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

Flathead sole are determined to be in Tier 3a based on the age-structured model. The 2011 ABC using  $F_{40\%} = 0.406$  is 49,133 t. The 2011 OFL using  $F_{35\%} = 0.530$  is 61,412 t. The final catch for 2010 was estimated by dividing the current catch by the ratio of the catch in the same week in 2009 as the current catch (week 39) to the final 2009 catch. The estimated final catch for 2010 (3,778 t) was also used as the estimate for the final 2011 catch.

The GOA Plan Team agrees with authors recommended ABC for flathead sole which is equivalent to the maximum permissible ABC.

### *Status determination*

The stock is not overfished nor approaching an overfished condition. Catch levels for this species remain below the TAC.

### *Ecosystem Considerations summary*

Flathead sole are benthic feeders and little is known about prey species abundance trends. Major predators are arrowtooth flounder and other groundfish. Ecosystem models have found that the largest component of mortality on adult flathead sole is unexplained.

### Area apportionment

Area apportionments of flathead sole ABC's for 2011 and 2012 are based on the fraction of the 2009 survey biomass in each area.

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2011	17,442	28,104	2,064	1,523	49,133
2012	17,960	28,938	2,125	1,568	50,591

### Slope Rockfish

Status and catch specifications (t) of slope rockfish management category and projections for 2011 and 2012. Projections are made using authors' estimate of 2009 and 2010 catch. Catch data in table below are current through 11/06/2011.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Pacific ocean perch	2009	318,336	17,940	15,111	15,111	12,985
	2010	334,797	20,243	17,584	17,584	15,520
	2011	330,480	19,566	16,997		
	2012		18,635	16,187		
Northern rockfish	2009	90,557	5,204	4,362	4,362	3,925
	2010	103,300	6,070	5,098	5,098	3,871
	2011	100,463	5,784	4,857		
	2012		5,498	4,616		
Shortraker rockfish	2009	39,905	1,197	898	898	550
	2010	40,626	1,219	914	914	457
	2011	40,626	1,219	914		
	2012		1,219	914		
Other slope rockfish	2009	90,283	5,624	4,297	1,730	881
	2010	76,867	4,881	3,749	1,192	798
	2011	76,867	4,881	3,749		
	2012		4,881	3,749		
Rougheye and blackspotted rockfish	2009	46,385	1,545	1,284	1,284	280
	2010	45,751	1,568	1,302	1,302	447
	2011	45,907	1,581	1,312		
	2012		1,581	1,312		

GOA slope rockfish are on a biennial stock assessment schedule to coincide with new survey data. This year's assessments are executive summaries as no survey was conducted in 2010. Area apportionments for rockfish ABC are based on a weighted average of the percent exploitable biomass distribution for each area in the three most recent trawl surveys (2005, 2007, and 2009). Each successive survey is given a progressively heavier weighting using factors of 4, 6, and 9, respectively. For all rockfish stocks with the exception of Pacific Ocean Perch, the OFL is specified Gulfwide. For POP, the OFL is apportioned to individual area by the same weighting scheme used to apportion the ABC.



Area apportionments of ABC for slope rockfish for 2011.

Species	Western	Central	Eastern	West Yakutat	E Yak./SE	Total
Pacific ocean perch	2,798	10,379	-	1,937	1,883	16,997
Northern rockfish	2,573	2,281	3	-	-	4,857
Rougheye and blackspotted rockfish	81	868	363	-	-	1,312
Shorthead rockfish	134	325	455	-	-	914
Other slope rockfish	212	507	-	273	2,757	3,749

## 9. Pacific ocean perch

Status and catch specifications (t) of Pacific ocean perch and projections for 2011 and 2012. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. ABC and OFL for 2011 and 2012 are projected using author's estimate of 2010 and 2011 catch. Catch data are current through 11/06/2010.

Year	Biomass <sup>1</sup>	OFL	ABC	TAC	Catch
2009	318,336	17,940	15,111	15,111	12,985
2010	334,797	20,243	17,584	17,584	15,520
2011	330,480	19,566	16,997		
2012		18,635	16,187		

<sup>1</sup>Total biomass from the age-structured model

### *Changes from previous assessment*

Pacific ocean perch are assessed on a biennial schedule to coincide with the timing of survey data. This year is an off-year thus an executive summary of the assessment was presented. New information included updated 2009 catch and catch to date in 2010 with new projections made.

### *Spawning biomass and stock status trends*

The 2010 spawning biomass estimate (107,800 t) is above  $B_{40\%}$  (91,044 t) and projected to be stable (a slight increase) through 2011.

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

Pacific ocean perch are determined to be in Tier 3a. For 2011 the Plan Team concurred with the authors' recommendation to use the maximum permissible ABC of 16,997 t from the updated projection. The  $F_{OFL}$  is set at  $F_{35\%}$  (0.142) and gives an OFL of 19,566 t.

### *Status determination*

The stock is not overfished, nor is it approaching an overfished condition. Catches remain well below levels where overfishing would be a concern.

### *Additional Plan Team Recommendations*

The Team reviewed maps of fishing patterns and corresponding survey data since 2007 to evaluate the potential changes in fishing patterns as a result of the implementation of the Rockfish Pilot Program (RPP) in 2006. The Team requested that the authors follow up with AFSC staff doing maturity studies in Kodiak prior to updating the assessment next year.

### *Ecosystem Considerations summary*

No ecosystem considerations were included in this off-year assessment.

### Area apportionment

Apportionment of the ABCs and OFLs is based on a weighted average of the percent exploitable biomass distribution for each area in the three most recent trawl surveys (2005, 2007, and 2009). Each successive survey is given a progressively heavier weighting using factors of 4, 6, and 9, respectively. The apportionment values are equal to the 2010 apportionments: Western area, 16%; Central area, 61%; and Eastern area, 23%.

Amendment 41 prohibited trawling in the Eastern area east of 140° W longitude. Since Pacific ocean perch are caught exclusively with trawl gear, there is concern that the entire Eastern area TAC could be taken in the area that remains open to trawling (between 140° and 147° W longitude). Thus, as was done for the last three years, the Team recommends that a separate ABC be set for Pacific ocean perch in WYAK. The ratio of biomass still obtainable in the W. Yakutat area (between 140° W and 147° W) is higher than last year at 0.50. This corresponds to a 2011 ABC of 1,937 t for WYAK. Under this apportionment strategy, very little of the 1,883 t assigned to the remaining Eastern area (East Yakutat/Southeast Outside area) will be harvested.

Area apportionment of 2011-2012 ABCs and OFLs for POP in the Gulf of Alaska:

Year		Western	Central	Eastern	WYAK	SEO	Total
2011	ABC	2,798	10,379	-	1,937	1,883	16,997
2012		2,665	9,884	-	1,845	1,793	16,187
2011	OFL	3,221	11,948	4,397	-	-	19,566
2012		3,068	11,379	4,188	-	-	18,635

## 10. Northern Rockfish

Status and catch specifications (t) of northern rockfish and projections for 2011 and 2012. Projections are made using author's best estimate of 2010 and 2011 catch. Catch data in table are current through 11/06/2010

Year	Biomass <sup>1</sup>	OFL	ABC	TAC	Catch
2009	90,557	5,204	4,362	4,362	3,925
2010	103,300	6,070	5,100	5,098	3,871
2011	100,463	5,784	4,857		
2012		5,498	4,616		

<sup>1</sup>Total biomass estimates from the age-structured model.

### Changes from previous assessment

No new assessment model was run in this off-survey year. Catches were updated for 2009 and 2010 and new projections made.

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

Northern rockfish are determined to be in Tier 3a. The recommended ABC for 2011 is 4,857 t. The corresponding reference values for northern rockfish recommended for this year and projected one additional year are summarized below. The value for  $B_{40\%}$  is 24,547 t compared to a 2011 estimate of 33,961 t of female spawning biomass. The  $F_{ABC}$  is set to  $F_{40\%}$  (0.059) and  $F_{OFL}$  set to  $F_{35\%}$  (0.071). The 2011 OFL is 5,784 t.

### Status determination

The stock is not overfished, nor is it approaching an overfished condition. Catches remain well below levels where overfishing would be a concern.

### *Additional Plan Team Recommendations*

The Team noted that methods for cutting off 2010 catch in early October may be inconsistent with estimating a full year's catch for 2011 in projections, especially for Northern rockfish where October and full year catch may differ by 10%. The Team suggests that total current year catch be estimated for projections to the extent possible.

### *Ecosystem Considerations summary*

No ecosystem considerations section of the assessment was included in the off-year assessment.

### *Area apportionment*

Apportioning the 2011 and 2012 ABC is based on the same method used from last year resulting in the following percentage apportionments by area: Western 53% and Central 47%. The small Northern rockfish ABC apportionments from the Eastern Gulf are combined with other slope rockfish for management purposes.

Northern rockfish area apportionments for ABCs in 2011-2012:

	<b>Western</b>	<b>Central</b>	<b>Eastern</b>	<b>West Yakutat</b>	<b>East Yak./SE</b>	<b>Total</b>
2011	2,573	2,281	3	-	-	4,857
2012	2,446	2,168	2	-	-	4,616

## **11. Shortraker and other slope rockfish**

### *Shortraker rockfish*

Status and catch specifications (t) of shortraker rockfish and projections for 2010 and 2011. Catch data are current through 11/07/2009. Biomass estimates are based on 3 most recent trawl surveys (2005, 2007, and 2009).

	<b>Species</b>	<b>Year</b>	<b>Biomass</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
	Shortraker rockfish	2009	39,905	1,197	898	898	567
		2010	40,626	1,219	914	914	457
		2011	40,626	1,219	914		
		2012			1,219	914	

### *Other slope rockfish*

Status and catch specifications (t) of the Other Slope rockfish management category and projections for 2010 and 2011. Catch data are current through 11/07/2009. Biomass estimates are based on 3 most recent trawl surveys (2005, 2007, and 2009).

	<b>Species</b>	<b>Year</b>	<b>Biomass</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
	Other Slope rockfish	2009	90,283	5,624	4,297	1,730	879
		2010	76,867	4,881	3,749	1,192	792
		2011	76,867	4,881	3,749		
		2012			4,881	3,749	

### *Changes from previous assessment*

No new assessment information was available in this off-survey year. Catches were updated for 2009 and 2010.

### *Spawning biomass and stock status trends*

Averaging the biomass from the last three Gulf of Alaska trawl surveys (2005, 2007, and 2009), results in a biomass of 40,626 t for shortraker rockfish and 76,867 t for “other slope rockfish”. The biomass for shortraker rockfish is very similar to the value computed in the 2007 assessment, but biomass for “other slope rockfish” has decreased almost 15% compared with 2007. Much of the decrease for “other slope rockfish” has been caused by a sharp decline in biomass for silvergray rockfish since 2003.

### *Tier determination, ABCs, and OFLs*

Shortraker rockfish and the various “other slope rockfish” species are Tier 5 species for specifications while sharpchin rockfish are in Tier 4. The Tier 5 definitions state that  $F_{ABC} \leq 0.75M$ . Applying this definition to the exploitable biomass of shortraker rockfish results in a recommended ABC of 914 t in 2011. For “other slope rockfish”, applying an  $F_{ABC} \leq 40\%$  rate to the exploitable biomass of sharpchin rockfish (Tier 4) and an  $F_{ABC} \leq 0.75M$  rate to that of the other species (Tier 5) results in ABCs of 931 t and 2,818 t, respectively, or a combined recommended ABC of 3,749 t for the “other slope rockfish” management group in 2011. Estimates from 2010 are rolled over for specifications in 2011 and 2012 due to lack of survey data in this off-year assessment cycle.

### *Status determination*

Information is insufficient to determine stock status relative to overfished criteria. Catch levels for this stock remain below levels where overfishing would be a concern.

### *Ecosystem Considerations summary*

No ecosystem considerations section was included in this off-year assessment.

### *Area apportionment*

Apportionment of the ABCs amongst management areas of the Gulf of Alaska is based on a weighted average of the percent exploitable biomass distribution for each area in the three most recent trawl surveys (2005, 2007, and 2009). Each successive survey is given a progressively heavier weighting using factors of 4, 6, and 9, respectively. Apportionment values for shortraker rockfish are: Western area, 15%; Central area, 35%; and Eastern area, 50%. Apportionment values for “other slope rockfish” are: Western area, 6%; Central area, 14%; and Eastern area, 80%. The Eastern area for “other slope rockfish” is further divided into the West Yakutat area and the East Yakutat/Southeast Outside area. Based on the weighted calculation procedure, the Eastern area apportionment is subdivided as follows: West Yakutat, 9%; and East Yakutat/Southeast Outside, 91%.

Area apportionment of 2011 and 2012 ABC for shortraker rockfish in the Gulf of Alaska:

<b>Western</b>	<b>Central</b>	<b>Eastern</b>	<b>Total</b>
134	325	455	914

Area apportionment of 2011 and 2012 ABC for Other Slope rockfish in the Gulf of Alaska:

<b>Western</b>	<b>Central</b>	<b>WYAK</b>	<b>SEO</b>	<b>Total</b>
212	507	273	2,757	3,749

## 12. Pelagic shelf rockfish

### *Pelagic shelf rockfish*

Status and catch specifications (t) of pelagic shelf rockfish and projections for 2011 and 2012. ABC and OFL are identical to those presented in the 2009 assessment. Catch data in this table are current through 11/6/2010. Biomass levels for dusky rockfish are based on updated catch data from 2009 and catch estimates for 2010.					
<b>Year</b>	<b>Biomass<sup>1</sup></b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
2009	66,603	5,803	4,781	4,781	3,057
2010	69,632	6,142	5,059	5,059	3,097
2011	66,498	5,770	4,754		
2012		5,387	4,438		

<sup>1</sup>Total biomass estimates for pelagic shelf rockfish include trawl survey estimates for widow and yellowtail rockfish and biomass estimates from an age-structured model for dusky rockfish. Note catch and biomass estimates after 2009 do not include the contribution from dark rockfish which was removed to State management.

### *Changes from previous assessment*

There is no new survey information for widow and yellowtail rockfish, and ABC and OFL are the same as last year's assessment. For dusky rockfish, the 2009 projection model was updated with revised catch data from 2009 and a new catch estimate for 2010.

Effective January 30, 2009, dark rockfish were removed from Federal management (including the associated contribution to OFLs and ABCs under the respective assemblages in both regions) and full management authority was turned over to the State of Alaska. ABCs and OFLs presented in this assessment for the pelagic shelf rockfish assemblage now exclude dark rockfish. This results in significantly lower exploitable biomass estimates and associated ABC/OFL recommendations for the Tier 5 species (widow and yellowtail rockfish) when compared to earlier assessment recommendations.

### *Spawning biomass and stock status trends*

The 2011 female spawning biomass for dusky rockfish (25,099 t) is well above  $B_{40\%}$  (19,159 t).

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

Widow and yellowtail rockfish are managed as Tier 5 species with ABC determined by the average of exploitable biomass from the three most recent trawl surveys. For dusky rockfish, which is managed as a Tier 3a species, we use an age-structured model. For the pelagic shelf rockfish complex, ABC and OFL for widow and yellowtail rockfish are combined with the ABC and OFL for dusky rockfish yielding a combined ABC of 4,754 for pelagic shelf rockfish and OFL of 5,770. Note that the 2009 specifications retained a typographical error.

### *Status determination*

The dusky rockfish stock is not overfished nor is it approaching an overfished condition. The catch of remaining stocks in the complex are below the OFL and thus are unlikely to be approaching a condition where overfishing would be a concern.

### *Ecosystem Considerations summary*

There was no new summary as it was an off-year for the assessment cycle.

### *Area apportionment*

The area apportionment of the ABCs and OFLs is based on a weighted average of the percent exploitable biomass distribution for each area in the three most recent trawl surveys. This year the apportionment of the ABCs and OFLs are the same as last year, as there is no new survey information.

The recommended area apportionments for pelagic shelf rockfish ABCs for 2011-2012:

	<b>Western</b>	<b>Central</b>	<b>W. Yakutat</b>	<b>E. Yakutat/SE</b>	<b>Total</b>
2011	611	3,052	408	683	4,754
2012	570	2,850	380	638	4,438

### **13. Rougheye and blackspotted rockfish (Rougheye complex)**

Status and catch specifications (t) of rougheye and blackspotted rockfish and projections for 2010 and 2011. Biomass<sup>1</sup> for each year corresponds to the projection given in the SAFE report issued in the preceding year. Projections to 2011 and 2012 use author's estimate of 2010 and 2011 catch. Catch data are current through 11/06/2010.

	<b>Species</b>	<b>Year</b>	<b>Biomass</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
	Rougheye and blackspotted rockfish	2009	46,385	1,545	1,284	1,284	280
		2010	45,751	1,568	1,302	1,302	447
		2011	45,907	1,579	1,312		
		2012		1,579	1,312		

<sup>1</sup>Ages 3+ from the age structured model

#### *Changes from previous assessment*

No new assessment model was run in this off-survey year. Catches were updated for 2009-2010 and new projections made.

#### *Spawning biomass and stock status trends*

Female spawning biomass is well above B<sub>40%</sub> (10,185 t) with projected biomass stable.

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

Rougheye and black spotted rockfish are determined to be in Tier 3a. Reference values are summarized below. The 2011 female spawning biomass is projected to be 13,720 t and the ABC and OFL are 1,312 t and 1,579 t, respectively.

#### *Status determination*

The stock is not overfished, nor is it approaching an overfished condition.

#### *Ecosystem Considerations summary*

No ecosystem considerations section of the assessment was included in the off-year assessment.

#### *Area apportionment*

Area apportionments (calculated using the same method as for POP) of the 2011 and 2012 ABCs for rougheye and blackspotted rockfish in the Gulf of Alaska:

	<b>Western</b>	<b>Central</b>	<b>Eastern</b>	<b>Total</b>
2011	81	868	363	1,312
2012	81	868	363	1,312

## 14. Demersal shelf rockfish

Status and catch specifications (t) of demersal shelf rockfish and projections for 2010 and 2011. Biomass for each year corresponds to the survey biomass estimates given in the SAFE report issued in the preceding year(s). 2010 catch data are from the NMFS Catch Accounting System through 11/6/2010.

Year	Biomass	OFL	ABC	TAC	Catch
2009	17,390	580	362	362	138
2010	14,321	472	295	295	127
2011	14,395	479	300		
2012		479	300		

<sup>1</sup> ABC, TAC, and catch reflect contributions from commercial and sport fisheries.

### *Changes from previous assessment*

An executive summary assessment was prepared this year. Density surveys were last conducted in 2009 for Eastern Yakutat (EYKT). The previous set of surveys in this area was conducted in 2003. New information included updated catch information from Southeast Outside Subdistrict (SEO) and average weights for all four management areas in SEO.

### *Spawning biomass and stock status trends*

Density and biomass estimates for this complex are based on yelloweye rockfish only. The density estimate in EYKT from the 2009 surveys was 1,930 adult yelloweye per km<sup>2</sup> which was 46% lower than the 2003 estimate. Yelloweye rockfish biomass for stock status evaluations are based on the most recent estimate by management area. The SSEO was last surveyed in 2005, and NSEO was surveyed in 2001. Density estimates by area range from 1,068 to 3,557 adult yelloweye per km<sup>2</sup>. The density estimate for CSEO in 2007 was 1,068 adult yelloweye/km<sup>2</sup> (CV=17%). As in previous assessments, biomass is estimated using the lower 90% confidence limit of the point estimate by management area. Overall, the trend is uncertain. Average weight changes resulted in small changes in the biomass point estimate for each management area. The overall biomass estimate for 2011 was 14,395 t, a slight increase from 14,321 in 2010.

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

There are reliable point estimates of  $B$ ,  $F_{35\%}$ , and  $F_{40\%}$  for yelloweye rockfish, therefore the species complex is managed under Tier 4. Maximum allowable ABC under Tier 4 is based on  $F_{40\%}$  which is equal to 0.026. This would result in a maximum permissible ABC of 390 t. Demersal shelf rockfish are particularly vulnerable to overfishing given their longevity, late maturation, and sedentary and habitat-specific residency. As in previous assessments, the Plan Team concurred with the authors' recommendation to establish a harvest rate lower than the maximum allowed under Tier 4 by applying  $F=M=0.02$  to the biomass estimate and adjusting for other DSR species. This results in a recommended **2011 ABC of 300 t for DSR**. The OFL fishing mortality rate under Tier 4 is  $F_{35\%}=0.032$ . Adjusting for the DSR species other than yelloweye results in an **OFL for 2011 of 479 t for DSR**.

The Team noted that there may be a lack of funding for submersible surveys next year. This survey is essential for assessment of this long-lived, vulnerable, and valuable species. There has been a lapse in surveys for many sub-areas and the Team strongly encourages that scheduled surveys are conducted. A draft age-structured assessment was presented and will be revised next year for possible use in specifications in the next cycle.

### *Ecosystem Considerations summary*

No major changes were made to the ecosystem considerations section of the assessment this year.

### *Area apportionment*

The ABC and OFL for DSR are for the SEO Subdistrict. DSR management is deferred to the State of Alaska and any further apportionment within the SEO Subdistrict is at the discretion of the State.

## **15. Thornyheads**

Status and catch specifications (t) of thornyheads in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data for 2010 are current through 11/06/2010.

<b>Year</b>	<b>Biomass</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
2009	84,775	2,540	1,910	1,910	666
2010	78,795	2,360	1,770	1,770	553
2011	78,795	2,360	1,770		
2012		2,360	1,770		

### *Changes from previous assessment*

Thornyheads continue to be on a biennial stock assessment schedule to coincide with the timing of the NMFS trawl survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2011 and 2012. New information includes updated 2009 and 2010 catches by area, and relative population number and weight for GOA thornyheads from the 2010 longline survey.

### *Spawning biomass and stock status trends*

Estimates of spawning biomass are unavailable for thornyheads which are assessed under Tier 5. Thornyhead biomass from the 2009 GOA trawl survey showed a decline of 9% relative to the 2007 survey results. However, most of this decrease was observed in the central GOA with a decrease of 24%. Biomass increased by 54% and 10% in the Western and Eastern Gulf areas, respectively.

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

No new information is incorporated into the projection, and last year's stock assessment recommendations are rolled over for 2011 and 2012. The 2011 (and 2012) ABC recommendation (where  $F_{ABC}=0.0225$ ) is 1,770 t and the OFL ( $F_{OFL}=0.03$ ) is 2,360 t.

### *Status determination*

Information is insufficient to determine stock status relative to overfished criteria. Catch levels for this remain below the TAC and below levels where overfishing would be a concern.

### *Additional Plan Team recommendations*

The Team noted that for shortspine thornyhead (and a number of other species), it is critically important to the assessment that the GOA trawl surveys continue and that they extend to 500m in order to cover the range of primary habitat for this (and other) species. The Team recommended the authors examine and report on estimates of thornyhead bycatch in the halibut IFQ fishery.

### *Ecosystem Considerations summary*

No ecosystem considerations in this off year assessment.



### *Area apportionment*

Area apportionments are identical to last year and are based upon the relative distribution of biomass by area from the 2009 GOA bottom trawl survey. Area apportionment of the 2011-2012 ABC for thornyhead rockfish:

	<b>Western</b>	<b>Central</b>	<b>Eastern</b>	<b>Total</b>
2011	425	637	708	1,770
2012	425	637	708	1,770

### **16. Atka mackerel**

Status and catch specifications (t) of Atka mackerel in recent years. Atka mackerel are managed under Tier 6 and reliable estimates of biomass are not available. The OFL and ABC for 2011 and 2012 are those recommended by the Plan Team. Catch data are current through 11/06/2010.

<b>Year</b>	<b>Biomass</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
2009	Unknown	6,200	4,700	2,000	2,222
2010	Unknown	6,200	4,700	2,000	2,409
2011	Unknown	6,200	4,700		
2012		6,200	4,700		

### *Changes from previous assessment*

Atka mackerel are assessed on a biennial schedule to coincide with the timing of survey data. The last complete assessment was presented in 2009. An executive summary is presented this year with rollover values for 2011 and 2012. New catch information includes updated 2009 catch (2,222 t), and 2010 catch (2,408 t) as of November 6, 2010. Since the 2009 assessment, ages from the 2009 GOA survey have become available. A total of 328 otoliths were collected from 66 hauls throughout the Western and Central Gulf. The data continue to show the strong Aleutian Islands 1999-2001 year classes in the age distribution. An unusual observation was the relatively large proportion of 4-year olds of the 2005 year class. This is in contrast to the Aleutian Islands which have shown above average numbers from the 2006 year class in the fishery and survey.

Survey biomass estimates are not considered consistent reliable indicators of absolute abundance or indices of trend.

### *Spawning biomass and stock status trends*

Gulf of Alaska Atka mackerel have been managed under Tier 6 specifications since 1996 due to lack of reliable estimates of current biomass. In the 2007 assessment, Tier 5 calculations of ABC and OFL (based on 2007 survey biomass estimates) were presented for consideration. The Plan Team, SSC, and Council agreed with the authors that there is no reliable estimate of Atka mackerel biomass and recommended continuing management under Tier 6. This year, the authors again present Tier 6 recommendations, but do not present Tier 5 calculations of ABC and OFL given the extreme variances associated with the 2009 survey biomass estimates.

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

Since 1996, the maximum permissible ABC has been 4,700 t under Tier 6. However, ABC has been set lower than 4,700 t (1,000 t in 1997 and 600 t for 1998-2005) for conservation reasons to allow for bycatch needs of other trawl fisheries and minimize targeting. The 2006-2010 ABCs (under Tier 6), were increased to the maximum allowable of 4,700 t and the TACs were set at 1,500 t and 2,000 t in 2009 and 2010 to accommodate an increase in GOA Atka mackerel, and still allow for bycatch in other directed fisheries and minimize targeting. Given the very patchy distribution of GOA Atka mackerel which results in highly variable estimates of abundance, the Plan Team continues to recommend that GOA Atka

mackerel be managed under Tier 6. **The Plan Team recommends a 2011 ABC for GOA Atka mackerel equal to the maximum permissible value of 4,700 t. The 2011 OFL is 6,200 t under Tier 6.**

*Status determination*

Information is insufficient to determine stock status relative to overfished criteria. Up until 2008, catches have been below the TAC. However, the 2010 Atka mackerel catch is 20% over TAC but still under the ABC and below levels where overfishing would be a concern.

*Additional Plan Team recommendations*

Due to concerns over uncertainty with the ABC estimates using Tier 6, a low TAC is recommended to provide for anticipated incidental catch needs of other fisheries, principally for Pacific cod, rockfish and pollock fisheries. The 2010 GOA Atka mackerel catch through October is 400 t over the 2010 TAC. Under the Rockfish Program, catcher processors who historically would move out of area 610 after the POP fishery closed, are now remaining in the area and targeting northern and pelagic shelf rockfish. This is contributing to greater catches (much of it discarded) of Atka mackerel. The 2010 TAC for GOA Atka mackerel was 2,000 t which the data suggests is insufficient to meet bycatch needs for 2011.

*Ecosystem Considerations summary*

This section is unchanged from the previous assessment.

**17. Skates**

Status and catch specifications (t) of skates and projections for 2011 and 2012. Average biomass for each group and area is based on 2003-2009 GOA bottom trawl surveys. Catch data are current through 11/06/2010.								
Species group	Area	Average Biomass	2010			2011 and 2012		
			OFL	ABC	TAC	Catch	ABC	OFL
Big skate	W	7,979		598	598	140	598	
	C	27,325		2,049	2,049	2,155	2,049	
	E	9,077		681	681	142	681	
	<b>Total</b>	<b>44,381</b>	<b>4,438</b>	<b>3,328</b>	<b>3,328</b>	<b>2,437</b>	<b>3,328</b>	<b>4,438</b>
Longnose skate	W	1,086		81	81	103	81	
	C	26,790		2,009	2,009	816	2,009	
	E	10,155		762	762	124	762	
	<b>Total</b>	<b>38,031</b>	<b>3,803</b>	<b>2,852</b>	<b>2,852</b>	<b>1,043</b>	<b>2,852</b>	<b>3,803</b>
<i>Bathyraja</i> skates	GOA wide	<b>27,908</b>	<b>2,791</b>	<b>2,093</b>	<b>2,093</b>	<b>1,464</b>	<b>2,093</b>	<b>2,791</b>

*Changes from previous assessment*

Skates are on a biennial stock assessment schedule to coincide with new survey data. Ordinarily, this year would be an executive summary. However, a full assessment for GOA skates was presented.

*Spawning biomass and stock status trends*

Other than updated catch data, there is no new information to update the harvest recommendations for skates. Last year's ABC recommendations for skates, set according to Tier 5 using a natural mortality rate of 0.1 for all skates, are rolled over for 2010 and 2011.

Information is presently insufficient for population dynamics modeling for GOA skates, although the authors suggested that age structured models might be possible for big and longnose skates in the near future. The Team encourages this development as data improve.

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

Skates are managed in Tier 5. A single value of  $M=0.10$  is applied to area-specific average biomass from the most recent four GOA trawl surveys to estimate the ABCs listed above using the maximum permissible  $F_{ABC}=0.075$  ( $0.75*M$ ), and the OFLs using  $F_{OFL}=0.10$ . The Team concurred with the authors' recommendation of area specific ABCs and bycatch-only status and continued to recommend Gulfwide OFLs. This is identical to the Team recommendations from previous years.

This was the second year that the Alaska Department of Fish & Game (ADF&G) opened a fishery for skates in the state waters of Prince William Sound during March-April. Scientists at ADF&G prepared harvest guidelines for this fishery of 20,000 pounds for big skates and 110,000 pounds for longnose skates in the Inside District and 30,000 pounds for big skates and 155,000 pounds for longnose skates in the Outside District. The big skate GHL was exceeded by a substantial amount in 2009. In 2010, trip limits for big skates were introduced, which resulted in a much smaller overage for the Inside District and no overage for the Outside District.

### *Status determination*

The catches have been below the TACs in recent years and thus are not expected to approach the OFL; therefore, the stock is unlikely to be approaching a condition where overfishing would be a concern. Catch as currently estimated does not exceed any Gulfwide OFLs established for skates, but given the potentially high unaccounted catch in the IFQ halibut fishery, we cannot definitively state that the stocks are not subject to overfishing. It is not possible to determine the status of stocks in Tier 5 with respect to overfished status.

### *Additional Plan Team recommendations*

The Plan Team concurs with the authors' recommendation that no directed fishing for skates be permitted in the GOA because catches approaching the ABCs may be taken incidentally in groundfish and IFQ halibut fisheries. The Plan Team recommends continued exploration of skate bycatch in IFQ halibut fisheries (i.e., methods for the estimation of non-target species catch in the unobserved halibut IFQ fleet).

Investigations of skate nursery areas in the GOA are encouraged, given that EBS skates were found to have discrete nursery areas which may be vulnerable to disturbance by bottom-tending fishing gear or other human activities. This may be exacerbated by the relatively long incubation periods (3+ years for some species) of the eggs.

### *Ecosystem Considerations summary*

No update of this section was conducted this year.

### *Area apportionment*

The Plan Team concurred with the authors recommended area-specific ABCs based on the average of the four most recent GOA bottom trawl surveys (shown above) and are unchanged from the 2010 values.

## **18. Squid, Sharks, Octopus, Sculpins**

Formerly, the other species complex in the GOA contained the following species: sculpins, squids, sharks, and octopus. Under Amendment 87 to the GOA FMP, the other species category was split into species complexes and these all determined to be "in the fishery." According to NMFS guidelines on Annual Catch Limits, this determination requires annual harvest specifications (ABC and OFL levels). As such, full assessments for these species groups are presented as separate sections (to be renumbered next year) and used as the basis for recommending harvest specifications for sculpins, squids, sharks, and octopus. The Team had lengthy discussions noting difficulties applying the current Tier system for harvest specifications for these complexes. These centered on the lack of information on life-history characteristics and reliable data on catch and abundance trends.

For comparison against previous years, status and catch specifications (t) for squid, sharks, octopus and sculpins are provided below in conjunction with the specifications to be set in 2011 and 2012. Prior to 2011, these groups were aggregated into an ‘other species’ category and managed with an aggregate TAC; no ABC or OFL specifications were made for category prior to 2009. In 2010 the category was managed with an aggregate OFL and ABC comprised of the sum of the individually estimated components from each species (or complex) specific assessment. Catch data in the table below are current through 11/06/2010.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Squid	2009	Unknown	NA	NA	NA	336
	2010	Unknown	1,530	1,148	NA	131
	2011	Unknown	1,530	1,148		
	2012		1,530	1,148		
Sharks	2009	Unknown	NA	NA	NA	365
	2010	Unknown	1,276	957	NA	603
	2011	79,257 <sup>1</sup>	8,262	3,601		
	2012		8,262	3,601		
Octopus	2009	Unknown	NA	NA	NA	238
	2010	Unknown	298	224	NA	324
	2011	2,400	1,272	954		
	2012		1,272	954		
Sculpins	2009	30,836	NA	NA	NA	1,146
	2010	33,307	6,328	4,746	NA	735
	2011	33,307	7,328	5,496		
	2012		7,328	5,496		
Other Species	2008		NA	NA	4,500	2,776
Total	2009		8,720	6,540	4,500	2,870
	2010		9,432	7,075	4,500	1,793
	2011 <sup>2</sup>		NA	NA	NA	

### 18a. Squid

Status and catch specifications (t) of squid and projections for 2011 and 2012. Through 2010, squid were managed as part of the “other species” complex, with catch and harvest specifications reported in aggregate along with sharks, octopus, and sculpins. Beginning in 2011, the GOA FMP has been amended to provide for separate management for sharks, squids, sculpins, and octopus. Reliable point estimates of biomass and life history information for squid are insufficient for Tier 5 management and Tier 6 management is recommended. Catch data in table are current through 11/06/2010.

Year	Biomass	OFL	ABC	TAC	Catch
2009	Unknown	NA	NA	NA	338
2010	Unknown	NA	NA	NA	131
2011	Unknown	1,530	1,148		
2012		1,530	1,148		

#### *Changes from previous assessment*

Squid were first assessed in 2008 for the purpose of recommending aggregate “other species” harvest levels. As 2010 is an off survey year, this year’s assessment is an update from the 2009 assessment. Catch information was updated through 2009 and through November 6, 2010 along with the distribution

of catch. With the approval of Amendment 87 to the GOA FMP beginning in 2011 the “other species” category will be dissolved and squid will be managed as a target species complex “in the fishery” with an OFL and ABC.

#### *Spawning biomass and stock status trends*

Assessment of squid is challenging due to lack of reliable abundance data and their life history. Squid are generally pelagic and therefore the AFSC standard bottom trawl or longline surveys are unreliable for providing reliable total biomass estimates. Trawl survey biomass estimates of squid are highly variable which may be due to natural variability in squid biomass and/or reflect their patchy distributions. The biomass estimate for all squids based on the 2009 NMFS bottom trawl survey is 8,603 t. Ecosystem models suggest that biomass of squid in the Gulf of Alaska may be at least an order of magnitude larger than trawl survey estimates, for example, salmon alone are estimated to consume between 200,000 and 1,500,000 t of squid annually in the GOA.

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

Calculation of standard fishery reference values is particularly problematic because squid are generally highly productive short lived animals with multiple cohorts in one year. For consistency with other species complexes the Team recommended that for historical catch the period 1997 through 2007 be used instead of 1997 through 2008. The Team discussed different options for making Tier 6 computations.

The stock assessment authors recommended the continued use of a modified Tier 6 (endorsed by the SSC) for establishing OFL and ABC levels for the squid complex based on the highest estimated squid catch during the 1997 to 2008 baseline period. The Team adopted this approach such that the OFL = maximum historical catch and  $ABC = 0.75 * OFL$ . This results **in a recommended OFL of 1,530 t and an ABC of 1,148 t**. The Team requested the assessment authors present a biomass based estimate of OFL and ABC for evaluation next year.

#### *Additional Plan Team Recommendations*

The Team encourages further development of alternative management for squid as an ecosystem component with the understanding that the current groundfish Tier system may be inappropriate for managing cephalopods. Investigating the interactions between incidental fishery removals of squid and foraging by sensitive species (such as toothed whales and albatrosses) should be a high priority research topic.

#### *Status determination*

For stocks in Tier 6, determination of overfished status or approaching an overfished condition is not possible.

#### *Ecosystem Considerations summary*

Fishery management should attempt to prevent negative impacts on squid populations primarily because they are important components in the diets of many seabirds, fish, and marine mammals.

#### *Area apportionment*

The ABC recommendations for squid are Gulf-wide.

## 18b. Sharks

Status and catch specifications (t) of sharks and projections for 2011 and 2012. Through 2010, sharks were managed as part of the “other species” complex, with catch and harvest specifications reported in aggregate along with squid, octopus, and sculpins. Beginning in 2011, the GOA FMP has been amended to provide for separate management for sharks, squids, sculpins, and octopus. For 2011 and 2012 biomass for spiny dogfish is based on minimum reliable biomass estimates from the bottom trawl survey under Tier 5 specifications. For other sharks Tier 6 recommendations based on average catch are used. Catch data for 2010 are current through 11/06/2010.

Year	Biomass	OFL	ABC	TAC	Catch
2009	Unknown	NA	NA	NA	1,167
2010	Unknown	NA	NA	NA	603
2011	79,257 <sup>1</sup>	8,262	3,601		
2012		8,262	3,601		

<sup>1</sup>Biomass estimates are only for spiny dogfish and computed as an average of the last three bottom trawl surveys. Biomass of other sharks is unknown.

### *Changes from previous assessment*

Changes were made to the Catch Accounting System which resulted in adjustments to shark catches. NMFS longline and IPHC survey data have been updated. A spatial examination of observed catch and survey catch was included and alternatives to the average catch history Tier 6 methodology were presented.

### *Spawning biomass and stock status trends*

Stock status and trends are difficult to determine for sharks. NMFS AFSC bottom trawl survey biomass estimates are available for sharks (1984-2009), but are of variable reliability between species. The surveys are expected to sample dogfish and sleeper sharks better than they sample salmon sharks. These biomass estimates generally showed an increasing trend during 1990 – 2007 for spiny dogfish and sleeper sharks. From 2007 to 2009 the biomass estimate for spiny dogfish decreased whereas the estimate for sleeper sharks was stable.

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

The authors recommend managing GOA sharks under Tier 6 (OFL = average catch 1997-2007 and ABC = 0.75\*OFL). The Team differed from the authors and determined that reliable minimum biomass estimates for spiny dogfish are available from the bottom trawl survey to support Tier 5 management. Biomass estimates for spiny dogfish have CVs similar to rockfish species. However, for other sharks the Team adopted Tier 6 for specifications due to the lack of reliable biomass estimates and/or reliable estimates of M. The biomass for spiny dogfish is computed as the average of the last three NMFS bottom trawl survey biomass estimates. This estimate is considered a minimum because spiny dogfish are known to spend considerable time in the pelagic zone where they are not susceptible to bottom trawl gear. The three year average is consistent with other stocks in the GOA.

Using Tier 5 calculations for spiny dogfish the recommended OFL is  $M \times \text{Biomass}$  ( $0.097 \times 79,257$  t) which results in an OFL of 7,688 t. For ABC, the Team recommends using a more precautionary approach than the maximum permissible F. As an alternative, the Team prefers to use the estimate of  $F = 0.04$  provided in the assessment. This value is a Leslie matrix model estimate of F based on Tribuzio and Kruse (in review). The method assumes a closed population and utilizes life history parameters for fecundity, growth, and survival. This approach is comparable to that used for marine mammals and may be appropriate for sharks that have low fecundity, high pup survival, and likely stable recruitment.

Therefore, recommended ABC is  $F * \text{Biomass}$  ( $0.04 \times 79,257 \text{ t}$ ) which results in an ABC of 3,170 t for spiny dogfish.

The Team adopted the Tier 6 approach using average catch for the remaining species in the complex. Using this methodology results in a Tier 6 OFL of 574 t (OFL = average catch of other sharks complex during 1997-2007) and an ABC of 431 t ( $\text{ABC} = 0.75 \times \text{OFL}$ ) for sleeper sharks, salmon sharks, and unidentified sharks. The Team does not support alternative Tier 6 options for sharks such as the maximum catch or percentile approaches discussed in the Joint Team meeting.

**These recommendations result in an overall shark complex ABC of 3,601 t and an overall OFL of 8,262 t.** Additionally, the Team recommends all sharks be placed on bycatch only status.

#### *Status determination*

For this complex, determination of overfished status or approaching an overfished condition is not possible.

#### *Additional Plan Team recommendations*

Sharks are now managed as an individual complex for specifications which creates concerns about the potential for constraining fisheries in which they are caught. It is important to investigate assessment methods which would move all sharks out of Tier 6. While information was presented on the bycatch of sharks in the halibut fishery, this catch is not currently included in official catch estimates. The Plan Team recommends that this work continues. The Plan Team encourages the assessment authors to evaluate the potential use of alternative survey indices such as the IPHC and NMFS longline surveys to help improve biomass indices for sharks. The authors are also encouraged to develop estimates of natural mortality for sleeper sharks.

#### *Ecosystem Considerations summary*

Understanding shark species population dynamics is fundamental to describing ecosystem structure and function in the GOA. Shark species are top level predators as well as scavengers and likely play an important ecological role. Studies designed to determine the ecological roles of spiny dogfish, Pacific sleeper sharks, and salmon sharks are ongoing and are important to determine the affect of fluctuations in shark populations on ecosystem dynamics in the GOA.

#### *Area apportionments*

The ABC and OFL recommendations for sharks are Gulf-wide.

### **18c. Octopus**

Status and catch specifications (t) of octopus and projections for 2011 and 2012. Through 2010, octopus were managed as part of the “other species” complex, with catch and harvest specifications reported in aggregate along with sharks, squids, and sculpins. Beginning in 2011, the GOA FMP has been amended to provide for separate management for sharks, squids, sculpins, and octopus. Reliable point estimates of biomass and life history information for octopus are not sufficient for Tier 5 management. However, minimum biomass estimates are available from the bottom trawl survey and management under Tier 6 is recommended using those estimates for harvest specifications. Catch data are current through 11/06/10.

<b>Year</b>	<b>Biomass</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
2009	Unknown	NA	NA	NA	310
2010	Unknown	NA	NA	NA	324
2011	2,400	1,272	954		
2012		1,272	954		

### *Changes from previous assessment*

The last full assessment was presented in 2009 which included the 2009 GOA bottom trawl survey data. The 2007 GOA survey caught octopus in 8.7% of the trawl tows, with a total biomass estimate of 2,296 tons. The 2009 survey caught octopus in 20.9% of tows, with a total biomass estimate of 3,791 t; this biomass estimate is the highest ever observed. The average of the three most recent (2005, 2007, and 2009) survey biomass estimates is 2,400 tons. The assessment provided updated results from observer special projects including data from 2009 on the condition of octopus discards, updated life history information, and a summary of new octopus research underway.

### *Spawning biomass and stock status trends*

Stock status and trends are difficult to determine for octopus. NMFS AFSC bottom trawl survey biomass estimates are available for octopus species in the GOA (1984-2009), but octopuses may not be well sampled by these surveys and may not reflect the same size octopus caught by the pot fishery (the majority of the removals). The trawl fishery and survey predominately catch small animals (<5 kg), while commercial pot gear retains only larger animals (10-20 kg). The Team discussion concluded that trawl surveys provide minimum biomass estimates and that for conservation purposes were better suited to manage bycatch levels.

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

The Plan Team determined that reliable point estimates of biomass and life history information (specifically  $M$ ) are insufficient for octopus for Tier 5 management and therefore Tier 6 management is recommended. There is no directed fishery for octopus, but the majority of the incidental catch of octopus is retained. Catch history is based on incidental catches thus ABC estimates based on standard Tier 6 criteria are particularly low. Minimum biomass estimates from the trawl surveys and a conservative estimate of octopus mortality based on current information (0.53) are available and represent improved information over average catch for specifications. The Plan Team recommends Tier 6 management with  $F=M=0.53$  and  $F=0.75M=0.3975$  applied to the average of the three most recent (2005, 2007, and 2009) survey biomass estimates (2,400 t) for OFL and ABC, respectively. This results in a 2011 OFL of 1,272 t and a 2011 ABC of 954 t. The Plan Team recommends that octopus be placed on bycatch-only status.

### *Status determination*

For stocks in Tier 6, determination of overfished status or approaching an overfished condition is not possible.

### *Additional Plan Team recommendations*

The Plan Team discussed the problems of applying the current tier system criteria to octopus and all other non-target species for which we are trying to get a reasonable bycatch limit, rather than optimize catch. The Plan Team believes that surveys deemed unreliable for optimizing catch may still be reliable for providing minimum biomass estimates. This information should be used, especially when Tier 6 criteria designed for targeted species with long catch histories are similarly difficult to apply to non-target species only recently identified in catch data. The Plan Team suggests that authors should examine which direction they believe surveys to be biased in and why, rather than rejecting them as information sources because they imperfectly characterize the population. Clearly, some surveys are inadequate even for providing minimum biomass estimates (i.e. where a given species appears in <1% of hauls). The Plan Team suggests that criteria be developed for using surveys as minimum biomass estimates.

### *Ecosystem Considerations summary*

Very little is known about the role of octopus in North Pacific ecosystems. The food-web model indicates that octopus in the GOA are preyed upon primarily by grenadiers, Pacific cod, halibut, and sablefish. The food web model also suggests that octopus biomass is at least an order of magnitude higher than the



survey, lending further support to its use as a minimum biomass estimate. Unlike in the Bering Sea, Steller sea lions and other marine mammals are thought to be insignificant predators of octopus in the GOA.

*Area apportionment*

The ABC recommendations for octopus are Gulf-wide.

**18d. Sculpins**

Status and catch specifications (t) of sculpins and projections for 2011 and 2012. Through 2010, sculpins were managed as part of the “other species” complex, with catch and harvest specifications reported in aggregate along with sharks, squids, and octopus. Beginning in 2011, the GOA FMP has been amended to provide for separate management for sharks, squids, sculpins, and octopus. Biomass is based on 2003-2009 GOA bottom trawl surveys. Catch data are current through 11/06/2010.

<b>Year</b>	<b>Biomass</b>	<b>OFL</b>	<b>ABC</b>	<b>TAC</b>	<b>Catch</b>
2009	30,836	NA	NA	NA	1,055
2010	30,307	NA	NA	NA	735
2011	33,307	7,328	5,496		
2012		7,328	5,496		

*Changes from previous assessment*

Sculpin catch was updated with complete 2009 and partial 2010 data as of November 6, 2010. In addition, catch data from 2003-2008 have been updated due to changes in the Catch Accounting System.

Estimates of instantaneous natural mortality (M) have changed based on recent life history studies on sculpins in the Bering Sea/Aleutian Islands (BSAI). Complex-level natural mortality rate in the Gulf was estimated by multiplying individual species biomass estimates by their respective natural mortality rates and then dividing by the total biomass.

*Spawning biomass and stock status trends*

Aggregate sculpin biomass shows no clear trend. Almost 95% of the sculpin biomass is composed of the larger sculpin species in the GOA. Yellow Irish lord is the most abundant, followed by great sculpin, bigmouth sculpin, and plain sculpin.

Biomass trends show that the bigmouth sculpin declined between 1984 and 2001, but has remained relatively stable since then. Yellow Irish lord biomass has increased over the last three surveys. The CVs for the 2009 survey biomass estimates for 7 out of 12 sculpin species are less than or equal to 0.3, suggesting that the GOA survey is doing an adequate job assessing the biomass of the more abundant species.

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

The Team determined that reliable estimates of biomass are available from the trawl survey and recommended that sculpins be managed under Tier 5. The Team agreed with the assessment authors on the use of a complex-level estimate of M (0.22) applied to the average of the last 4 survey biomass estimates for sculpins (33,307 t) and recommend a 2010 ABC of 5,496 t ( $F_{ABC} = 0.17$ ) and OFL of 7,328 t ( $F_{OFL}=0.22$ ).

*Status determination*

For stocks in Tier 5, determination of overfished condition or approaching an overfished condition is not possible.

### *Additional Plan Team recommendations*

The Team encourages research into Gulf-specific sculpin life history parameters.

### *Ecosystem Considerations summary*

Little is known about sculpin food habits in the GOA, especially during fall and winter months. Limited information from the BSAI suggests that in the GOA the larger sculpin species likely prey on shrimp and other benthic invertebrates, as well as juvenile walleye pollock. In the GOA the main predator of large sculpins are Pacific halibut, pinnipeds, small demersal fish and sablefish.

### *Area apportionment*

The ABC recommendations for sculpins apply Gulf-wide.

## **Appendix 1: Grenadiers**

An executive summary assessment of the grenadier assemblage is provided in **Appendix 1**. This is an update of a full assessment that was provided in the 2006 SAFE report. The grenadier assessment covers both the BSAI and GOA management areas. 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 and popeye grenadiers are occasionally caught. Grenadier species are currently considered “non-specified” under both BSAI and GOA Groundfish FMPs; however, the Teams recommend that the grenadier assemblage, which would include giant grenadier as the indicator species, along with popeye grenadier and Pacific grenadier be moved into a managed category so that annual catch limits can be established. The remaining four grenadier species would remain non-specified.

No management measures have been implemented for grenadiers and no official catch statistics exist because reporting for this assemblage is not required. However, catches have been estimated based on observer data or the NMFS Alaska Region Catch Accounting System from 2003 through October 10, 2010. Average annual catches over this time period have been 2,052 t in the EBS, 3,234 t in the Aleutian Islands (AI), and 5,214 t in the GOA. Most of the catch occurs in longline and pot fisheries.

The Team accepted a Tier 5 approach for determining OFL and ABC under a proposed FMP amendment to set annual catch limits for the grenadier assemblage (using giant grenadiers as a proxy for the assemblage).

## **Appendix 2: Forage fish**

An assessment for forage fish in the Gulf of Alaska is provided in **Appendix 2**. The forage fish category in the Gulf of Alaska FMP contains over sixty species with diverse characteristics. Many of the species in this category are rare and poorly sampled with standard survey methods, therefore it is likely that the FMP forage species list is not comprehensive and the exact number and types of all GOA forage fish is uncertain. Species in the forage fish category have been identified as having ecological importance as prey, and directed fishing is prohibited for the group. Beginning in 2011, forage fishes in the GOA are designated as “Ecosystem Components” in the GOA FMP; as such, they are outside of the specification process and stock assessments are not conducted for this category. Although a full forage fish report has not been prepared since 2008, a lack of significant new data led the Alaska Fisheries Science Center (AFSC) to limit this year’s report to an executive summary. Catch data are updated and there is a brief discussion of two recent developments relevant to GOA forage fishes: 1) the listing of eulachon stocks in northern California, Oregon, Washington, and southern British Columbia as threatened under the Endangered Species Act and 2) progress in implementing the GOA Integrated Ecosystem Research Project (IERP) that is expected to enhance our understanding of GOA forage fish abundance, distribution, and ecology.

The Plan Team continues to recommend maintaining the forage fish chapter as a SAFE appendix to be updated similar to groundfish stock assessments as new information becomes available in the off year, or in the interim as new information and issues arise, noting that forage fish are essential ecosystem components, important to seabirds, marine mammals and commercially important groundfish.

## Tables

Table 1. Gulf of Alaska groundfish 2010 - 2012 OFLs and ABCs, 2010 TACs, and 2010 catches (reported through November 6<sup>th</sup>, 2010).

Stock/ Assemblage	Area	2010			2011		2012		
		OFL	ABC	TAC	Catch	OFL	ABC	OFL	ABC
Pollock	W (61)		26,256	26,256	26,047		27,031		34,932
	C (62)		28,095	28,095	28,269		37,365		48,293
	C (63)		19,118	19,118	19,236		20,235		26,155
	WYAK		2,031	2,031	1,637		2,339		3,024
	Subtotal	103,210	75,500	75,500	75,189	118,030	86,970	151,030	112,404
	EYAK/SEO	12,326	9,245	9,245		12,326	9,245	12,326	9,245
	Total	115,536	84,745	84,745	75,189	130,356	96,215	163,356	121,649
Pacific Cod	W		27,685	20,764	20,971		30,380		27,370
	C		49,042	36,782	36,808		53,816		48,484
	E		2,373	2,017	881		2,604		2,346
	Total	94,100	79,100	59,563	58,660	102,600	86,800	92,300	78,200
Sablefish	W		1,660	1,660	1,329		1,620		1,484
	C		4,510	4,510	4,434		4,740		4,343
	WYAK		1,620	1,620	1,561		1,990		1,818
	SEO		2,580	2,580	2,674		2,940		2,700
	Total	12,270	10,370	10,370	9,998	13,340	11,290	12,232	10,345
Shallow-water flatfish	W		23,681	4,500	75		23,681		23,681
	C		29,999	13,000	5,333		29,999		29,999
	WYAK		1,228	1,228	1		1,228		1,228
	EYAK/SEO		1,334	1,334	1		1,334		1,334
	Total	67,768	56,242	20,062	5,410	67,768	56,242	67,768	56,242
Deep-water Flatfish	W		521	521	2		529		541
	C		2,865	2,865	490		2,919		3,004
	WYAK		2,044	2,044	7		2,083		2,144
	EYAK/SEO		760	760	3		774		797
	Total	7,680	6,190	6,190	502	7,823	6,305	8,046	6,486
Rex sole	W		1,543	1,543	101		1,517		1,490
	C		6,403	6,403	3,284		6,294		6,184
	WYAK		883	883	2		868		853
	EYAK/SEO		900	900			886		869
	Total	12,714	9,729	9,729	3,387	12,499	9,565	12,279	9,396
Arrowtooth Flounder	W		34,773	8,000	2,270		34,317		33,975
	C		146,407	30,000	20,532		144,559		143,119
	WYAK		22,835	2,500	140		22,551		22,327
	EYAK/SEO		11,867	2,500	73		11,723		11,606
	Total	254,271	215,882	43,000	23,015	251,068	213,150	248,576	211,027
Flathead Sole	W		16,857	2,000	317		17,442		17,960
	C		27,124	5,000	3,141		28,104		28,938
	WYAK		1,990	1,990			2,064		2,125
	EYAK/SEO		1,451	1,451			1,523		1,568
	Total	59,295	47,422	10,441	3,458	61,412	49,133	63,202	50,591

Table 1. continued.

Stock/ Assemblage	Area	2010				2011		2012	
		OFL	ABC	TAC	Catch	OFL	ABC	OFL	ABC
Pacific ocean perch	W	3,332	2,895	2,895	3,133	3,221	2,798	3,068	2,665
	C	12,361	10,737	10,737	10,461	11,948	10,379	11,379	9,884
	WYAK		2,004	2,004	1,926		1,937		1,845
	SEO		1,948	1,948			1,883		1,793
	E(subtotal)	4,550	3,952	3,952	1,926	4,397	3,820	4,188	3,638
	Total	20,243	17,584	17,584	15,520	19,566	16,997	18,635	16,187
Northern rockfish <sup>3</sup>	W		2,703	2,703	2,033		2,573		2,446
	C		2,395	2,395	1,838		2,281		2,168
	E								
	Total	6,070	5,098	5,098	3,871	5,784	4,854	5,498	4,614
Shortraker	W		134	134	64		134		134
	C		325	325	136		325		325
	E		455	455	257		455		455
	Total	1,219	914	914	457	1,219	914	1,219	914
Other slope <sup>3</sup>	W		212	212	362		212		212
	C		507	507	275		507		507
	WYAK		273	273	128		276		275
	EYAK/SEO		2,757	200	33		2,757		2,757
	Total	4,881	3,749	1,192	798	4,881	3,752	4,881	3,751
Pelagic Shelf rockfish	W		650	650	530		611		570
	C		3,249	3,249	2,481		3,052		2,850
	WYAK		434	434	75		407		380
	EYAK/SEO		726	726	11		684		638
	Total	6,142	5,059	5,059	3,097	5,570	4,754	5,387	4,438
Rougeye and blackspotted rockfish	W		80	80	91		81		81
	C		862	862	217		868		868
	E		360	360	139		363		363
	Total	1,568	1,302	1,302	447	1,579	1,312	1,581	1,312
Demersal rockfish	Total	472	295	295	127	479	300	479	300
Thornyhead Rockfish	W		425	425	129		425		425
	C		637	637	275		637		637
	E		708	708	149		708		708
	Total	2,360	1,770	1,770	553	2,360	1,770	2,360	1,770
Atka mackerel	Total	6,200	4,700	2,000	2,409	6,200	4,700	6,200	4,700
Big Skate	W		598	598	140		598		598
	C		2,049	2,049	2,155		2,049		2,049
	E		681	681	142		681		681
	Total	4,438	3,328	3,328	2,437	4,438	3,328	4,438	3,328
Longnose Skate	W		81	81	103		81		81
	C		2,009	2,009	816		2,009		2,009
	E		762	762	124		762		762
	Total	3,803	2,852	2,852	1,043	3,803	2,852	3,803	2,852
Other skates	Total	2,791	2,093	2,093	1,464	2,791	2,093	2,791	2,093
Squid	GOA-wide				131	1,530	1,148	1,530	1,148
Sharks	GOA-wide				603	8,262	3,601	8,262	3,601
Octopus	GOA-wide				324	1,272	954	1,272	954
Sculpins	GOA-wide				735	7,328	5,496	7,328	5,496
Other spp total	Total	9,432	7,075	4,500	1,793	18,393	11,199	18,393	11,199
Total		693,253	565,499	292,087	213,635	723,928	587,525	743,421	601,394

Table 2. Gulf of Alaska 2011 ABCs, biomass, and overfishing levels (t) for Western, Central, Eastern, Gulfwide, West Yakutat, and Southeast Outside regulatory areas.

Species/Assemblage	Area	2011		
		ABC	Biomass	OFL
Pollock	W (61)	27,031		
	C (62)	37,365		
	C (63)	20,235		
	WYAK	2,339		
	Subtotal	86,970	934,788	118,030
	EYAK/SEO	9,245	41,088	12,326
	Total	96,215	975,876	130,356
Pacific Cod	W	30,380		
	C	53,816		
	E	2,604		
	Total	86,800	428,000	102,600
Sablefish	W	1,620		
	C	4,740		
	WYAK	1,990		
	EY/SEO	2,940		
	Total	11,290	149,000	13,340
Deep water flatfish	W	23,681		
	C	29,999		
	WYAK	1,228		
	EYAK/SEO	1,334		
	Total	56,242	89,691 <sup>1</sup>	67,768
Shallow water flatfish	W	529		
	C	2,919		
	WYAK	2,083		
	EYAK/SEO	774		
	Total	6,305	398,961	7,823
Rex sole	W	1,517		
	C	6,294		
	WYAK	868		
	EYAK/SEO	886		
	Total	9,565	86,729	12,499
Arrowtooth flounder	W	34,317		
	C	144,559		
	WYAK	22,551		
	EYAK/SEO	11,723		
	Total	213,150	2,121,440	251,068
Flathead sole	W	17,442		
	C	28,104		
	WYAK	2,064		
	EYAK/SEO	1,523		
	Total	49,133	325,357	61,412

Table 2. Continued...

Species/Assemblage	2011			
	Area	ABC	Biomass	OFL
Pacific ocean perch	W	2,798		3,221
	C	10,379		11,948
	WYAK	1,937		
	EY/SEO	1,883		
	EGOA	3,820		4,397
	Total	16,997		330,480
Northern rockfish	W	2,573		
	C	2,281		
	E		2	
	Total	4,854		100,463
Shortraker	W	134		
	C	325		
	E	455		
	Total	914		40,626
Other Slope rockfish	W	212		
	C	507		
	WYAK	276		
	EYAK/SEO	2,757		
	Total	3,752		76,867 <sup>3</sup>
Pelagic shelf rockfish	W	611		
	C	3,052		
	WYAK	407		
	EY/SEO	684		
	Total	4,754		66,498
Rougheye	W	81		
	C	868		
	E	363		
	Total	1,312		45,907
Demersal shelf rockfish	Total	300		14,395
Thornyhead rockfish	Western	425		
	Central	637		
	Eastern	708		
	Total	1,770		78,795 <sup>3</sup>
Atka mackerel	Total	4,700		Unknown
Big skates	W	598		7,979
	C	2,049		27,325
	E	681		9,077
	Total	3,328		44,381
Longnose skates	W	81		1,086
	C	2,009		26,790
	E	762		10,155
	Total	2,852		38,031
Other skates	Total	2,093		28,908
Squid		1,148		1,530
Sharks		3,601		79,257
Octopus		954		2,400
Sculpins		5,496		33,307
Other species total		11,199		NA
All species	Total	587,525		5,402,961
				723,928

1/ The EGOA ABC of 2 t for northern rockfish has been included in the WYAK ABC for other slope rockfish.

2/ Biomass of Dover sole; biomass of Greenland turbot and deep-sea sole is unknown.

3/ Historically lightly exploited therefore expected to be above the specified reference point.

Table 3. Summary of fishing mortality rates and overfishing levels for the Gulf of Alaska, 2011.

Species	Tier	$F_{ABC}^1$	Strategy	$F_{OFL}^2$	Strategy
Pollock	3b	0.12	$F_{ABC}$	0.16	$F_{35\%}$ adjusted
Pacific cod	3a	0.42	$F_{40\%}$	0.51	$F_{35\%}$
Sablefish	3b	0.089	$F_{40\%}$ adjusted	0.106	$F_{35\%}$ adjusted
Deepwater flatfish	3a,6 <sup>3</sup>	0.119	$F_{40\%}$ , $F_{ABC}^3$	0.149	$F_{35\%}$ , $F_{OFL}^4$
Rex sole	5	0.128	$F=.75M$	0.17	$F=M$
Flathead sole	3a	0.406	$F_{40\%}$	0.53	$F_{35\%}$
Shallow water flatfish	4,5 <sup>5</sup>	0.150, 0.162, 0.204	$F_{40\%}$ , $F=.75M^5$	0.192, 0.20, 245	$F_{35\%}$ , $F=M^6$
Arrowtooth	3a	0.183	$F_{40\%}$	0.219	$F_{35\%}$
Pacific ocean perch	3a	0.123	$F_{40\%}$	0.142	$F_{35\%}$
Rougheye and blackspotted rockfish	3a	0.040	$F_{40\%}$	0.048	$F_{35\%}$
Shortraker rockfish	5	0.0225	$F=.75M$	0.03	$F=M$
Other slope rockfish	4, 5 <sup>7</sup>	0.053, 0.038-0.075	$F_{40\%}$ , $F=.75M^7$	0.064, 0.05, 0.10	$F_{35\%}$ , $F=M^8$
Northern rockfish	3a	0.059	$F_{40\%}$	0.071	$F_{35\%}$
Pelagic shelf rockfish	3a,5 <sup>9</sup>	0.087, 0.0525	$F_{40\%}$ , $F=.75M^9$	0.106, 0.07	$F_{35\%}$ , $F=M^{10}$
Demersal shelf rockfish	4	0.02	$F=M$	0.032	$F_{35\%}$
Thornyhead rockfish	5	0.0225	$F=.75M$	0.03	$F=M$
Atka mackerel	6	NA	$F_{ABC}^{11}$	NA	$F_{OFL}^{12}$
Skates	5	0.08	$F=.75M$	0.10	$F=M$
Sculpins	5	0.17	$F=.75M$	0.22	$F=M$
Squid	6	NA	$F_{ABC}^{13}$	NA	$F_{OFL}^{14}$
Octopus	6	0.3975	$F=.75M^{15}$	0.53	$F=M^{16}$
Sharks	5,6 <sup>17</sup>	0.04	$F_{ABC}^{17}$	0.097	$F=M$ , $F_{OFL}^{18}$

1/ Fishing mortality rate corresponding to acceptable biological catch.

2/ Maximum fishing mortality rate allowable under overfishing definition.

3/  $F_{40\%}$  for Dover sole (Tier 3a),  $ABC=.75$  x average catch (1978-1995) for other deepwater flatfish (Tier 6).

4/  $F_{35\%}$  for Dover sole (Tier 3a), average catch (1978-1995) for other deepwater flatfish (Tier 6).

5/  $F_{40\%}$  for northern and southern rocksole (Tier 4),  $F=.75M$  for remaining shallow water flatfish (Tier 5).

6/  $F_{35\%}$  for northern and southern rocksole (Tier 4),  $F=M$  for remaining shallow water flatfish (Tier 5).

7/  $F_{40\%}$  for sharpchin rockfish (Tier 4),  $F=.75M$  for other species (Tier 5).

8/  $F_{35\%}$  for sharpchin (Tier 4),  $F=M$  for other species (Tier 5).

9/  $F_{40\%}$  for dusky rockfish (Tier 3a),  $F=.75M$  for dark, widow, and yellowtail rockfish (Tier 5).

10/  $F_{35\%}$  for dusky rockfish (Tier 3a),  $F=M$  for dark, widow and yellowtail rockfish (Tier 5).

11/  $ABC$  for Atka mackerel is equal to 0.75 x average catch from 1978 to 1995. This maximum permissible  $ABC$  is intended for bycatch in other target fisheries and to minimize targeting.

12/  $OFL$  for Atka mackerel is equal to average catch from 1978 to 1995.

13/  $ABC$  for squid is equal to 0.75 x the maximum catch of squid from 1997-2007. This is a modified Tier 6 recommendation.

14/  $OFL$  for squid is equal to the maximum catch of squid from 1997-2007. This is a modified Tier 6 recommendation.

15/  $ABC$  for octopus is equal to  $F=.75M$  x the average estimate of biomass from the 2005, 2007, and 2009 surveys. This is a modified Tier 6 recommendation.

16/  $OFL$  for octopus is equal to  $F=M$  x the average estimate of biomass from the 2005, 2007, and 2009 surveys. This is a modified Tier 6 recommendation.

17/  $F_{ABC} = 0.04$  for spiny dogfish (Tier 5),  $ABC$  for other sharks is equal to 0.75 x average catch from 1997-2007 (Tier 6). This time frame differs from the standard Tier 6 time frame of 1978-1995. The  $F_{ABC}$  for spiny dogfish is a sustainable fishing mortality presented in the assessment.

18/  $F=M$  for spiny dogfish (Tier 5),  $OFL$  for sharks is equal to the average catch from 1997-2007 (which differs from the standard Tier 6 time frame of 1978-1995).

Table 4. Maximum permissible fishing mortality rates and ABCs as defined in Amendment 56 to the GOA and BSAI Groundfish FMPs, and the Plan Team's 2011 recommended fishing mortality rates and ABCs, for those species whose recommendations were below the maximum. Relative to last year, there are no changes to this table.

Species	Tier	2011			2011
		$Max F_{ABC}$	$Max ABC$	$F_{ABC}$	ABC
Pollock <sup>1</sup>	3b	0.14	102,940	0.12	86,970
Demersal shelf rockfish	4	0.026	390	0.02	300
Sharks	5,6	0.073	6,197	0.04	3,601

1/ The Plan Team reco 2011 W/C pollock ABC of 86,970 t is reduced by 1,650 t to accommodate the Prince William Sound GHL. For comparisons in this table, the maximum permissible ABC of 102,940 t should be compared with the full ABC 88,620 t. Table 5. Groundfish landings (metric tons) in the Gulf of Alaska, 1956-2010.



Year	Pollock	Pacific cod	sablefish	Flat fish	Arrowtooth Flounder	Slope rockfish <sup>a</sup>
1956			1,391			
1957			2,759			
1958			797			
1959			1,101			
1960			2,142			
1961			897			16,000
1962			731			65,000
1963			2,809			136,300
1964	1,126	196	2,457	1,028		243,385
1965	2,749	599	3,458	4,727		348,598
1966	8,932	1,376	5,178	4,937		200,749
1967	6,276	2,225	6,143	4,552		120,010
1968	6,164	1,046	15,049	3,393		100,170
1969	17,553	1,335	19,376	2,630		72,439
1970	9,343	1,805	25,145	3,772		44,918
1971	9,458	523	25,630	2,370		77,777
1972	34,081	3,513	37,502	8,954		74,718
1973	36,836	5,963	28,693	20,013		52,973
1974	61,880	5,182	28,335	9,766		47,980
1975	59,512	6,745	26,095	5,532		44,131
1976	86,527	6,764	27,733	6,089		46,968
1977	112,089	2,267	17,140	16,722		23,453
1978	90,822	12,190	8,866	15,198		8,176
1979	98,508	14,904	10,350	13,928		9,921
1980	110,100	35,345	8,543	15,846		12,471
1981	139,168	36,131	9,917	14,864		12,184
1982	168,693	29,465	8,556	9,278		7,991
1983	215,567	36,540	9,002	12,662		7,405
1984	307,400	23,896	10,230	6,914		4,452
1985	284,823	14,428	12,479	3,078		1,087
1986	93,567	25,012	21,614	2,551		2,981
1987	69,536	32,939	26,325	9,925		4,981
1988	65,625	33,802	29,903	10,275		13,779
1989	78,220	43,293	29,842	11,111		19,002
1990	90,490	72,517	25,701	15,411		21,114
1991	107,500	76,997	19,580	20,068		13,994
1992	93,904	80,100	20,451	28,009		16,910
1993	108,591	55,994	22,671	37,853		14,240
1994	110,891	47,985	21,338	29,958		11,266
1995	73,248	69,053	18,631	32,273		15,023
1996	50,206	67,966	15,826	19,838	22,183	14,288
1997	89,892	68,474	14,129	17,179	16,319	15,304
1998	123,751	62,101	12,758	11,263 <sup>1</sup>	12,974	14,402
1999	95,637	68,613	13,918	8,821	16,209	18,057
2000	71,876	54,492	13,779	13,052	24,252	15,683
2001	70,485	41,614	12,127	11,817	19,964	16,479
2002	49,300 <sup>1</sup>	52,270	12,246	12,520	21,230	17,128
2003	49,300	52,500	14,345	10,750	23,320	18,678
2004	62,826	43,104	15,630	7,634	15,304	18,194
2005	80,086	35,205	13,997	9,890	19,770	17,306
2006	70b,522	37,792	13,367	14,474	27,653	20,492
2007	51,842	39,473	12,265	15,077	25,364	18,718
2008	51,721	43,481	12,326	16,393	29,293	18,459
2009	42,389	39,397	10,910	17,360	24,937	18,621
2010 <sup>H</sup>	75,189	58,660	9,998	12,757	23,015	21,093

a/ Catch defined as follows: (1) 1961-78, Pacific ocean perch (*S. alutus*) only; (2) 1979-1987, the 5 species of the Pacific ocean perch complex; 1988-90, the 18 species of the slope rock assemblage; 1991-1995, the 20 species of the slope rockfish assemblage.

b/ Catch from Southeast Outside District.

c/ Thornyheads were included in the other species category, and are foreign catches only.

d/ After numerous changes, the other species category was stabilized in 1981 to include sharks, skates, sculpins, eulachon, capelin (and other smelts in the family Osmeridae and octopus. Atka mackerel and squid were added in 1989. Catch of Atka Mackerel is reported separately for 1990-1992; thereafter Atka mackerel was assigned a separate target species.

Table 5. (cont'd) Groundfish landings (metric tons) in the Gulf of Alaska, 1956-2009.

Year	Pelagic Shelf rockfish	Demersal shelf rockfish <sup>b</sup>	Thornyheads <sup>c</sup>	Atka mackerel <sup>e</sup>	Skates <sup>k</sup>	Other species <sup>d</sup>	Total
1956							1,391
1957							2,759
1958							797
1959							1,101
1960							2,142
1961							16,897
1962							65,731
1963							139,109
1964							248,192
1965							360,131
1966							221,172
1967							139,206
1968							125,822
1969							113,333
1970							84,983
1971							115,758
1972							158,768
1973							144,478
1974							153,143
1975							142,015
1976							174,081
1977			0	19,455		4,642	195,768
1978			0	19,588		5,990	160,830
1979			0	10,949		4,115	162,675
1980			1,351	13,166		5,604	202,426
1981			1,340	18,727		7,145	239,476
1982		120	788	6,760		2,350	234,001
1983		176	730	12,260		2,646	296,988
1984		563	207	1,153		1,844	356,659
1985		489	81	1,848		2,343	320,656
1986		491	862	4		401	147,483
1987		778	1,965	1		253	146,703
1988	1,086	508	2,786	-		647	158,411
1989	1,739	431	3,055	-		1,560	188,253
1990	1,647	360	1,646	1,416		6,289	236,591
1991	2,342	323	2,018	3,258		1,577	247,657
1992	3,440	511	2,020	13,834		2,515	261,694
1993	3,193	558	1,369	5,146		6,867	256,482
1994	2,990 <sup>f</sup>	540	1,320	3,538		2,752	232,578
1995	2,891	219 <sup>g</sup>	1,113	701		3,433	216,585
1996	2,302	401	1,100	1,580		4,302	199,992
1997	2,629	406	1,240	331		5,409	231,312
1998	3,111	552	1,136	317		3,748	246,113
1999	4,826	297	1,282	262		3,858	231,780
2000	3,730	406	1,307	170		5,649	204,396
2001	3,008	301	1,339	76		4,801	182,011
2002	3,318	292	1,125	85		4,040	173,554
2003	2,975	229	1,159	578		6,339	180,173
2004	2,674	260	818	819	2,912	1,559	171,734
2005	2,235	187	719	799	2,710	2,294	185,211
2006	2,446	166	779	876	3,501	3,526	195,594
2007	3,318	250	701	1,453	3,498	2,928	174,887
2008	3,634	149	741	2,109	3,606	2,776	184,149
2009	3,057	138	666	2,222	7,020	2,870	169,604
2010 <sup>h</sup>	3,097	127	553	2,409	4,944	1,793	213,635

e/ Atka mackerel was added to the Other Species category in 1988 and separated out in 1994

f/ PSR includes light dusky, yellowtail, widow, dark, dusky, black, and blue rockfish; black and blue excluded in 1998, dark in 2008.

g/ Does not include at-sea discards.

h/ Catch data reported through November 6<sup>th</sup>, 2010.

i/ Includes all species except arrowtooth.

j/ Does not include state fisheries

k/ Includes all managed skates species

## Figures

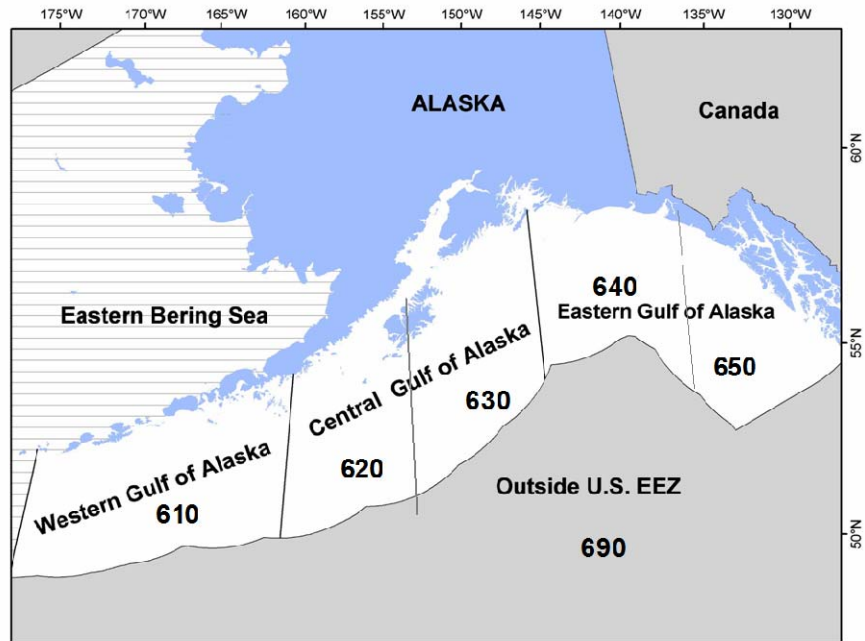


Figure 1. Gulf of Alaska statistical and reporting areas.

## Gulf of Alaska

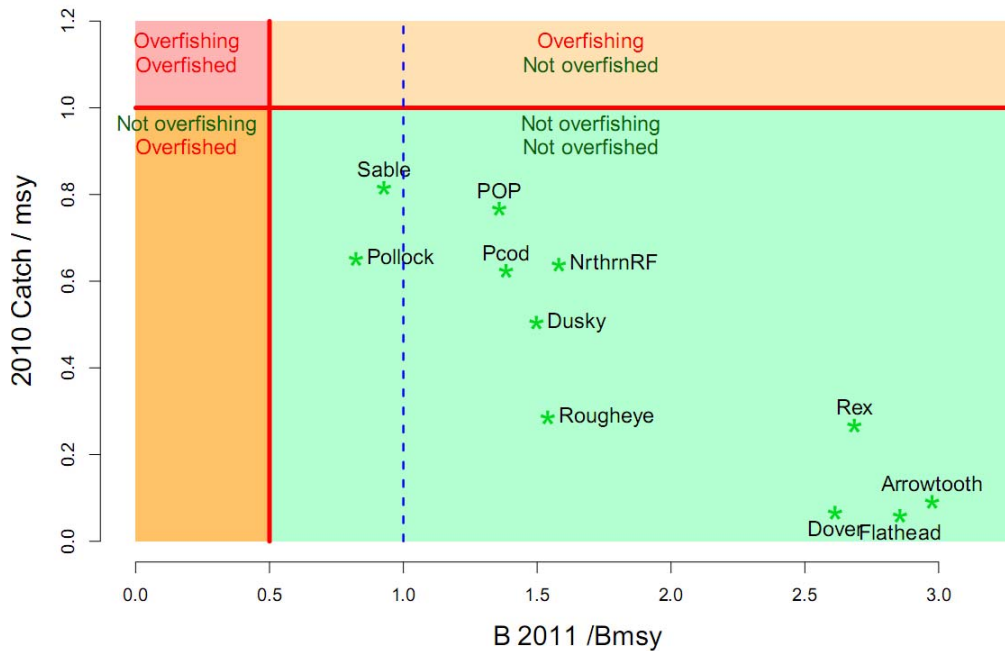
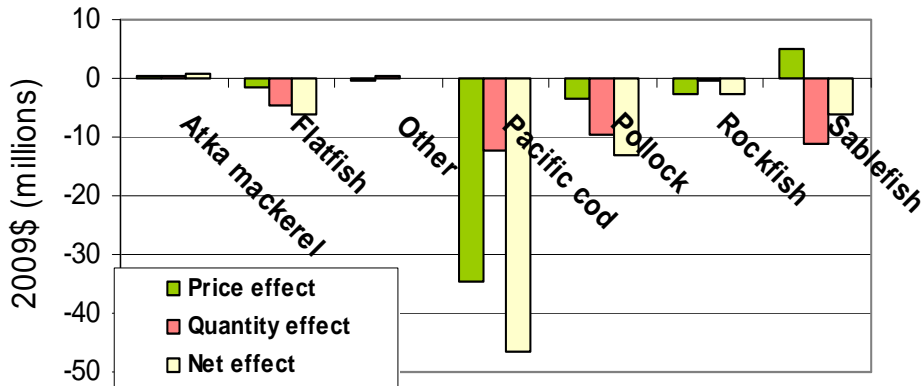


Figure 2. Summary status of age-structured GOA species relative to 2010 catch levels (vertical axis) and projected 2011 spawning biomass relative to  $B_{msy}$  levels. Note that the 2010 MSY level is defined as the 2010 catch at  $F_{OFL}$ .

**GOA First-Wholesale Revenue Change in 2008-09  
Decomposed by Species Group**



**GOA First-Wholesale Revenue Change in 2008-09  
Decomposed by Product Group**

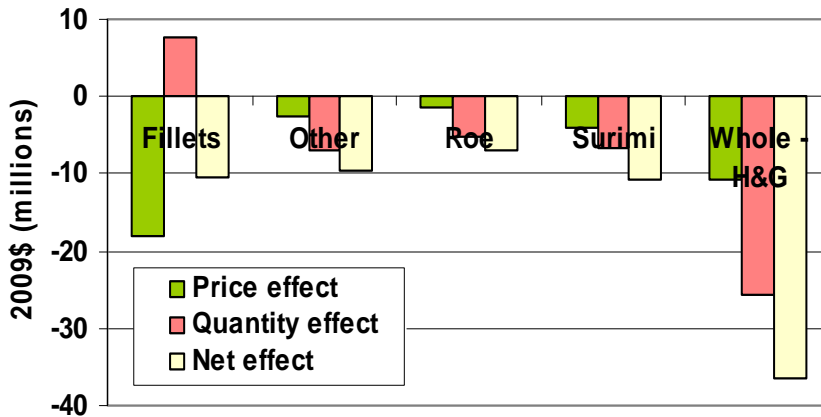


Figure 3.

Decomposition of the change in first-wholesale revenues from 2008-09 in the GOA area. 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.