

APPENDIX B

STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

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

Compiled by

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



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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	9
Stock Assessment Section	
1. Walleye pollock	53
2. Pacific cod	183
3. Sablefish	323
4. Shallow water flatfish	433
4.1 Northern and southern rock sole	437
5. Deep water flatfish	535
6. Rex sole	551
7. Arrowtooth flounder	555
8. Flathead sole	559
9. Pacific ocean perch	563
10. Northern rockfish	593
11. Shortraker rockfish	597
12. Dusky rockfish	601
13. Rougheye and blackspotted rockfish	605
14. Demersal shelf rockfish	609
15. Thornyhead rockfish	617
16. Other rockfish	621
17. Atka mackerel	625
18. Skates	629
19. Sculpins	637
20. Sharks	639
21. Squid	643
22. Octopus	647
Appendix 1: Grenadiers	689
Appendix 2: Forage fish	759
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 13-16th, 2012 to review the status of stocks of twenty three 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), Sandra Lowe, Chris Lunsford, Jon Heifetz, Kristen Green, Elisa Russ, Mark Stichart, Mike Dalton, Nancy Friday, Leslie Slater, Craig Faunce, Ian Stewart, and Paul Spencer. Tom Pearson was unable to attend. Additional AFSC staff (Steve Kasperski) assisted with the meeting and report preparation.

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 (Fig. 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 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, northern and southern rock sole, rex sole, flathead sole, arrowtooth flounder, Pacific ocean perch, shortraker rockfish, rougheye/blackspotted rockfish, northern rockfish, “other ” rockfish (formerly “other slope” rockfish), dusky rockfish (formerly “pelagic shelf” rockfish), demersal shelf rockfish, thornyhead rockfish, Atka mackerel, squid, sculpin, sharks, octopus, big skates, longnose skates, and other 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:

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

¹Must be immediately returned to the sea

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

³Management delegated to the State of Alaska

⁴Management 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, a summary is provided in Appendix 1 if in the future grenadiers are moved back into the FMP. The Council took initial action in June, 2012 to go forward with an EA/RIR/ERFA to consider grenadiers for inclusion in the groundfish FMPs.

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, dusky rockfish (formerly in the “pelagic shelf” rockfish category), 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 rockfish (formerly “other slope” rockfish), rougheye and blackspotted 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 as individual complexes (previously they were managed as “other species”). Also in 2011, the rockfish categories were reorganized: widow and yellowtail rockfish were removed from the pelagic shelf rockfish complex leaving dusky rockfish as a single species category. Widow and yellowtail rockfish were added to the 15 species that were part of the former “other slope” rockfish group to form a new category in the Gulf of Alaska, “other rockfish”. Previously, yellowtail and widow rockfish were part of the “pelagic shelf”

rockfish group in the Gulf of Alaska, which will no longer exist (for assessment purposes) in 2012. Both shortraker rockfish and “other rockfish” are each presented as separate SAFE chapters in 2012. Separating these two chapters responds to recommendations from the Gulf of Alaska Plan Team and the NPFMC Scientific and Statistical Committee.

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 conferred to the ADF&G. In 2008, dark rockfish were similarly removed from the GOA FMP with sole management taken over by the 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. The 2001 through 2012 W/C/WY pollock ABCs have been reduced by the PWS GHL as provided by ADF&G, before area apportionments were made. At the 2012 September Plan Team meeting, ADF&G presented a proposal to set the PWS GHL in future years as a fixed percentage of the W/C/WY pollock ABC of 2.5%. That value is the midpoint between the 2001-2010 average GHL percentage of the GOA ABC (2.44%) and the 1996 and 2012 levels (2.55%). The Plan Team accepted this proposal, but noted concern regarding the lack of a biomass-based allocation in PWS. The Team encouraged the State to work with the AFSC in order to provide a biomass-based evaluation for PWS prior to fixing a percentage in regulation. In the interim, the Plan Team will deduct a value for the 2013 PWS GHL (equal to 2.5% of the recommended 2013 W/C/WY pollock ABC) from the recommended 2013 and 2014 W/C/WY pollock ABCs before area apportionments are made. It is important to note that the value of the PWS GHL is dependent on the final specified W/C/WY pollock ABC. The values used by the Plan Team to derive the 2013 and 2014 W/C/WY pollock ABCs (and PWS GHLs) are given in Table 4 of the SAFE Introduction.

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.

No Split	Split, Point Estimate	Split, Upper 95% CI
Pacific cod	Pollock	Pacific ocean perch
Atka mackerel	Sablefish	Dusky 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 rockfish	

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 α is set at a default value of 0.05, with the understanding that the SSC may establish a different value for a specific stock or stock complex as merited by the best available scientific information. For tiers (2-4), a designation of the form “ $F_{X\%}$ ” refers to the F associated with an equilibrium level of spawning per recruit (SPR) equal to $X\%$ of the equilibrium level of spawning per recruit in the absence of any fishing. If reliable information sufficient to characterize the entire maturity schedule of a species is not available, the SSC may choose to view SPR calculations based on a knife-edge maturity assumption as reliable. For tier (3), the term $B_{40\%}$ refers to the long-term average biomass that would be expected under average recruitment and $F=F_{40\%}$.

Tier	<p>1) Information available: <i>Reliable point estimates of B and B_{MSY} and reliable pdf of F_{MSY}.</i></p> <p>1a) Stock status: $B/B_{MSY} > 1$ $F_{OFL} = \mu_A$, the arithmetic mean of the pdf $F_{ABC} \leq \mu_H$, the harmonic mean of the pdf</p> <p>1b) Stock status: $\alpha < B/B_{MSY} \leq 1$ $F_{OFL} = \mu_A \times (B/B_{MSY} - \alpha)/(1 - \alpha)$ $F_{ABC} \leq \mu_H \times (B/B_{MSY} - \alpha)/(1 - \alpha)$</p> <p>1c) Stock status: $B/B_{MSY} \leq \alpha$ $F_{OFL} = 0$ $F_{ABC} = 0$</p> <p>2) Information available: <i>Reliable point estimates of B, B_{MSY}, F_{MSY}, F_{35%}, and F_{40%}.</i></p> <p>2a) Stock status: $B/B_{MSY} > 1$ $F_{OFL} = F_{MSY}$ $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%})$</p> <p>2b) Stock status: $\alpha < B/B_{MSY} \leq 1$ $F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)$ $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)$</p> <p>2c) Stock status: $B/B_{MSY} \leq \alpha$ $F_{OFL} = 0$ $F_{ABC} = 0$</p> <p>3) Information available: <i>Reliable point estimates of B, B_{40%}, F_{35%}, and F_{40%}.</i></p> <p>3a) Stock status: $B/B_{40\%} > 1$ $F_{OFL} = F_{35\%}$ $F_{ABC} \leq F_{40\%}$</p> <p>3b) Stock status: $\alpha < B/B_{40\%} \leq 1$ $F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$ $F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$</p> <p>3c) Stock status: $B/B_{40\%} \leq \alpha$ $F_{OFL} = 0$ $F_{ABC} = 0$</p> <p>4) Information available: <i>Reliable point estimates of B, F_{35%}, and F_{40%}.</i> $F_{OFL} = F_{35\%}$ $F_{ABC} \leq F_{40\%}$</p> <p>5) Information available: <i>Reliable point estimates of B and natural mortality rate M.</i> $F_{OFL} = M$ $F_{ABC} \leq 0.75 \times M$</p> <p>6) Information available: <i>Reliable catch history from 1978 through 1995.</i> $OFL =$ the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information $ABC \leq 0.75 \times OFL$</p>
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Overfished or approaching an overfished condition is determined for all age-structured stock assessments by comparison of the stock level in relation to its MSY level according to 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 2012 or 2) above ½ of its MSY level in 2012 and above its MSY level in 2022 under this scenario, then the stock is not overfished.)

Approaching an overfished condition (listed in each assessment as scenario 7):

In 2013 and 2014, 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 2025 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, flathead sole, northern and southern rocksole, arrowtooth flounder, Pacific ocean perch, rougheye 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 deep-water flatfish (including Dover sole), shallow-water flatfish (excluding northern and southern rocksole), rex sole, shorttraker rockfish, other rockfish (formerly other slope rockfish), demersal shelf 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 2013, and recommendations for ABCs and overfishing levels (OFLs) for 2013 and 2014. 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, 1956-2012.

The sum of the preliminary 2013, 2014 ABCs for target species are 595,920 t (2013), 584,094 t (2014) which are within the FMP-approved optimum yield (OY) of 116,000 - 800,000 t for the Gulf of Alaska. The sum of 2013 and 2014 OFLs are 738,676 t and 723,580 t, respectively. The Team notes that because of halibut bycatch mortality considerations in the high-biomass flatfish fisheries, an overall OY for 2013 will be considerably under this upper limit. For perspective, the sum of the 2012 TACs was 438,159 t, and the sum of the ABCs was 606,048 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 2011 and 2012 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 2013 and 2014 correspond to the Plan Team recommendations.
- (4) The exploitable biomass for 2011 and 2012 that are reported in the following summaries were estimated by the assessments in those years. Comparisons of the projected 2013 biomass with previous years’ levels should be made with biomass levels from the revised hindcast reported in each assessment.

- (5) The values used for 2013 and 2014 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. Since 2012 is 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 2013 and 2014 (Table 1). In the case of stocks managed under Tier 3, 2013 and 2014 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 (2011) was used. Tier 6 stocks may have alternatives based on updated catch information.

The 2014 ABC and OFL values recommended in next year's SAFE report are likely to differ from this year's projections for 2014 because data from 2013 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 2010-11

The domestic groundfish fishery off Alaska (BSAI and GOA) is the largest fishery by volume in the U.S. With a total catch of 2.07 million metric tons (t), a retained catch of 1.99 million t, and an ex-vessel value of \$992 million in 2011, it accounted for 55.4% of the weight and 18.1% of the ex-vessel value of total U.S. domestic landings as reported in Fisheries of the United States, 2010. The real ex-vessel value of all Alaska domestic fish and shellfish catch, including the estimated value of fish caught almost exclusively by catcher/processors, increased from \$1.74 billion in 2010 to \$1.87 billion in 2011. The value of 2011 groundfish catch after primary processing was \$2.52 billion (F.O.B. Alaska). The 2011 total catch increased by 26% and the total value of primary processed catch increased by 34% relative to 2010. The groundfish fisheries accounted for the largest share (44%) of the ex-vessel value of all commercial fisheries off Alaska in, while the Pacific salmon (*Oncorhynchus spp.*) fishery was second with \$565 million or 30% of the total Alaska ex-vessel value. The value of the shellfish fishery amounted to \$266 million or 14% of the total for Alaska and exceeded the value of Pacific halibut (*Hippoglossus stenolepis*) with \$205 million or 11% of the total for Alaska (Fig. 3).

The Economic SAFE report (appendix bound separately) contains detailed information about economic aspects of the fishery, including figures and tables, market profiles for the most commercially valuable species, a summary of the relevant research being undertaken by the Economic and Social Sciences Research Program (ESSRP) at the Alaska Fisheries Science Center (AFSC) and a list of recent publications by ESSRP analysts. The figures and tables in the report provide estimates of total groundfish catch, groundfish discards and discard rates, prohibited species catch (PSC) and PSC rates, the ex-vessel value of the groundfish catch, the ex-vessel value of the catch in other Alaska fisheries, the gross product value of the resulting groundfish seafood products, the number and sizes of vessels that participated in the groundfish fisheries off Alaska, vessel activity, and employment on at-sea processors. Generally, the data presented in this report cover the years 2006 through 2011, but limited catch and ex-vessel value data are reported for earlier years in order to illustrate the rapid development of the domestic groundfish fishery in the 1980s and to provide a more complete historical perspective on catch.

In addition, the Economic SAFE contains links to data on some of the external factors that impact the economic status of the fisheries. Such factors include foreign exchange rates, the prices and price indices

of products that compete with products from these fisheries, domestic per capita consumption of seafood products, and fishery imports.

The Economic SAFE report also updates the set of market profiles for pollock, Pacific cod, sablefish, and flatfish published here in the last four years' reports. These analyses discuss the relatively recent states of the markets for these species in terms of pricing, volume, supply and demand. Trade patterns and market share are also discussed.

This is the second year in which the Economic SAFE report has added a section that analyzes economic performance of the groundfish fisheries using indices. These indices are created for different sectors of the North Pacific, and relate changes in value, price, and quantity across species, product and gear types to aggregate changes in the market.

The tables from this and past Economic SAFE reports are available online at <http://www.afsc.noaa.gov/REFM/Socioeconomics/documents.php>.

Decomposition of the change in first-wholesale revenues from 2010-11 in the GOA

The following brief analysis summarizes the overall changes that have occurred in the quantity produced, value, and revenue generated from GOA groundfish. According to data reported in the 2012 Economic SAFE report, the ex-vessel value of Alaska groundfish in the GOA area grew from approximately \$174 million in 2010 to approximately \$233 million in 2011 which is an increase of 34% (Fig. 4), first-wholesale revenues from the processing and production of Alaska groundfish in the GOA grew from approximately \$310 million in 2010 to \$407 million in 2011, an increase of 31.3% (Fig. 5). During that same time-period, the total quantity of groundfish products from the GOA increased from 91.5 thousand t to 104.0 thousand t, a difference of 12.6 thousand t. These changes in the GOA account for part of the change in first-wholesale revenues from Alaska groundfish fisheries overall which increased by 34.0% in 2011 relative to 2010 levels.

By species, positive price and quantity effects for Pacific cod and sablefish were the largest contributors to the change in first-wholesale revenues for the GOA from 2010-11 (Fig. 6), with a combined net effect of \$70.3 million. In addition, there was a modest price and effect for rockfish, and quantity effect for pollock, which added \$13.1 million, and \$10.2 million, respectively, to the total change in GOA first-wholesale revenues for 2010-2011. These positive effects were mainly concentrated in the whole head & gut product group.

In summary, first-wholesale revenues from the GOA groundfish fisheries increased by \$97 million from 2010-11. This increase was concentrated in positive price and quantity effects for cod and sablefish, and in the whole head & gut product group. Overall, price effects contributed more than quantity effects in the GOA. In comparison, first-wholesale revenues increased by \$543 million from 2010-11 in the BSAI, due mainly higher pollock landings.

Ecosystem Considerations-Gulf of Alaska

The Ecosystem Considerations chapter (appendix bound separately) consists of three sections: executive summary, ecosystem assessment, and ecosystem status and management indicators. The ecosystem assessment section combines information from the stock assessment chapters with the indicators followed in this chapter to summarize the climate and fishery effects on the ecosystem. A workshop is planned for 2013, during which a new Gulf of Alaska Ecosystem Assessment team will develop an assessment following the procedure and format of the Eastern Bering Sea and Aleutian Island assessments. Until then, we summarize GOA contributions to the ecosystem considerations chapter below.

New trends highlighted in the 2012 ecosystem considerations chapter include:

- North Pacific atmosphere-ocean system during 2010-2011 reflected the combination of a response to La Niña and intrinsic variability. Cooler than normal upper ocean temperatures prevailed in the

eastern portion of the North Pacific and warmer than normal temperatures occurred in the west-central and then central portion of the basin. The models used to forecast ENSO are indicating outcomes for the winter of 2012-13 ranging from near neutral to a weak-moderate El Niño. It is likely that there will be a warming of Alaskan waters over the next 2-3 seasons, relative to the mostly cooler than normal temperatures that have prevailed over the last 5 years.

- The poleward branch of the Alaska Current in the southeastern portion of the Gulf increased markedly from summer into fall of 2011, and after declining over the course of the winter, again increased from spring into summer 2012. The mixed layer depths in the Gulf were shallower than usual during the winter of 2011-2012 but by early summer 2012 were near their seasonal norms. Eddy Kinetic Energy (EKE) levels were approximately average off Kodiak and high in the northern Gulf of Alaska in 2011. The 2011/2012 PAPA trajectory followed the general northeastwardly path of most drifters, but was notable because its ending latitude was the northernmost of all trajectories since 1994.
- Phytoplankton biomass was probably more tightly confined to the shelf during 2009 due to the absence of eddies, while in 2007, 2010 and 2011, phytoplankton biomass likely extended farther off the shelf.
- Zooplankton was numerically dominated by calanoid copepods, including small and large species. Mesozooplankton biomass was apparently low in the Alaskan shelf region (northern GOA) in 2011, while the oceanic Northeast Pacific showed a late and extended biomass peak. Larger species were present in the northeast Pacific later into summer than average, consistent with cool La Niña conditions delaying their development.
- Presently, four of the five crab fisheries analyzed show no increases in the spatial variability of the catch, and thus are not showing patterns that might be consistent with declining resilience and an increased chance of sudden collapse.
- Forage species catch rates remain at low levels, one to two orders of magnitude lower than peak values observed in the 1970s and early 1980s. Eulachon, which in recent years has had the highest catch rates of the time series, decreased in 2011 to a rate below the long-term average.
- Spatial patterns were apparent in the 2011 GOA IERP survey. The highest CPUE of juvenile salmon was in the central GOA and the mouth of Cross Sound. Catches of age-0 marine fish were relatively low, with most rockfish located off the shelf in the southeast and arrowtooth flounder on the shelf and in the central regions.
- Although an apparent decrease in biomass was observed between 2010 and 2011 for some areas, including Tenakee Inlet and Hobart Bay, the long-term trends in most Southeast Alaska herring spawning areas are increasing.
- Arrowtooth flounder, flathead sole, and other flatfish continue to dominate the catches in the ADF&G trawl survey. A decrease in overall biomass is apparent from 2007 to 2011 from years of record high catches seen from 2002 to 2005.
- Total trawl survey CPUE in the western GOA varied over time with lowest abundances in 1999 and 2001. The eastern GOA shows a significantly increasing trend from 55 kg/ha in 1990 to 70 kg/ha in 2011.
- Discard rates in the GOA have varied over time but were lower than average in 2010 and 2011.
- Non-specified catch comprised the majority of non-target catch during 1997-2011. The catch of nonspecified species in the GOA has been generally consistent aside from a peak in 1998 and lows in 2009 and 2010. The catch of forage species increased in 2010-2011, primarily due to eulachon and other osmerids.

Other Plan Team discussions

Two “Hot Topics” were identified in the GOA: 1) anomalous conditions in 2011 and 2) reoccurrence of “mushy” halibut syndrome. Widespread seabird reproductive failures and increased prevalence of nutrient-deficient (“mushy”) halibut during summer 2011 were early indicators that foraging conditions

for upper trophic-level predators were poor in the Gulf of Alaska (GOA) that year. Direct sampling of low trophic level zooplankton and small fish provides supporting evidence of poor food supply for upper trophic predators during 2011. It is unclear whether these anomalies were climate driven. Data from Argo profiling floats, used for diagnosing the sub-surface physical properties of the GOA region, indicated that the poleward branch of the Alaska Current in the southeastern portion of the Gulf declined considerably from its peak in the winter of 2009-10 through summer 2011. Similarly, the PAPA Trajectory Index (PTI), which provides an annual index of near-surface water movement variability based on the trajectory of a simulated surface drifter released at Ocean Station PAPA, generally fan out northeastwardly toward the North American continent. The 2010/2011 endpoint for January 2011 was east of the release site and the southernmost endpoint since the early 1990s. The current (5-year averaged) PTI trend remains consistent with a return to conditions associated with the preceding “cold” regime.

“Mushy” halibut syndrome was first detected in Gulf of Alaska halibut in 1998. Increased prevalence occurred in 2005, 2011, and 2012. It is most often observed in smaller halibut of 15-20 lbs in the Cook Inlet area, but has also been noted in Kodiak, Seward, and Yakutat. The condition is considered a result of nutritional myopathy/deficiency, and thus may be indicative of poor prey conditions for halibut.

“Mushy” halibut syndrome is similar to that described for other animals with nutritional deficiencies in vitamin E and selenium.

1. Walleye pollock

Status and catch specifications (t) of pollock and projections for 2013 and 2014. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2013 and 2014 are those recommended by the Plan Team. Catch data are current through November 3rd, 2012. Note that the projections for 2014 are subject to change in 2013. The 2013 and 2014 ABCs incorporate the EFP catches in the model projection and have been reduced to accommodate the anticipated Prince William Sound GHL.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
GOA	2011	941,585	130,356	96,215	96,215	79,789
	2012	911,725	158,082	116,444	116,444	100,912
	2013	1,029,676	165,183	121,046		
	2014		152,976	111,530		
W/C/WYK	2011	893,700	118,030	86,970	86,970	79,789
	2012	863,840	143,716	105,670	105,670	100,912
	2013	981,791	150,817	110,272		
	2014		138,610	100,756		
SEO	2011	47,885	12,326	9,245	9,245	0
	2012	47,885	14,366	10,774	10,774	0
	2013	47,885	14,366	10,774		
	2014		14,366	10,774		

Changes in assessment methodology and data

The age-structured model developed using AD Model Builder and used for GOA W/C/WYK pollock assessment remains similar to the model used for assessments in 1999-2011. A number of changes were considered based on recommendations of the July 2012 Center for Independent Experts (CIE) review.

This assessment implemented CIE recommendations that could be easily accommodated within the existing model framework. Future assessments will explore CIE recommendations that require methodological development and substantial analysis. This year, the following changes were implemented: 1) the model includes ages 1-10 rather than ages 2-10 as in previous assessments; 2) a “plus-group” age was added to initial age composition and stronger equilibrium assumptions were used to initialize the model; 3) mean unbiased log-normal likelihoods are used for survey biomass indices; 4) the historical trawl data (pre-1984) was removed from the model; 5) six selectivity blocks were used for fishery selectivity rather than allowing selectivity parameters to vary annually with a random walk; 6) reduced weights (input sample sizes) were used for the fishery age composition data; and finally, 7) the model begins in 1964 rather than 1961. For comparison, two alternative models were also presented: 1) a model with the configuration from 2012, and 2) a model where NMFS trawl survey catchability was estimated using a prior. The performance of the new model was comparable to the model with the 2012 configuration. The Plan Team agreed with the authors that the new model was preferred since it performed well and incorporated a number of improvements over the 2012 configuration.

This year’s pollock chapter features the following new data: 1) 2011 total catch and catch at age from the fishery, 2) 2011 age composition from the NMFS bottom trawl survey, 3) 2012 biomass and length composition from the ADF&G crab/groundfish trawl survey. In addition to the historical trawl data (pre-1984), the egg production index from 1981 to 1992 was also removed. Model fits to fishery age composition data are adequate in most years. The largest residuals tended to be at ages 1-2 for the Shelikof Strait acoustic survey and the NMFS bottom trawl survey due to inconsistencies between the initial estimates of abundance and subsequent information about year class size. Model fits to survey time series are similar to previous assessments, and general trends are fit reasonably well. The discrepancy between the NMFS trawl survey and the Shelikof Strait acoustic survey biomass estimates in the 1980s accounts for the poor model fit to both time series during those years. All survey time series are consistent in showing an increase since 2007, but the magnitude is not the same for all time series. The ADF&G survey shows the strongest increase since 2007 and the Shelikof Strait acoustic survey shows the weakest increase. Therefore the model fit represents a compromise between different survey trends.

Status determination and stock trends

The 2012 Shelikof Strait acoustic survey biomass estimate declined 22% from the 2010 estimate (no survey was conducted in 2011). In contrast, the ADF&G crab/groundfish survey biomass estimate increased by 71% from the 2011 estimate. The estimated abundance of mature fish in 2013 is projected to be nearly the same as in 2012, and is projected to decrease gradually over the next five years.

The model estimate of spawning biomass in 2013 is 259,843 t, which is 35.1% of unfished spawning biomass (based on average post-1977 recruitment). The $B_{40\%}$ estimate is 297,000 t. This represents a 9% increase from the 2011 assessment, which is due to an increase in mean recruitment, and an increase in mean weight at age.

The Gulf of Alaska pollock is not being subjected to overfishing and is neither overfished nor approaching an overfished condition.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Plan Team concurred with the author’s recommendation to use the new model projection and the more conservative adjusted $F_{40\%}$ harvest rate. Because model estimated 2012 female spawning biomass is below $B_{40\%}$, the W/C/WYK Gulf of Alaska pollock stock is 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 2013 age-3+ biomass estimate is 981,791 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 the next 5 years.

An exempted fishing permit (EFP) has been proposed to evaluate the effect of salmon excluder devices in the pollock fishery. Based on the Plan Team recommendation, the assessment author provided the ABC and OFL values which accounted for estimated EFP catches by removing them from the population at the start of year in 2013 and 2014.

Therefore, the ABC for 2013 is based on the recommended model configuration, adjusted harvest control rule, and accounting for the EFP is 113,099 t ($F_{ABC} = 0.15$) for GOA waters west of 140°W longitude. **The ABC is 110,272 t for 2013** (reduced by 2,827 t which is 2.5% of the ABC to account for the Prince William Sound GHL). The 2013 OFL under Tier 3b is 150,817 t ($F_{OFL} = 0.20$). In 2014, the recommended ABC and OFL values are 103,339 t (reduced by 2,583 t to account for the Prince William Sound GHL) and 138,610 t, respectively.

The Southeast Alaska pollock component (East Yakutat and Southeast areas) is in Tier 5 and the ABC and OFL recommendations are based on natural mortality (0.30) and the biomass from the 2011 NMFS bottom trawl survey (47,885 t). This results in a **2013 ABC of 10,774 t**, and a **2013 OFL of 14,366 t**. Recommendations for 2014 are the same as 2013.

Additional Plan Team Recommendations

The Plan Team recommended that the assessment authors explore alternative approaches to model fishery selectivity. For example, modeling a smooth selectivity curve over time versus modeling blocks with constant selectivity may affect retrospective patterns and future catch recommendations. The Plan Team recommended that the age 1 (and possibly age 2) age classes be modeled separately from the other age classes with their own variance structure. Finally, the Plan Team recommended that if the assessment authors explore substantive changes based on CIE recommendations, that a preliminary assessment be presented in September 2013.

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). The Team concurred with these updates since they are more likely to represent the current distribution. Area apportionments, reduced by 2.5% of the ABC (2,827 t in 2013 and 2,583 t) for the State of Alaska managed pollock fishery in Prince William Sound, are tabulated below:

Area apportionments (with EFP incorporated in the model projection and ABCs reduced by Prince William Sound GHL) for 2013 and 2014 pollock ABCs for the Gulf of Alaska (t).						
Year	610	620	630	640	650	
	W	Central	Central	W. Yakutat	SEO	Total
2013	28,072	51,443	27,372	3,385	10,774	121,046
2014	25,648	47,004	25,011	3,093	10,774	111,530

2. Pacific cod

Status and catch specifications (t) of Pacific cod in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2013 and 2014 are those recommended by the Plan Team. Catch data are current through November 3rd 2012.

Year	Age 0+ biomass	OFL	ABC	TAC	Catch
2011	428,000	102,600	86,800	65,100	62,475
2012	521,000	104,000	87,600	65,700	52,942
2013	449,300	97,200	80,800		
2014		101,100	84,200		

Changes in assessment methodology and data

The fishery data series was updated with catch for 2011, preliminary catch for 2012, catch-at-length for 2011, and seasonal and gear-specific catch for 1991-2012. The survey data series was updated with 2011 NMFS bottom trawl survey data for age composition and mean size-at-age.

The 2012 GOA Pacific cod assessment author evaluated ten models. The different model configurations focused on exploration of the effects of different combinations of the survey 27 cm – plus and sub 27 cm length groups on model fit. The sub-27 survey data are highly variable and there is considerable uncertainty with the probability and consistency of the capture of sub 27 cm fish in the trawl survey.

Author and Team evaluation of alternative models

Model 2 was selected by the author as the preferred model because biomass estimates were similar to other model configurations, it had fewer parameters due to excluding the sub – 27 survey data, and it estimated the length of age-1 fish closer to the observed value than most other model configurations. The Plan Team accepted the author's recommendation to use Model 2 as the preferred model. Model 4 had much better fits to other data components and the Team encouraged the author to examine alternatives along these lines (e.g., down-weighting sensitivity to the mean-length at age data).

Status determination and stock trends

Estimated age-0 recruitment has been relatively strong since 2005, and stock abundance is expected to be stable in the near term. The stock is not being subjected to overfishing and is neither overfished nor approaching an overfished condition.

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

$B_{40\%}$ for this stock is estimated to be 93,900 t and projected spawning biomass in 2013 according to Model 2 is 111,000 t, therefore this stock is determined to be in Tier 3a. Neither the author nor the Team saw any compelling reason to recommend OFL or ABC values lower than prescribed by the standard control rule. The current values of $F_{35\%}$ and $F_{40\%}$ are 0.61 and 0.49.

Area apportionment

In the past the ABC of Pacific cod was apportioned among regulatory areas based on the three most recent trawl surveys. The apportionments based on the average area-specific biomass estimates from the 2007-2011 surveys were 32% in the Western GOA, 65% in the Central GOA, and 3% in the Eastern GOA. An alternative that is used in the Bering Sea - Aleutian Islands based on a Kalman filter approach would result in apportionments of 35% in the Western GOA, 61% in the Central GOA, and 4% in the Eastern GOA. The Team did not see any compelling biological reason to recommend one alternative over another. Given that the 2012 survey averaging working group report recommended adopting the Kalman filter approach for Tier 5, the Team anticipated that this method would be appropriate for

apportionments as well. Consequently, the percentages derived from the Kalman filter method were adopted resulting in the following area-apportioned ABCs:

	Western	Central	Eastern	Total
2013	28,280	49,288	3,232	80,800
2014	29,470	51,362	3,368	84,200

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 2013 and 2014 are those recommended by the Plan Team. Catch data are current through November 3rd 2012.

Year	Age 4+ biomass	OFL	ABC	TAC	Catch
2011	149,000	13,340	11,290	11,290	11,148
2012	180,000	15,330	12,960	12,960	11,854
2013	167,000	14,780	12,510		
2014		13,871	11,731		

Changes in assessment methodology and data

Relative abundance and length data from the 2012 longline survey, relative abundance and length data from the 2011 longline and trawl fisheries, age data from the 2011 longline survey and 2011 longline fixed gear fishery, updated 2011 catch and estimated 2012 catch were added to the assessment model. The fishery abundance index was stable from 2010 to 2011 (the 2012 data are unavailable). The longline survey abundance index decreased 21% from 2011 to 2012 following an 18% increase from 2008 to 2011. There were no changes in the assessment model.

Author and Team evaluation of alternative models

The model likelihood components and key parameter estimates from 2011 were compared with the 2012 updated model. The 2012 update shows a slight decrease in recent recruitment, spawning and total biomass from previous projections.

An analysis of the longline survey index to address the depredation issues with both killer whales and sperm whales is ongoing. While substantial progress has been made, the new index is not ready to be utilized until several issues are more fully explored. Work is also in progress on an updated migration model and development of a spatially-explicit model.

Status determination and stock trends

Spawning biomass has increased from a low of 30% of unfished biomass in 2002 to 37% projected for 2013. The 1997 year class has been an important contributor to the population but has been reduced and should comprise 10% of the 2013 spawning biomass. The 2000 year class is still the largest contributor, with 20% of the spawning biomass in 2013. The 2008 year class is beginning to show signs of strength and will comprise 5% of spawning biomass in 2013 even though it is only 40% mature.

Recent catches have been below OFL therefore overfishing is not occurring. The Alaska-wide sablefish stock is not overfished and is not approaching an overfished condition.

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

$B_{40\%}$ for this stock is estimated to be 106,506 t and projected spawning biomass in 2013 is 97,193 t, so this stock is assigned to Tier 3b. Neither the author nor the Team saw any compelling reason to

recommend OFL or ABC values lower than prescribed by the standard control rule. The current values of $F_{35\%}$ and $F_{40\%}$ are 0.113 and 0.095, respectively; the Tier 3b adjusted values are 0.102 and 0.086, respectively.

Area apportionment

Sablefish are apportioned based on a 5-year exponential weighting of the survey and fishery abundance indices. The same algorithm is used to apportion the 2013 and 2014 ABC and OFL.

Region	2012				2013		2014	
	OFL	ABC	TAC	Catch*	OFL	ABC	OFL	ABC
BS	2,640	2,230	2,230	717	1,870	1,580	1,755	1,482
AI	2,430	2,050	2,050	1,180	2,530	2,140	2,374	2,007
GOA	15,330	12,960	12,960	11,854	14,780	12,510	13,871	11,731
Alaska-wide	20,400	17,240	17,240	13,751	19,180	16,230	18,000	15,220
W	--	1,780	1,780	1,390	--	1,750	--	1,641
C	--	5,760	5,760	5,248	--	5,540	--	5,195
WYAK	--	2,247+	2,247+	2,028	--	2,030	--	1,902
SEO	--	3,173+	3,173+	3,188	--	3,190	--	2,993
GOA total	15,330	12,960	12,960	11,854	14,780	12,510	13,871	11,731

* Catch through Nov 3 2012.

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

4. Shallow water flatfish

Status and catch specifications (t) of shallow water flatfish and projections for 2013 and 2014. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through November 3rd 2012.

Year	Biomass	OFL	ABC	TAC	Catch
2011	398,961	67,768	56,242	20,062	3,974
2012	329,217	61,681	50,683	37,029	3,475
2013	433,869	55,680	45,484		
2014		51,580	42,084		

Changes in assessment methodology and data

This is an off-year for the assessment cycle therefore an executive summary only is provided. New data for the shallow water flatfish complex include a new output from the northern and southern rock sole assessment (A'mar et al. 2012), final total catch from 2011, and current catch for 2012.

Author and Team evaluation of alternative models

The author responded to a number of requests from the Plan Team and SSC and 8 models were presented. The author noted that a CIE review was done in the summer of 2012 and progress was made in responding to their comments in this assessment cycle. A number of the model alternatives eliminated different data components to examine sensitivity. These data components were mainly dealing with mean length-at-age for different years. The model results were most sensitive for northern rock sole whereas results for southern rock sole were more similar over the different model alternatives. The Team was concerned over the model selection approach that was used. Namely, the author's main justification for selecting Model 3 was that it was intermediate in biomass during the early period of the time series. The Team would prefer an objective evaluation of model fits. The Team recommended using Model 1 (which uses all the data) for future evaluations since Model 3 omitted length-at-age data from the 1984 and 1987

surveys. They also noted that fitting length-at-age data with fixed growth was inadvisable. The Team accepted Model 3 for specifications in the interim given similarities between results among models.

Status determination and stock 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 2011). Survey abundance estimates for the entire shallow-water complex were lower in 2011 compared to 2009; decreasing by 37,629 t. By species, southern rock sole has a generally increasing trend in abundance, although biomass decreased between 2009 and 2011. Northern rock sole has general increasing trend through 2007 and then has been decreasing since. The remainder of the species in the shallow water flatfish complex have varying trends, although most species increased in abundance between 2009 and 2011 with the exception of sand sole and English sole. There will be a new survey in 2012.

Information is insufficient to determine stock status relative to overfished criteria for the complex. For the rock sole species, the assessment model indicates they are not overfished nor are they approaching an overfished condition. Catch levels for this complex remain below the TAC and below levels where overfishing would be a concern.

Tier determination/Plan Team discussion resulting ABCs and OFLs

The shallow water complex is comprised of northern rock sole, southern rock sole, yellowfin sole, butter sole, starry flounder, English sole, sand sole and Alaska plaice. Northern and southern rock sole are in Tier 3a while the other species in the complex are in Tier 5. There was a new projection model run for northern and southern rock sole this year; the remaining shallow water flatfish biomass estimates are rolled over from the 2011 survey.

The 2013 and 2014 F_{ABC} and F_{OFL} values for southern rock sole were estimated as: $F_{40\%}=0.193$ and $F_{35\%}=0.230$, respectively. For northern rock sole the values are: $F_{40\%}=0.152$ and $F_{35\%}=0.180$. Other flatfish species ABCs were estimated with $F_{ABC}=0.75 M (0.15)$ and $F_{OFL}=M (0.2)$.

For the shallow water flatfish complex, ABC and OFL for southern and northern rock sole are combined with the ABC and OFL for the rest of the shallow water flatfish complex. This yields a combined ABC of 45,484 t and OFL of 55,680 t for 2013. For 2014, the combined ABC is 42,084 t and the OFL is 51,580 t.

The ABC and OFL for 2013 and 2014 shallow-water flatfish are lower than the 2011 and 2012 due to a decrease in the northern and southern rock sole biomass estimates from the model. The GOA Plan Team agrees with authors' recommended ABC for the shallow water flatfish complex which was equivalent to maximum permissible ABC.

Area apportionment

The recommended apportionment percentages based on the 2011 survey biomass abundances by area, because there is no new survey information.

Year	Western	Central	West Yakutat	SEO	Total
2013	19,489	20,168	4,647	1,180	45,484
2014	18,033	18,660	4,299	1,092	42,084

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 2013 and 2014. Biomass for each year corresponds to the estimate given when the ABC was determined. Catch data in this table are current through November 3 rd 2012.					
Year	Biomass	OFL	ABC	TAC	Catch
2011	89,691	7,823	6,305	6,305	465
2012	77,531	6,834	5,126	5,126	262
2013	77,531	6,834	5,126		
2014		6,834	5,126		

Changes in assessment methodology and data

The assessment included updated fisheries catch data for 2011 and estimated catch for 2012.

The deep water flatfish complex is comprised of Dover sole, Greenland turbot, and deepsea sole. Catch and trawl survey biomass data for Dover sole, Greenland turbot and deepsea sole are updated to 2011.

The author used the survey abundance estimate from 2011 rather than the survey averaging approach since this was an executive summary. Next year the author will apply the survey averaging approach.

Author and Team evaluation of alternative models

In September the author presented progress on a new model that is planned to be implemented in the coming year. The details of the model were appended to the summary presented in November. The Plan Team looks forward to evaluating the new model in September 2013.

Status determination and stock trends

Information is insufficient to determine stock status relative to overfished criteria for Tier 5 and 6 species. Catch levels for this complex remain below the TAC and below levels where overfishing would be a concern.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Dover Sole was in Tier 3a, but due to concerns about the validity of the model the Plan Team recommended that it be moved to Tier 5 last year (2011). For the Dover sole Tier 5 assessment the 2013 and 2014 ABC using $F_{ABC}=0.75M = 0.064$ results in 4,943 t. The 2013 and 2014 OFL using $F_{OFL}=M = 0.085$ results in 6,590 t. The GOA Plan Team agrees with the authors' recommendation to use the combined ABC (5,126 t) and OFL (6,834 t) for the deep water flatfish complex for 2013 and 2014. The ABC is equivalent to the maximum permissible ABC. Both Greenland turbot and deepsea sole are in Tier 6. The Tier 6 calculation (based on average catch from 1978-1995) for the remaining species in the deep water flatfish complex ABC is 183 t and the OFL is 244 t. These values apply for 2013 and 2014 ABC and OFLs.

Area apportionment

Area apportionments of deep water flatfish are based on the relative abundance (biomass) of each species in the stock complex in each management area in the last GOA survey. The recommended ABC area apportionment percentages are identical to last year.

Area apportionments of deep water flatfish (<i>Dover sole and others</i>) ABCs for 2013 and 2014 are based on the fraction of the 2011 survey biomass in each area.					
Year	Western	Central	West Yakutat	SEO	Total
2013 & 2014	176	2,308	1,581	1,061	5,126

6. Rex Sole

Status and catch specifications (t) of rex sole and projections for 2013 and 2014. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through November 3rd 2012.

Year	Biomass	OFL	ABC*	TAC	Catch
2011	86,974	12,499	9,565	9,565	2,876
2012	87,162	12,561	9,612	9,612	2,187
2013	86,684	12,492	9,560		
2014		12,362	9,460		

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

Changes in assessment methodology and data

Rex sole 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 2011 catch and catch to date in 2012 with new projections made.

Status determination and stock trends

The assessment model biomass estimates (age 3+) decreased from 87,162 t in 2012 to 86,684 t in 2013 and a continuing decrease into 2014 is expected. Catches of rex sole are well below TACs and below levels where overfishing would be a concern.

The model estimate of spawning biomass in 2013 is 53,164 t, which is 96% of unfished spawning biomass (based on average post-1977 recruitment). The Gulf of Alaska rex sole stock is therefore not overfished nor approaching an overfished condition.

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 2013 ABC of 9,560 t. The 2013 OFL using $F_{OFL} = M = 0.17$ is 12,492 t.

Area apportionment

Area apportionments of rex sole ABC's for 2013 and 2014 are based on the fraction of the 2011 GOA bottom trawl survey biomass in each area.

Year	Western	Central	West Yakutat	SEO	Total
2013	1,300	6,376	832	1,052	9,560
2014	1,287	6,310	823	1,040	9,460

7. Arrowtooth flounder

Status and catch specifications (t) of arrowtooth flounder and projections for 2013 and 2014. 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 November 3rd 2012.

Year	Biomass	OFL	ABC	TAC	Catch
2011	2,121,440	251,068	213,150	103,300	30,890
2012	2,161,690	250,100	212,882	103,300	19,737
2013	2,055,560	247,196	210,451		
2014		245,262	208,811		

Changes in assessment methodology and data

New data includes updated 2011 catch and estimated 2012 catch. The single species projection model was re-run using new catch data only. No changes in assessment methods were made.

Status determination and stock trends

The estimated age 3+ biomass from the model has increased by an order of magnitude since 1961 and peaked at about 2.2 million t in 2006. Since then the stock has stabilized, although there has been a slight decline in age 3+ biomass estimates since 2009. Age 3+ biomass is expected to increase in 2014. Female spawning biomass has been trending upward since 2009.

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.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Arrowtooth flounder has been determined to fall under Tier 3a. The 2013 ABC using $F_{40\%}=0.174$ is 210,451 t, a decrease from the 2012 ABC of 212,882 t. The 2013 OFL using $F_{35\%}=0.207$ is 247,196 t. The 2014 ABC (208,811 t) and OFL (245,262 t) were estimated using the projection model and with total catch in 2011 and the estimated catch for 2012 and 2013. Catch in 2012 and 2013 was estimated using the recent 5-year average ($F=0.020$).

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

Area apportionment

Area apportionments of arrowtooth flounder for 2013 and 2014 are based on the fraction of the 2011 survey biomass in each area.

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2013	27,181	141,527	20,917	20,826	210,451
2014	26,970	140,424	20,754	20,663	208,811

8. Flathead sole

Status and catch specifications (t) of flathead sole and projections for 2013 and 2014. 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 November 3rd 2012.

Year	Biomass	OFL	ABC	TAC	Catch
2011	297,130	61,412	49,133	10,587	2,728
2012	292,189	59,380	47,407	30,319	1,890
2013	288,538	61,036	48,738		
2014		62,296	49,771		

Changes in assessment methodology and data

Flathead sole 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 2011 catch and catch to date in 2012 for use in projections.

Status determination and stock trends

The 2013 spawning biomass estimate (106,377 t) is above $B_{40\%}$ (41,547 t) and projected to be stable through 2014. The stock is not overfished nor approaching an overfished condition. Catch levels for this species remain below the TAC.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Flathead sole are determined to be in Tier 3a. For 2013 the Plan Team concurred with the authors' recommendation to use the maximum permissible ABC of 48,738 t from the updated projection. The F_{OFL} is set at $F_{35\%}$ (0.593) and gives an OFL of 61,036 t.

Area apportionment

Area apportionments of flathead sole ABCs for 2013 and 2014 are based on the fraction of the 2011 GOA bottom trawl survey biomass in each area.

Year	Western	Central	West Yakutat	SEO	Total
2013	15,729	26,563	4,686	1,760	48,738
2014	16,063	27,126	4,785	1,797	49,771

9. Pacific ocean perch

Status and catch specifications (t) of Pacific ocean perch and projections for 2013 and 2014. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2013 and 2014 are those recommended by the Plan Team. Catch data are current as of November 3rd 2012.

Year	Biomass	OFL	ABC	TAC	Catch
2011	330,480	19,566	16,997	16,997	14,211
2012	348,168	19,498	16,918	16,918	14,875
2013	345,260	18,919	16,412		
2014		18,601	16,133		

Changes in assessment methodology and data

Pacific ocean perch (POP) are assessed on a biennial schedule to coincide with the timing of survey data. This year is an off-year and an executive summary of the assessment and updated projection model were presented. New information included updated 2011 catch and new estimated catches for 2012-2014.

Status determination and stock trends

The 2013 spawning biomass estimate (107,511 t) is above $B_{40\%}$ (93,876 t) and projected to be stable through 2014. The area-specific OFL was exceeded by 28 t in the western GOA in 2012. However, the stock is not overfished, nor is it approaching an overfished condition.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The GOA Pacific ocean perch stock was determined to be in Tier 3a. The F_{OFL} is set at $F_{35\%}$ (0.138) and gives an OFL of 18,919 t. The Team accepted the author recommended model resulting in an estimated ABC of 16,412 t (with $F_{ABC} = F_{40\%}$ of 0.119).

Area apportionment

Apportionment of ABCs is based on a weighted average of the percent distribution of biomass for each area using the three most recent trawl survey estimates (from 2007, 2009, and 2011). Each successive survey is given a progressively heavier weighting using factors of 4, 6, and 9, respectively. The apportionment values are: Western area, 12.4%; Central area, 66.6%; and Eastern area, 21.0%.

Amendment 41 prohibited trawling in the Eastern area east of 140° W longitude. Since POP 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 four years, the Team recommends that a separate ABC be set for POP in WYAK. The ratio of biomass still obtainable in the W. Yakutat area (between 140° W and 147° W) is the same as last year at 0.48. This corresponds to a 2013 ABC of 1,641 t for WYAK. Under this apportionment, it is unlikely that the 1,805 t assigned to the remaining Eastern area (East Yakutat/Southeast Outside area) will be harvested.

OFLs are apportioned to individual areas by the same weighting scheme used to apportion the ABC. Area specific OFLs were assigned in 1994 when POP were placed under a rebuilding plan. Appendix 9A of the chapter contains additional information on POP stock structure and apportionment. Since the late 1990s the GOA POP have been considered rebuilt and are above the B_{msy} proxy. The overall stock is well above target levels, so the original rationale of initiating area-specific OFL's in the rebuilding plan is no longer needed because there are multiple levels of precaution built into the current management recommendations and regular overharvest is unlikely. Therefore the Team considered that the need to have such detailed area-specific OFLs was unnecessary. The Plan Team recommends apportioning the OFL to two areas, the area that is currently fished (the Western, Central, WYAK GOA combined) and the remaining Eastern GOA (East Yakutat/Southeast Outside area). Having two OFLs as opposed to a single GOA-wide OFL would protect the stock in the unlikely event that the unused OFL in the Eastern GOA was all taken in a different area.

The Plan Team recommended OFL value for the combined Western, Central and WYAK area is 16,838 t (89%). The remaining area (SEO) OFL would be 2,081 t (11%).

Area apportionment of 2013-2014 ABC and OFL for POP in the Gulf of Alaska:

Year		Western	Central	WYAK	SEO	Total
2013	ABC	2,040	10,926	1,641	1,805	16,412
2014	ABC	2,005	10,740	1,613	1,775	16,133
2013	OFL		16,838		2,081	18,919
2014	OFL		16,555		2,046	18,601

10. Northern Rockfish

Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2013 and 2014 are those recommended by the Plan Team. Catch data are current through November 3rd 2012. Note that for management purposes, the ABC in the EGOA is combined with other rockfish. The ABC listed below is with that value (2 t) deducted.

Year	Age 2+ biomass	OFL	ABC	TAC	Catch
2011	108,298	5,784	4,857	4,857	3,440
2012	104,155	6,574	5,507	5,507	5,027
2013	99,089	6,124	5,130		
2014		5,791	4,850		

Changes in assessment methodology and data

No new assessment model was run in this off-survey year. Catches were updated for 2011 and 2012 and new projections were made.

Status determination and stock trends

The stock is not overfished, nor is it 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

Northern rockfish are determined to be in Tier 3a. The recommended ABC for 2012 is 5,132 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 29,193 t compared to a 2012 estimate of 25,544 t of female spawning biomass. The F_{ABC} is set to $F_{40\%}$ (0.062) and F_{OFL} set to $F_{35\%}$ (0.074). The 2013 OFL is 6,124 t.

Additional Plan Team Recommendations

The Team noted that the catch projection for the current year should be the maximum of the ABC or the current technique for estimating in year catches (whichever is less). They also noted that this should be common practice for all groundfish stocks.

Area apportionment

Apportioning the 2012 and 2013 ABC is based on the same method used from last year resulting in the following percentage apportionments by area: Western 39.13%, Central 60.83% and Eastern 0.04%. 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 2013-2014:

Year	Western	Central	Eastern	West Yakutat	East Yak./SE	Total
2013	2,008	3,122	2	-	-	5,132
2014	1,899	2,951	2	-	-	4,852

11. Shortraker rockfish

Status and catch specifications (t) of shortraker rockfish and projections for 2013 and 2014. Biomass estimates are based on 3 most recent trawl surveys (2007, 2009, and 2011). The OFL and ABC for 2013 and 2014 are those recommended by the Plan Team. Catch data are current as of November 3rd 2012.

Year	Biomass	OFL	ABC	TAC	Catch
2011	40,626	1,219	914	914	546
2012	48,048	1,441	1,081	1,081	873
2013	48,048	1,441	1,081		
2014		1,441	1,081		

Changes in assessment methodology and data

No new assessment information was available in this off-survey year, therefore the 2011 estimates are rolled over for the next two years. Catches were updated for 2011 and 2012.

Status determination and stock trends

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.

Averaging the biomass from the last three Gulf of Alaska trawl surveys (2007, 2009, and 2011) results in a biomass of 48,048 t for shortraker rockfish.

Tier determination, ABCs, and OFLs

Shortraker rockfish are Tier 5 species for specifications where $F_{ABC} = 0.75M = 0.0225$ and $F_{OFL} = 0.03$. Applying this definition to the exploitable biomass of shortraker rockfish results in a 2013 ABC of 1,081 t and an OFL of 1,441 t.

Area apportionment

The apportionment percentages are the same as in the 2011 full assessment. The following table shows the recommended apportionment for 2013. Please refer to last year's full stock assessment report for information regarding the apportionment rationale for shortraker rockfish. Apportionment values for shortraker rockfish are: Western area, 9.59%; Central area, 41.82%; and Eastern area, 48.59%.

Area apportionment of 2013 and 2014 ABC for shortraker rockfish in the Gulf of Alaska:

Western	Central	Eastern	Total
104	452	525	1,081

12. Dusky rockfish

Status and catch specifications (t) of dusky rockfish in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Years prior to 2012 include yellowtail and widow rockfish. The OFL and ABC for 2013 and 2014 are those recommended by the Plan Team. Catch data are current through November 3rd 2012.

Year	Age 4+ biomass	OFL	ABC	TAC	Catch
2011	66,498	5,570	4,754	4,754	2,531
2012	66,771	6,257	5,118	5,118	4,001
2013	63,515	5,746	4,700		
2014		5,395	4,413		

Changes in assessment methodology and data

The 2012 “off-year” dusky rockfish assessment consists of updating the catch data and re-running the projection model from the 2011 assessment. The estimated 2012 catch was 4,162 t, which was based on extrapolating the October 1, 2012 by a factor representing the average fraction of harvest from October to December in recent years.

There have been no changes in the assessment methods in this “off-year” assessment.

Author and Team evaluation of alternative models

The “off-year” assessment consisted of rerunning the projection model; thus, alternative models were not considered.

Status determination and stock trends

The 2013 spawning biomass estimate (25,337 t) is above $B_{40\%}$ (19,873 t) and projected to decrease slightly to 23,874 t in 2014. GOA dusky rockfish are not overfished, nor approaching an overfished condition.

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

GOA dusky rockfish are in Tier 3a. The Plan Team agreed with the authors’ recommendation to use the maximum permissible ABC and OFL of 4,700 t and 5,746 t from the updated projection model.

Area apportionment

The methodology for apportioning the ABC among areas remains unchanged from the 2011 assessment model, with the apportionments shown below:

Year	Western	Central	Eastern		Total
			W. Yakutat	SEO	
	8%	75.2%	10.5%	6.3%	100%
2013	377	3,533	495	295	4,700
2014	354	3,317	465	277	4,413

13. Rougheye and blackspotted rockfish

Status and catch specifications (t) of rougheye and blackspotted rockfish and projections for 2013 and 2014. Biomass for each year corresponds to the projections given in the SAFE report issued in the preceding year. The OFL and ABC for 2013 and 2014 are those recommended by the Plan Team. Catch data are current as of November 3rd 2012.

Year	Biomass	OFL	ABC	TAC	Catch
2011	45,907	1,579	1,312	1,312	543
2012	42,856	1,472	1,223	1,223	664
2013	42,883	1,482	1,232		
2014		1,508	1,254		

Changes in assessment methodology and data

Rockfish 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 and updated projection model were presented. New information included updated 2011 catch and new estimated catches for 2012-2014.

Status determination and stock trends

Female spawning biomass (12,786 t) is well above $B_{40\%}$ (9,732 t) with projected biomass stable. Catches remain well below levels where overfishing would be a concern (45% of ABC). The stock is not overfished, nor is it approaching an overfished condition.

Tier determination, ABCs and OFLs

The rougheye/blackspotted complex is in Tier 3a. For the 2013 fishery, the Team accepts the authors' recommended maximum allowable ABC of 1,232 t ($F_{ABC} = F_{40\%} = 0.039$) and OFL ($F_{OFL} = F_{35\%} = 0.047$) of 1,482 t.

Area apportionment

The apportionment percentages are the same as in the 2011 full assessment. The following table shows the recommended apportionment for 2013. Please refer to last year's full stock assessment report for information regarding the apportionment rationale for rougheye and blackspotted rockfish.

Apportionment values for rougheye and blackspotted rockfish are: Western area, 6.60%; Central area, 69.46%; and Eastern area, 23.94%.

Area apportionment of the 2013 and 2014 ABCs for the rougheye and blackspotted rockfish complex in the Gulf of Alaska are:

Year	Western	Central	Eastern	Total
2013	81	856	295	1,232
2014	83	871	300	1,254

14. Demersal shelf rockfish

Status and catch specifications (t) of demersal shelf rockfish and projections for 2013 and 2014. Biomass for each year corresponds to the survey biomass estimates given in the SAFE report issued in the preceding year(s). The 2012 catch data are from the NMFS Catch Accounting System through November 3rd 2012.

Year	Biomass	OFL	ABC	TAC	Catch
2011	14,395	479	300	247	82
2012	14,307	479	293	240	178
2013	14,588	487	303		
2014		487	303		

Changes in assessment methodology and data

An executive summary assessment was prepared this year. Density surveys were last conducted in 2009 for Eastern Yakutat (EYKT). Preliminary work with an ROV has been done to evaluate this as an alternate assessment technique to the submersible surveys. New information included updated average weight estimates by area.

Status determination and stock 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 km² 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 km². The density estimate for CSEO in 2007 was 1,068 adult yelloweye/km². 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 a change in the biomass point estimate for each management area. The overall biomass estimate for 2013 was 14,588 t, a slight increase from 14,307 in 2012.

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 395 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 **2013 ABC of 303 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 2013 of 487 t for DSR**.

Assessment work for DSR is complicated by a lack of federal funding and the availability of the Delta submersible for surveys. An ROV pilot survey was conducted in 2012 as a potential alternative to the submersible studies that have been done in the past. The Team was supportive of the ROV work as a viable alternative to the submersible surveys and provided additional guidance in their minutes on moving forward with further analyses of the data and plans for 2013 survey efforts.

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 2012 are current through November 3rd 2012.

Year	Biomass	OFL	ABC	TAC	Catch
2011	78,795	2,360	1,770	1,770	612
2012	73,990	2,220	1,665	1,665	743
2013	73,990	2,220	1,665		
2014		2,220	1,665		

Changes in assessment methodology and data

Thornyheads are assessed on a biennial schedule to coincide with the timing of survey data. The last complete assessment was presented in 2011. An executive summary is presented this year with rollover values for 2013 and 2014. New catch information includes updated 2011 and 2012 catch.

Status determination and stock trends

Information is insufficient to determine stock status relative to overfished criteria as estimates of spawning biomass are not available.

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 2013 and 2014. The 2013 (and 2014) ABC recommendation (where $F_{ABC} = 0.0225$) is 1,665 t and the OFL ($F_{OFL} = 0.03$) is 2,220 t.

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 500 m in order to more completely cover their habitat. The Team recommends the application of the Kalman filter model for estimating biomass for this and other Tier 5 stocks.

Area apportionment

Area apportionments are identical to last year and are based upon the relative distribution of biomass by area from the 2011 GOA bottom trawl survey. Area apportionment of the 2013-2014 ABC for thornyhead rockfish:

Year	Western	Central	Eastern	Total
2013 and 2014	150	766	749	1,665

16. Other rockfish

Status and catch specifications (t) of other rockfish. In 2011, other rockfish were called “other slope rockfish” and did not include yellowtail and widow rockfish. Biomass estimates are based on the three most recent trawl survey estimates. The OFL and ABC for 2013 and 2014 are those recommended by the Plan Team. Catch data are current through November 3rd 2012. Note that 2 t of Northern rockfish have been added for management purposes to “other rockfish” in the EGOA.

Year	Survey biomass	OFL	ABC	TAC	Catch
2011	76,867	4,881	3,752	1,195	872
2012	85,774	5,305	4,045	1,080	1,040
2013	85,774	5,305	4,045		
2014		5,305	4,045		

Changes in assessment methods and data

The biomass of the GOA other rockfish stock complex is estimated by averaging recent trawl survey biomass estimates. No new survey data exists for the 2012 “off-year” stock assessment.

Status determination and stock trends

The estimated biomass, based on an average from the three most recent GOA trawl surveys, is 85,774 t. In 2012, ABCs were substantially exceeded in WGOA & CGOA. In CGOA, catch of harlequin substantially increased (38% above average). GOA other rockfish were not subject to overfishing in 2012.

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

GOA other rockfish are a Tier 5 stock complex. The Plan Team agreed with the authors’ recommendation to “roll over” the maximum permissible ABC and OFL of 4,045 t and 5,305 t from the 2011 assessment.

Area apportionment

The methodology for apportioning the ABC among areas remains unchanged from the 2011 assessment model, with the apportionments shown below:

Year	Eastern				Total
	Western	Central	W. Yakutat	SEO	
2013 and 2014	1.08%	14.98%	5.69%	78.24%	100%
	44	606	230	3,165	4,045

Additional Plan Team Recommendations

The Plan Team supports the author’s consideration to examine the catch of Demersal Shelf Rockfish (DSR) species (primarily yelloweye) that occur outside of SEO management area. These species are not accounted for in the DSR assessment, and are reported in the AKRO CAS as Other Rockfish. In 2012, the other rockfish complex in the CGOA and WGOA exceeded ABCs. As a result, retention in these areas was prohibited and discards of the other rockfish complex, including DSR, increased. The Plan Team asked the authors together with ADF&G to present an analysis on GOA DSR west of 140°W for the September 2013 meeting. The analysis should investigate if a separate OFL and ABC can be estimated for DSR outside of SEO, possibly using a Tier 6 approach. Available sources of data should be evaluated including catch trends, HFICE, and survey data (including IPHC). Discussion included

potential for evaluation of whether a future DSR (outside SEO) assessment would remain as part of the other rockfish complex or moved to the DSR chapter.

The Plan Team also recommended that the authors investigate the source of component species constituting the increased catch for the Other Rockfish complex in 2012, notably the substantial increase in harlequin rockfish catch, and plausible explanations for increase.

17. 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 2013 and 2014 are those recommended by the Plan Team. Catch data are current through November 3 rd 2012.					
Year	Biomass	OFL	ABC	TAC	Catch
2011	-	6,200	4,700	2,000	1,615
2012	-	6,200	4,700	2,000	1,187
2013	-	6,200	4,700		
2014	-	6,200	4,700		

Changes in assessment methodology and data

Atka mackerel are assessed on a biennial schedule to coincide with the timing of survey data. The last complete assessment was presented in 2011. An executive summary is presented this year with rollover values for 2013 and 2014. New catch information includes updated 2011 and 2012 catches. Since the 2011 assessment, ages from the 2011 GOA survey have become available and are comprised of large numbers of fish from the 2006 and 2007 year classes which are also prevalent in the Aleutian Islands.

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

Status determination and stock trends

Gulf of Alaska Atka mackerel have been managed under Tier 6 specifications since 1996. In 2007, 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.

Information is insufficient to determine stock status relative to overfished criteria. In 2010, the Atka mackerel catch was 20% over TAC. However, the 2011 catch was 81% of the TAC and the 2012 catch is only 59% of the TAC. These catches are below ABC and below levels where overfishing would be a concern.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Since 1996, the maximum permissible ABC has been 4,700 t under Tier 6 and the OFL has been 6,200 t. The Team noted the TAC has previously been set at 2,000 t to accommodate bycatch that occurs in other directed fisheries and that the 2012 catch of 1,178 t was only 59% of the 2012 TAC. 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 2013 ABC for GOA Atka mackerel equal to the maximum permissible value of 4,700 t. The 2013 OFL is 6,200 t under Tier 6.

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.

18. Skates

Status and catch specifications (t) of skates in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2013 and 2014 are those recommended by the Plan Team. Catch data are current through November 3rd 2012.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Big Skate	2011	44,381 ^a	4,438	3,329	3,329	2,263
	2012	50,229 ^b	5,023	3,767	3,767	1,694
	2013	50,229 ^b	5,023	3,767		
	2014		5,023	3,767		
Longnose Skate	2011	38,031 ^a	3,803	2,852	2,852	981
	2012	34,995 ^b	3,500	2,625	2,625	762
	2013	34,995 ^b	3,500	2,625		
	2014		3,500	2,625		
Other Skates	2011	27,908 ^a	2,791	2,093	2,093	1,193
	2012	27,061 ^b	2,706	2,030	2,030	1,110
	2013	27,061 ^b	2,706	2,030		
	2014		2,706	2,030		

^a Average of the 2003, 2005, 2007, and 2009 GOA bottom trawl surveys.

^b Average of the 2007, 2009, and 2011 bottom trawl survey estimates.

Changes in assessment methodology and data

Skates are assessed on a biennial schedule to coincide with the timing of survey data. The last complete assessment was presented in 2011. An executive summary is presented this year with rollover values for 2013 and 2014. Other than updated catch data, there is no new information to update the harvest recommendations for skates. New catch information includes updated 2011 catch and 2012.

Status determination and stock trends

The catches have been below the ABCs 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 gulf-wide 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. In the future, we expect to obtain skate catch information from the IFQ halibut fishery with the implementation of observer restructuring in 2013. It is not possible to determine the status of stocks in Tier 5 with respect to overfished status.

Information is presently insufficient for population dynamics modeling for GOA skates, although the authors have 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 ABC and OFL recommendations

Skates are managed in Tier 5. A single value of $M=0.10$ is applied to area-specific (for big and longnose skates) and gulf-wide (for other skates) average biomass from the most recent three GOA trawl surveys to estimate the ABCs listed above using the maximum permissible $F_{ABC}=0.075$ ($0.75M$), 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 gulf-wide OFLs. This is identical to the Team recommendations from previous years.

Area apportionment

The Plan Team concurred with the authors recommended area-specific ABCs (shown above) based on the average of the three most recent GOA bottom trawl surveys (2007, 2009, and 2011). Big and longnose skates have area-specific ABCs and gulf-wide OFLs; other skates have a gulf-wide ABC and OFL.

Year	Species	Western	Central	Eastern	Total
2013 and 2014	Big skate	469	1,793	1,505	3,767
2013 and 2014	Longnose skate	70	1,879	676	2,625
2013 and 2014	Bathyraja skates				2,030

19. Sculpins

Status and catch specifications (t) of GOA sculpins in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2013 and 2014 are those recommended by the Plan Team. Catch data for 2012 are current through November 3rd 2012.

Year	Biomass	OFL	ABC	TAC	Catch
2011	33,307	7,328	5,496	5,496	691
2012	34,610	7,641	5,731	5,731	802
2013		7,614	5,884		
2014		7,614	5,884		

Changes in assessment methodology and data

GOA sculpin continue to be on a biennial stock assessment schedule to coincide with the timing of the NMFS bottom trawl survey. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2013 and 2014. New information includes catch data updated for 2011 and partial data for 2012, by target fishery and area. The OFL and ABC recommendations were adjusted slightly from last year reflecting updates and corrections to the data.

There were no changes to the Tier 5 approach used in 2011. The biomass estimate was based on the average biomass estimate of the last four NMFS bottom trawl surveys in 2011, 2009, 2007, and 2005. The sculpin complex mortality rate is based on a biomass-weighted average of the instantaneous mortality rates for the four most abundant sculpins in the GOA; bigmouth, great, plain, and yellow Irish lord sculpins from the 2011 survey. As a result, the sculpin complex M was calculated as 0.22.

Status determination and stock trends

As a Tier 5 stock there is not sufficient data to determine if the sculpin complex is in an overfished condition and therefore the status is unknown. Recent catches of sculpins have been well below the ABC first established for the sculpin complex in 2011. The stock status trend is stable. The sculpin complex is not currently being subjected to overfishing.

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

The Plan Team concurred with the Tier 5 approach, including the biomass estimates based on the most recent 4 surveys, and authors' recommendations for ABC and OFL.

For 2013 the full assessment will evaluate and apply the Kalman filter or random effects survey averaging approach as recommended by the Joint Plan Team in September 2012 for Tier 5 stocks.

Area apportionment

The GOA sculpins are managed gulf-wide.

20. Sharks

Status and catch specifications (t) of GOA shark 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 2013 and 2014 are those recommended by the Plan Team. Catch data for 2012 are current through November 3 rd 2012.					
Year	Biomass	OFL	ABC	TAC	Catch
2011	74,355	8,262	6,197	6,197	523
2012	118,621	8,037	6,028	6,028	595
2013	118,621	8,037	6,028		
2014		8,037	6,028		

Changes in assessment methodology and data

The GOA shark complex (spiny dogfish, Pacific sleeper shark, salmon shark, and other/unidentified sharks) continues to be on a biennial stock assessment schedule to coincide with the timing of the NMFS bottom trawl survey. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2013 and 2014. New information includes catch data updated for 2011 and partial data for 2012.

Status determination and stock trends

Sharks are caught incidentally in other targeted fisheries. Recent catches of sharks, from 1992 through 2012, have been well below the ABC first established for the shark complex in 2011. As reliable total biomass estimates for the shark complex do not exist, there can be no determination of spawning biomass or stock status trend.

As Tier 5/6 stocks, there is insufficient data to determine if the shark complex is in an overfished condition and therefore the status is unknown. The shark complex is not currently being subjected to overfishing.

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

The Plan Team concurred with the author's recommendation to use the status quo Tier 5/6 assessment approach used in 2011. Spiny dogfish are assessed as a Tier 5 species where $OFL = B$ (3-survey average; 79,257 t) * M (0.097) and $ABC = 0.75 OFL$. For the remainder of the species in the shark complex a Tier 6 approach is used where $OFL =$ average historical catch between 1997 and 2007 (571 t) and $ABC = OFL * 0.75$. The results are summed for a recommended OFL of 8,037 t and ABC of 6,028 t.

Area apportionment

GOA sharks are managed gulf-wide.

21. Squid

Status and catch specifications (t) of GOA squid in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2013 and 2014 are those recommended by the Plan Team. Catch data for 2012 are current through November 3 rd 2012.					
Year	Biomass	OFL	ABC	TAC	Catch
2011	-	1,530	1,148	1,148	231
2012	-	1,530	1,148	1,148	18
2013	-	1,530	1,148		
2014		1,530	1,148		

Changes in assessment methodology and data

GOA squid continue to be on a biennial stock assessment schedule to coincide with the timing of the NMFS bottom trawl survey. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2013 and 2014. New information includes catch data updated for 2011 and partial data for 2012, by target fishery and area.

There were no changes to the modified Tier 6 assessment method used in 2011. In 2011 a separate "in the fishery" category for the GOA squid complex was established.

Status determination and stock trends

Estimates of spawning biomass are unavailable as reliable biomass estimates for squid do not exist. The squid complex is not currently being subjected to overfishing. As a Tier 6 stock there is insufficient data to determine if the squid complex is in an overfished condition and therefore the status is unknown.

Total squid catches, for years which data are available, from 1990 through 2012, have been well below the ABC first established for the squid complex in 2011, with the exception of 2006, the year in which the highest historical catch was observed (1,530 t, the basis for the OFL level adopted). Squid catch in 2012 is the lowest on record. There is no directed fishery for squid and historically the majority of squid catch has occurred as bycatch to the walleye pollock fishery. However, in 2012 most of the squid catch occurred in the rockfish fishery. Nearly all catch in recent years has occurred in NMFS Area 620.

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

The Plan Team concurred with the author's recommendation to set the OFL equal to the maximum historical catch between 1997 and 2007 (1,530 t) and the ABC equal to 0.75 * OFL (1,148 t) because reliable estimates of biomass and natural mortality do not exist.

Area apportionment

GOA squid are managed gulf-wide.

22. Octopus

Status and catch specifications (t) of GOA octopus in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2013 and 2014 are those recommended by the Plan Team. Catch data for 2012 are current through November 3rd 2012.

Year	Biomass	OFL	ABC	TAC	Catch
2011	-	1,272	954	954	917
2012	-	1,941	1,455	1,455	368
2013	-	1,941	1,455		
2014		1,941	1,455		

Changes in assessment methodology and data

The GOA octopus stock complex consists of at least seven species of octopus. GOA octopuses continue to be on a biennial stock assessment schedule to coincide with the timing of the NMFS bottom trawl survey. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2013 and 2014. New information includes an analysis of Pacific cod stomachs, and a new approach for estimating biomass and mortality based on consumption of octopus by Pacific cod. Catch data were updated for 2011 and partial data reported for 2012.

The authors provided three different Tier 6 assessment approaches to estimate OFL and ABC for GOA octopus. The three methods presented were 1) the *status quo* approach used last year based on trawl

survey biomass estimates, 2) the maximum of 1997-2007 historical catch, and 3) a new consumption-based approach that estimates the mortality of octopus based on consumption by Pacific cod. The consumption-based approach was introduced at the September meeting and the Plan Team requested that estimates for ABC and OFL using this method be presented at the November 2012 meeting.

Author and Team evaluation of alternative models

The authors recommended the consumption-based method over using the *status quo* approach used last year because of poor estimates of both survey biomass and natural mortality. This consumption-based approach provided OFL and ABC estimates that were slightly lower than those provided by the *status quo* method. The assertion is that predators may be better samplers of octopus than the survey, and Pacific cod was chosen as the proxy. The authors estimated annual consumption of octopus by Pacific cod and calculated M*B. Data were used from 1990-2009 stomach analysis of Pacific cod. There was relatively low occurrence of octopus in Pacific cod stomachs, although there was good correspondence with where Pacific cod were eating octopus and where the fishery was catching octopus. The majority of octopus present in Pacific cod stomachs were small (<5 kg) which is similar to animals caught in survey trawls. However, most of the octopus caught in the commercial fishery were caught in pot gear and average about 15 kg. There was very little overlap between the diet and commercial weight distributions. The authors consider this a conservative approach because only about one-third of predation is being accounted, the assessed biomass from this estimate is lower than the *status quo* approach, and the harmonic mean of simulated rates of consumption were used to estimate OFL (since it is a right-skewed distribution).

While the Plan Team recognized that the survey estimate may be unreliable, the Team was unconvinced the consumption approach was an improvement. The sizes of octopus beaks found in stomachs differed to a large extent from those found in the fishery. Another concern was that the method measured consumption/mortality on a different demographic than the fishery. As additional size composition information is analyzed, and knowledge of natural mortality is increased, the consumption-based approach might become more viable. Given these concerns, the Plan Team recommended to continue with the modified Tier 6 approach.

Status Determination and Stock Trends

Octopuses are taken as incidental catch in trawl, longline, and pot fisheries. The highest octopus catch rates are from Pacific cod pot fisheries in the CGOA and WGOA. The author noted that the trawl biomass estimate and incidental catch of octopus in 2011 was the highest on record.

Recent catches of octopus, from 1997 through 2011, have been well below the ABC first established for the octopus complex in 2011. As reliable total biomass estimates for octopuses do not exist, there can be no determination of spawning biomass or stock status trend.

As a tier 6 stock, there is insufficient data to determine if the complex is in an overfished condition and therefore the status is unknown. The octopus complex is not currently being subjected to overfishing.

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

The status quo assessment method used last year, and recommended by the Plan Team for 2013, is a modified Tier 6 approach that includes a conservative estimate of natural mortality of 0.53 and a minimum biomass estimate using the average of the last three surveys. Using a Tier 5-like calculation of OFL, average minimum B×M ($3,662 \text{ t} \times 0.53 = 1,941 \text{ t}$) and the ABC equal to $0.75 \times \text{OFL}$ (1,455 t) is estimated.

Area apportionment

GOA octopus complex is managed gulf-wide.

Appendix 1: Grenadiers

A full assessment of the grenadier assemblage is provided in Appendix 1; while not required, it is provided to assist the Council in its pending decision of whether to include the assemblage in the groundfish FMPs. The GOA Plan Team continues to recommend that the Council add grenadiers to the GOA FMP so that annual catch limits can be established.

Seven species of grenadiers are known to occur in Alaska. The giant grenadier is the most abundant and has the shallowest depth distribution on the continental slope. The assessment focused on the giant grenadier as it is the most common grenadier caught in both the commercial fishery and longline and trawl surveys. Pacific grenadiers and popeye grenadiers are occasionally caught.

The estimated annual catches of grenadiers in Alaska for the years 1997-2012 have ranged between 11,700-21,300 t, with an average for this period of 15,400 t. Highest catches have consistently been in the GOA. By region, annual catches have ranged between 5,400-14,700 t in the GOA, 1,600-5,000 t in the EBS, and 1,300-4,400 t in the AI. Most of the catch occurs in longline and pot fisheries.

Changes in assessment methodology and data

New data for this assessment includes: 1) updated catch estimates for 2011-2012; 2) trawl survey results for the eastern Bering Sea (EBS) slope in 2012; 3) a time series of Aleutian Island (AI) biomass and variance estimates using a new estimation method for 1996-2012; 4) NMFS longline survey results for 2011 and 2012; and 5) observer data on giant grenadier length and sex in the commercial fishery for 2011 and 2012.

A new method for determining AI biomass and variance estimates was presented. This new method utilizes available biomass estimates from AFSC trawl surveys in the AI that only extend from 1-500 m. A ratio of “shallow” biomass estimates from the trawl survey (1-500 m) to “shallow” relative population weights (RPWs) from the AFSC longline survey (1-500 m) is used to extrapolate total biomass from longline survey RPWs for 1-1000 m.

Tier determination and resulting ABCs and OFLs

If included in the fishery in the FMPs, Tier 5 determinations would result in the following OFLs and ABCs.

Area	OFL	ABC
EBS	46,200	32,400
AI	89,000	35,000
GOA	46,600	35,000

For the EBS and GOA these Tier 5 calculations are based on the average of the three most recent deep-water trawl surveys that sampled down to at least 1,000 and an $M = 0.078$. In the EBS, these are now the 2008, 2010, and 2012 surveys. In the GOA, these are the 2005, 2007, and 2009 surveys. In the AI the new method combines the use of 2008, 2010, 2012 trawl survey data and longline survey data even when trawl surveys sampled only to 500 m.

For comparison, the authors also calculated a Tier 5 ABC for the GOA based on the Kalman filter model estimates of biomass. Since the depth sampled differed among the time series of the trawl surveys, the model was applied separately to three depth strata and then summed to give an estimate of biomass. This resulted in an OFL of 30,800 t and an ABC of 23,100 t for the GOA.

Appendix 2: Forage fish

A forage fish assessment for the GOA is provided in Appendix 2. The forage fish category in the GOA 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 the exact number and types of species in the forage fish category is unknown. Species in the forage fish category have been identified as having ecological importance as prey, and directed fishing is prohibited for the group. As of 2011, the forage fish category in the GOA FMP is considered an “ecosystem component.” An expanded assessment of forage fish was completed this year. The report included additional information on the distribution, catches, monitoring programs, and trends for the forage fish category. Additional information was also included for species outside of the actual forage fish FMP category such as squid, shrimp, and salmon since they represent important prey. As information is available additional updates to this chapter will be provided on a biennial cycle.

Tables

Table 1. Gulf of Alaska groundfish 2012 - 2014 OFLs and ABCs, 2012 TACs, and 2012 catches (reported through November 3rd 2012).

Stock/ Assemblage	Area	2012				2013		2014	
		OFL	ABC	TAC	Catch	OFL	ABC	OFL	ABC
Pollock	W (61)		30,270	30,270	27,893		28,072		25,648
	C (62)		45,808	45,808	45,050		51,443		47,004
	C (63)		26,348	26,348	25,589		27,372		25,011
	WYAK		3,244	3,244	2,380		3,385		3,093
	Subtotal	143,716	105,670	105,670	100,912	150,817	110,272	138,610	100,756
	EYAK/SEO	14,366	10,774	10,774		14,366	10,774	14,366	10,774
	Total	158,082	116,444	116,444	100,912	165,183	121,046	152,976	111,530
Pacific Cod	W		28,032	21,024	17,703		28,280		29,470
	C		56,940	42,705	34,901		49,288		51,362
	E		2,628	1,971	338		3,232		3,368
	Total	104,000	87,600	65,700	52,942	97,200	80,800	101,100	84,200
Sablefish	W		1,780	1,780	1,390		1,750		1,641
	C		5,760	5,760	5,248		5,540		5,195
	WYAK		2,247	2,247	2,028		2,030		1,902
	SEO		3,176	3,176	3,188		3,190		2,993
	Total	15,330	12,960	12,960	11,854	14,780	12,510	13,871	11,731
Shallow-water flatfish	W		21,994	13,250	153		19,489		18,033
	C		22,910	18,000	3,322		20,168		18,660
	WYAK		4,307	4,307			4,647		4,299
	EYAK/SEO		1,472	1,472			1,180		1,092
	Total	61,681	50,683	37,029	3,475	55,680	45,484	51,580	42,084
Deep-water Flatfish	W		176	176	8		176		176
	C		2,308	2,308	246		2,308		2,308
	WYAK		1,581	1,581	5		1,581		1,581
	EYAK/SEO		1,061	1,061	3		1,061		1,061
	Total	6,834	5,126	5,126	262	6,834	5,126	6,834	5,126
Rex sole	W		1,307	1,307	215		1,300		1,287
	C		6,412	6,412	1,972		6,376		6,310
	WYAK		836	836			832		823
	EYAK/SEO		1,057	1,057			1,052		1,040
	Total	12,561	9,612	9,612	2,187	12,492	9,560	12,362	9,460
Arrowtooth Flounder	W		27,495	14,500	1,331		27,181		26,970
	C		143,162	75,000	18,213		141,527		140,424
	WYAK		21,159	6,900	53		20,917		20,754
	EYAK/SEO		21,066	6,900	140		20,826		20,663
	Total	250,100	212,882	103,300	19,737	247,196	210,451	245,262	208,811
Flathead Sole	W		15,300	8,650	277		15,729		16,063
	C		25,838	15,400	1,613		26,563		27,126
	WYAK		4,558	4,558			4,686		4,785
	EYAK/SEO		1,711	1,711			1,760		1,797
	Total	59,380	47,407	30,319	1,890	61,036	48,738	62,296	49,771

Table 1. continued.

Stock/ Assemblage	Area	2012				2013		2014	
		OFL	ABC	TAC	Catch	OFL	ABC	OFL	ABC
Pacific ocean perch	W	2,423	2,102	2,102	2,452		2,040		2,005
	C	12,980	11,263	11,263	10,741		10,926		10,740
	WYAK		1,692	1,692	1,682		1,641		1,613
	W/C/WYAK					16,838		16,555	
	SEO	4,095	1,861	1,861		2,081	1,805	2,046	1,775
	Total	19,498	16,918	16,918	14,875	18,919	16,412	18,601	16,133
Northern rockfish ³	W		2,156	2,156	1,817		2,008		1,899
	C		3,351	3,351	3,210		3,122		2,951
	E								
	Total	6,574	5,507	5,507	5,027	6,124	5,130	5,791	4,850
Shortraker Rockfish	W		104	104	110		104		104
	C		452	452	361		452		452
	E		525	525	402		525		525
	Total	1,441	1,081	1,081	873	1,441	1,081	1,441	1,081
Dusky rockfish	W		409	409	435		377		354
	C		3,849	3,849	3,558		3,533		3,317
	WYAK		542	542	2		495		465
	EYAK/SEO		318	318	6		295		277
	Total	6,257	5,118	5,118	4,001	5,746	4,700	5,395	4,413
Rougheye and blackspotted rockfish	W		80	80	39		81		83
	C		850	850	389		856		871
	E		293	293	236		295		300
	Total	1,472	1,223	1,223	664	1,482	1,232	1,508	1,254
Demersal rockfish	Total	467	293	293	178	487	303	487	303
Thornyhead Rockfish	W		150	150	186		150		150
	C		766	766	340		766		766
	E		749	749	217		749		749
	Total	2,220	1,665	1,665	743	2,220	1,665	2,220	1,665
Other Rockfish	W		44	44	255		44		44
	C		606	606	724		606		606
	WYAK		230	230	37		230		230
	EYAK/SEO		3,165	200	24		3,165		3,165
	Total	5,305	4,045	1,080	1,040	5,305	4,045	5,305	4,045
Atka mackerel	GOA-wide	6,200	4,700	2,000	1,187	6,200	4,700	6,200	4,700
Big Skate	W		469	469	60		469		469
	C		1,793	1,793	1,596		1,793		1,793
	E		1,505	1,505	38		1,505		1,505
	Total	5,023	3,767	3,767	1,694	5,023	3,767	5,023	3,767
Longnose Skate	W		70	70	28		70		70
	C		1,879	1,879	656		1,879		1,879
	E		676	676	78		676		676
	Total	3,500	2,625	2,625	762	3,500	2,625	3,500	2,625
Other Skates	GOA-wide	2,706	2,030	2,030	1,110	2,706	2,030	2,706	2,030
Sculpins	GOA-wide	7,641	5,731	5,731	802	7,614	5,884	7,614	5,884
Sharks	GOA-wide	8,037	6,028	6,028	595	8,037	6,028	8,037	6,028
Squid	GOA-wide	1,530	1,148	1,146	18	1,530	1,148	1,530	1,148
Octopus	GOA-wide	1,941	1,455	1,455	368	1,941	1,455	1,941	1,455
Total	Total	747,780	606,048	438,159	227,196	738,676	595,920	723,580	584,094

Table 2. Gulf of Alaska 2013 ABCs, biomass, and overfishing levels (t) for Western, Central, Eastern, Gulfwide, West Yakutat, and Southeast Outside regulatory areas.

Species/Assemblage	Area	2013		
		ABC	Biomass	OFL
Pollock	W (61)	28,072		
	C (62)	51,443		
	C (63)	27,372		
	WYAK	3,385		
	Subtotal	110,272	981,791	150,817
	EYAK/SEO	10,774	47,885	14,366
	Total	121,046	1,029,676	165,183
Pacific Cod	W	28,280		
	C	49,288		
	E	3,232		
	Total	80,800	449,300	97,200
Sablefish	W	1,750		
	C	5,540		
	WYAK	2,030		
	EY/SEO	3,190		
	Total	12,510	167,000	14,780
Shallow water Flatfish	W	19,489		
	C	20,168		
	WYAK	4,647		
	EYAK/SEO	1,180		
	Total	45,484	433,869	55,680
Deep water Flatfish	W	176		
	C	2,308		
	WYAK	1,581		
	EYAK/SEO	1,061		
	Total	5,126	77,531	6,834
Rex sole	W	1,300		
	C	6,376		
	WYAK	832		
	EYAK/SEO	1,052		
	Total	9,560	86,684	12,492
Arrowtooth Flounder	W	27,181		
	C	141,527		
	WYAK	20,917		
	EYAK/SEO	20,826		
	Total	210,451	2,055,560	247,196
Flathead sole	W	15,729		
	C	26,563		
	WYAK	4,686		
	EYAK/SEO	1,760		
	Total	48,738	288,538	61,036

Table 2. Continued...

Species/Assemblage	2013			
	Area	ABC	Biomass	OFL
Pacific ocean perch	W	2,040		
	C	10,926		16,838
	WYAK	1,641		
	EY/SEO	1,805		2,081
	Total	16,412	345,260	18,919
Northern rockfish	W	2,008		
	C	3,122		
	E	²		
	Total	5,130	99,089	6,124
Shortraker	W	104		
	C	452		
	E	525		
	Total	1,081	48,048	1,441
Dusky rockfish	W	377		
	C	3,533		
	WYAK	495		
	EYAK/SEO	295		
	Total	4,700	63,515	5,746
Rougheye / blackspotted rockfish	W	81		
	C	856		
	E	295		
	Total	1,232	42,883	1,482
Demersal shelf rockfish	Total	303	14,588	487
Thornyhead rockfish	Western	150		
	Central	766		
	Eastern	749		
	Total	1,665	73,990	2,220
Other rockfish	W	44		
	C	606		
	WYAK	230		
	EY/SEO	3,165		
	Total	4,045	85,774	5,305
Atka mackerel	Total	4,700	Unknown	6,200
Big skates	W	469		
	C	1,793		
	E	1,505		
	Total	3,767	50,229	5,023
Longnose skates	W	70		
	C	1,879		
	E	676		
	Total	2,625	34,995	3,500
Other Skates	Total	2,030	27,061	2,706
Sculpins		5,884	34,610	7,614
Sharks		6,028	118,621	8,037
Squid		1,148	NA	1,530
Octopus		1,455	NA	1,941
Total		595,920	5,626,821	738,676

¹For management purposes 2 t of northern rockfish in to “other rockfish” in the eastern GOA.

Table 3. Summary of fishing mortality rates and overfishing levels for the Gulf of Alaska, 2013.

Species	Tier	F_{ABC}^1	Strategy	F_{OFL}^2	Strategy
Pollock	3b	0.15	F_{ABC}	0.20	$F_{35\%}$ adjusted
Pacific cod	3a	0.49	$F_{40\%}$	0.61	$F_{35\%}$
Sablefish	3b	0.086	$F_{40\%}$ adjusted	0.102	$F_{35\%}$ adjusted
Deepwater flatfish	5, 6 ³	0.064	$F=.75M$, F_{ABC}^3	0.085	$F=M$, F_{OFL}^4
Rex sole	5	0.128	$F=.75M$	0.17	$F=M$
Flathead sole	3a	0.450	$F_{40\%}$	0.593	$F_{35\%}$
Shallow water flatfish (excl. rocksoles)	5	0.15	$F=.75M$	0.20	$F=M$
Northern rocksole	3a	0.152	$F_{40\%}$	0.18	$F_{35\%}$
Southern rocksole	3a	0.193	$F_{40\%}$	0.23	$F_{35\%}$
Arrowtooth	3a	0.174	$F_{40\%}$	0.207	$F_{35\%}$
Pacific ocean perch	3a	0.119	$F_{40\%}$	0.138	$F_{35\%}$
Rougheye and blackspotted rockfish	3a	0.039	$F_{40\%}$	0.047	$F_{35\%}$
Shortraker rockfish	5	0.0225	$F=.75M$	0.03	$F=M$
Other rockfish ("other slope" rockfish)	4, 5 ⁵	0.053, 0.038-0.075	$F_{40\%}$, $F=.75M^5$	0.064, 0.05, 0.10	$F_{35\%}$, $F=M^6$
Northern rockfish	3a	0.062	$F_{40\%}$	0.074	$F_{35\%}$
Dusky rockfish ⁷ (formerly "pelagic shelf" rockfish)	3a	0.098	$F_{40\%}$	0.122	$F_{35\%}$
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}^8	NA	F_{OFL}^9
Skates	5	0.075	$F=.75M$	0.10	$F=M$
Sculpins	5	0.165	$F=.75M$	0.22	$F=M$
Squid	6	NA	F_{ABC}^{10}	NA	F_{OFL}^{11}
Octopus	6	0.3975	$F=.75M^{12}$	0.53	$F=M^{13}$
Sharks	5,6 ¹⁴	0.073	$F=.75M, F_{ABC}^{14}$	0.097	$F=M, F_{OFL}^{15}$

- 1/ Fishing mortality rate corresponding to acceptable biological catch.
- 2/ Maximum fishing mortality rate allowable under overfishing definition.
- 3/ $F=.75M$ for Dover sole (Tier 5), $ABC=.75$ x average catch (1978-1995) for other deepwater flatfish (Tier 6).
- 4/ $F=M$ for Dover sole (Tier 5), average catch (1978-1995) for other deepwater flatfish (Tier 6).
- 5/ $F_{40\%}$ for sharpchin rockfish (Tier 4), $F=.75M$ for other rockfish species (Tier 5). The other rockfish category (formerly the "other slope" rockfish category now includes widow and yellowtail rockfish.
- 6/ $F_{35\%}$ for sharpchin (Tier 4), $F=M$ for other species (Tier 5). The other rockfish category (formerly the "other slope" rockfish category now includes widow and yellowtail rockfish.
- 7/ Dusky rockfish were formerly in the "pelagic shelf" rockfish category which no longer exists. Widow and yellowtail rockfish which were in the former "pelagic shelf" category have been moved to the other rockfish category.
- 8/ 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.
- 9/ OFL for Atka mackerel is equal to average catch from 1978 to 1995.
- 10/ ABC for squid is equal to 0.75 x the maximum catch of squid from 1997-2007. This is a modified Tier 6 recommendation.
- 11/ OFL for squid is equal to the maximum catch of squid from 1997-2007. This is a modified Tier 6 recommendation.
- 12/ ABC for octopus is equal to $F=.75M$ x the average estimate of biomass from the 2007, 2009, and 2011 surveys. This is a modified Tier 6 recommendation.
- 13/ OFL for octopus is equal to $F=M$ x the average estimate of biomass from the 2007, 2009, and 2011 surveys. This is a modified Tier 6 recommendation.
- 14/ $F_{ABC} = 0.073$ 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.
- 15/ $F=M$ for spiny dogfish (Tier 5), OFL for other 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 2013 recommended fishing mortality rates and ABCs, for those species whose recommendations were below the maximum.

Species	Tier	2013			2013
		<i>Max F_{ABC}</i>	<i>Max ABC</i>	<i>F_{ABC}</i>	ABC
Pollock ¹	3b	0.18	131,630	0.15	110,272
Demersal shelf rockfish	4	0.026	395	0.02	303

1/ The Plan Team recommended 2013 W/C pollock ABC of 110,272 t was derived by first incorporating the anticipated EFP pollock catches in the model projection resulting in an ABC value of 113,099 t, which is then reduced by 2,827 t to accommodate the Prince William Sound (PWS) GHF. The PWS GHF value is 2.5% of the W/C pollock ABC . For comparisons in this table, the maximum permissible ABC of 131,630 t should be compared with the full author recommended ABC of 113,586 t.

Table 5. Groundfish landings (metric tons) in the Gulf of Alaska, 1956-2012.

Year	Pollock	Pacific cod	sablefish	Flat fish	Arrowtooth Flounder	Slope rockfish ^a
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 ^c	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 ^d	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	75,167	58,003	10,086	13,556	24,334	21,368
2011	79,789	62,475	11,148	10,043	30,890	19,612
2012 ^h	100,912	52,942	11,854	7,814	19,737	22,479

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, 1956-2012.

Year	Pelagic Shelf rockfish	Demersal shelf rockfish ^b	Thornyheads ^c	Atka mackerel ^e	Skates ^k	Other species ^d	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 ^f	540	1,320	3,538		2,752	232,578
1995	2,891	219 ^g	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	3,111	128	565	2,417	5,056	2,042	215,833
2011	2,531	82	612	1,615	4,437	2,362	225,596
2012 ^h	4,001	178	743	1,187	3,566	1,783	227,196

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, widow and yellowtail in 2012 (note only dusky remains in PSR in 2012)

g/ Does not include at-sea discards.

h/ Catch data reported through November 3rd, 2012.

i/ Includes all species except arrowtooth.

j/ Does not include state fisheries

k/ Includes all managed skates species

Figures

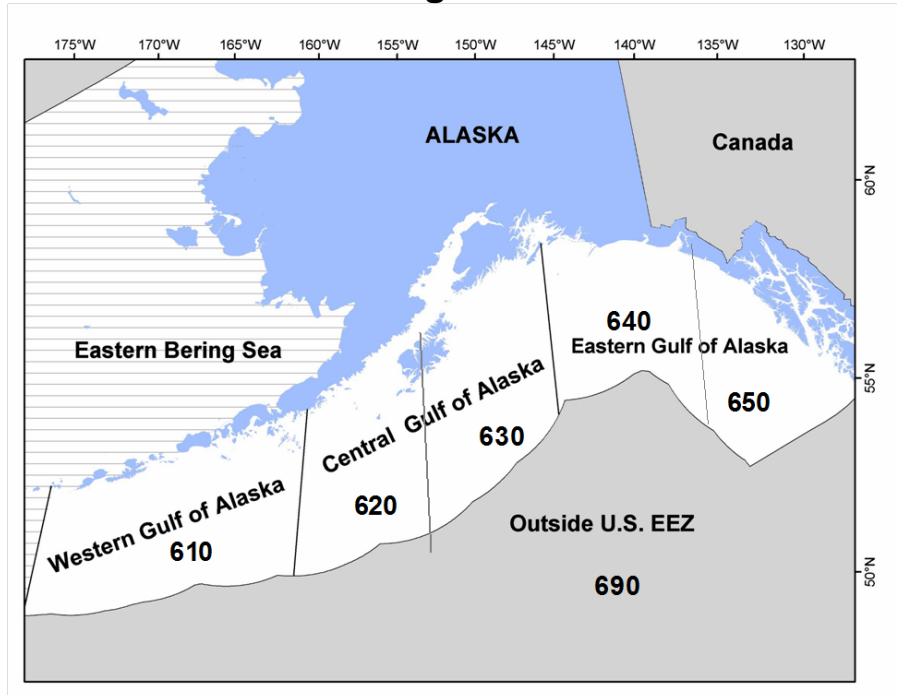


Figure 1. Gulf of Alaska statistical and reporting areas.

Gulf of Alaska

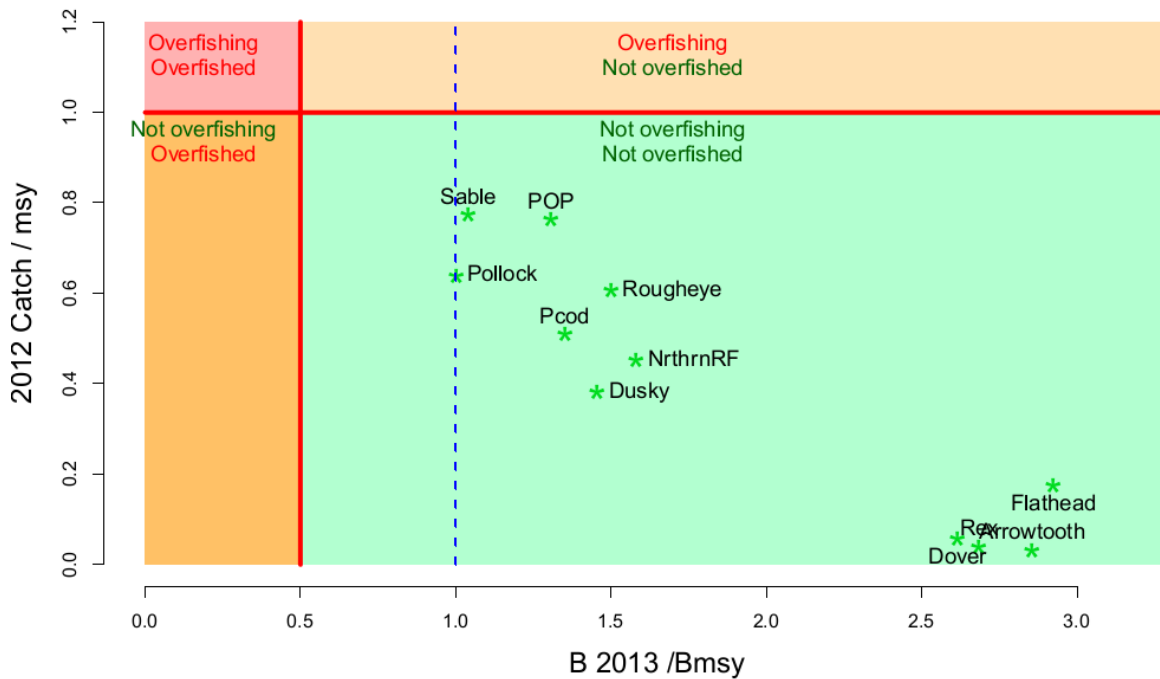


Figure 2. Summary status of age-structured GOA species relative to 2012 catch levels (vertical axis) and projected 2013 spawning biomass relative to B_{msy} levels. Note that the 2012 MSY level is defined as the 2012 catch at F_{OFL} .

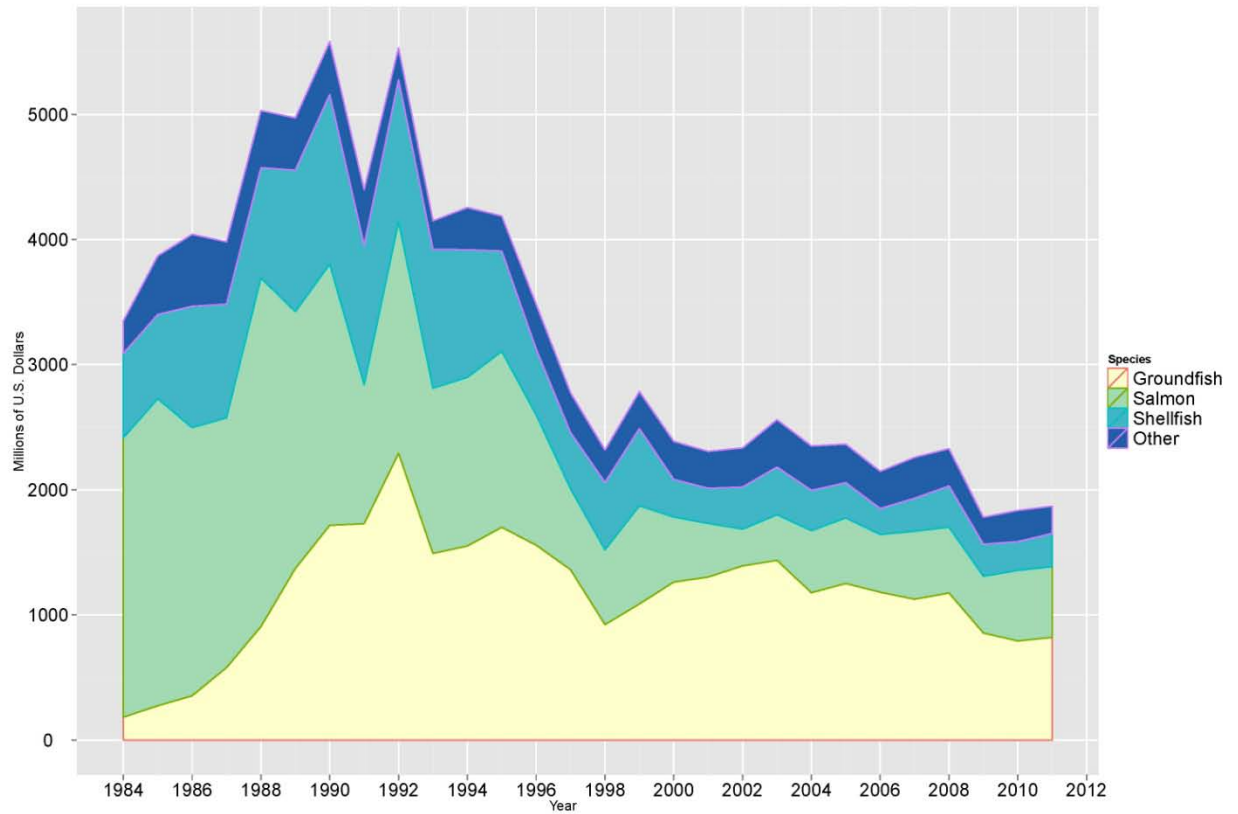


Figure 3. Real ex-vessel value of the domestic fish and shellfish catch off Alaska (GOA and BSAI) by species group, 1984-2011 (base year = 2011).

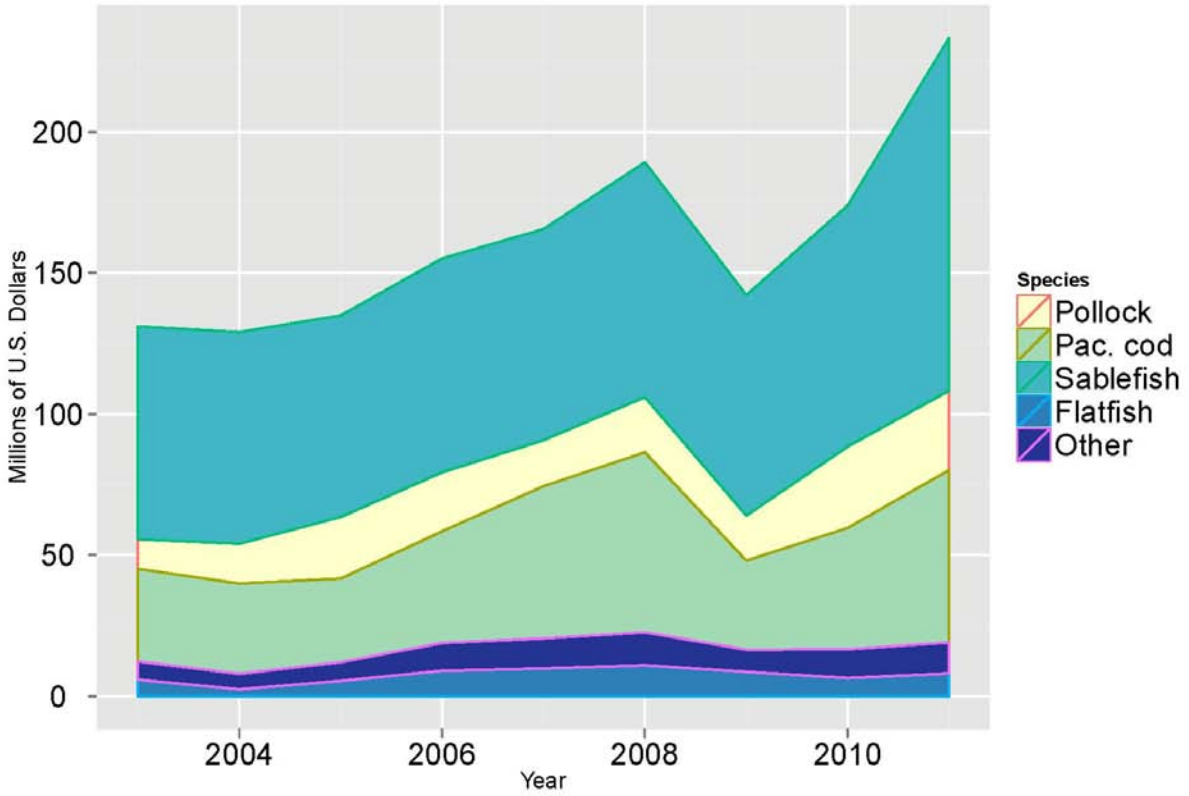


Figure 4. Real ex-vessel value of the groundfish catch in the domestic commercial fisheries in the GOA area by species, 2003-2011 (base year = 2011).

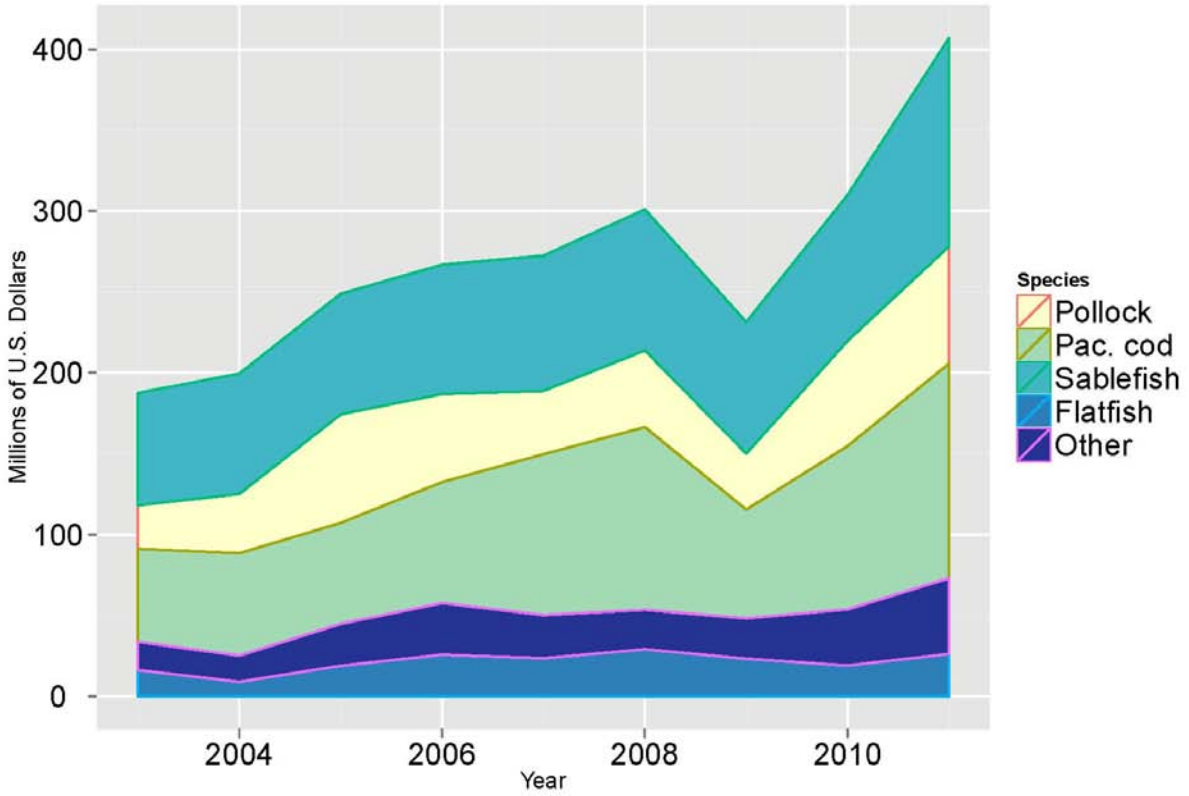


Figure 5. Real gross product value of the groundfish catch in the GOA area by species, 2003-2011 (base year = 2011).

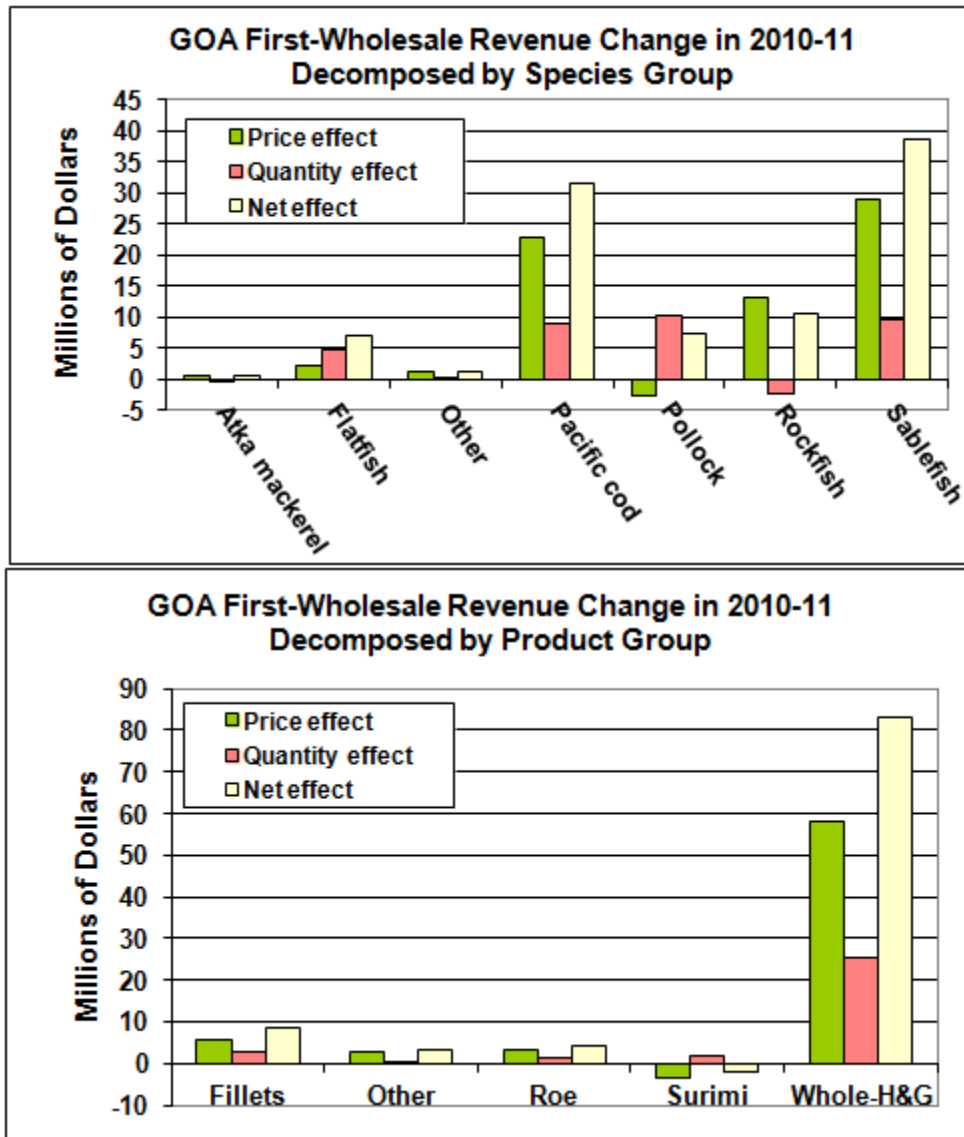


Figure 6. Decomposition of the change in first-wholesale revenues from 2010-11 in the GOA. The first decomposition is by the species groups used in the Economic SAFE report, and the second decomposition is by product group. The price effect refers to the change in revenues due to the change in the first-wholesale price index (current dollars per metric ton) for each group. The quantity effect refers to the change in revenues due to the change in production (in metric tons) for each group. The net effect is the sum of price and quantity effects.