APPENDIX B

STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

FOR THE GROUNDFISH RESOURCES OF THE GULF OF ALASKA

Compiled by

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with contributions by

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November 2009

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

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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 16-20th, 2009 to review the status of stocks of eighteen 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), Bob Foy, Sarah Gaichas, Ken Goldman, Sandra Lowe, Jeff Fujioka, Jon Heifetz, Cleo Brylinsky, Tom Pearson, Nick Sagalkin, Mike Dalton, Nancy Friday, Leslie Slater, and Paul Spencer.

Background Information

Management Areas and Species

The Gulf of Alaska (GOA) management area lies within the 200-mile U.S. Exclusive Economic Zone (EEZ) of the United States (Figure 1). Five categories of finfishes and invertebrates have been designated for management purposes. They are: target species, other species, prohibited species, forage fish species and non-specified species. This SAFE report describes stock status of target species and other species only. Species or complexes included in each of the first three categories are listed below.

Target Species	Other Species	Prohibited Species
Pollock	Octopus	Pacific halibut
Pacific cod	Squids	Pacific herring
Flatfishes	Sculpins	Pacific salmon
Rockfishes	Sharks	Steelhead trout
Sablefish		King crabs
Atka mackerel		Tanner crabs
Skates		

A species or species group from within the target species category may be split out and assigned an appropriate harvest level. Similarly, species in the target species 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. All other species of fish and invertebrates taken incidentally that are not managed by other FMPs and are associated with groundfish fisheries are designated as "non-specified species", e.g. grenadiers, and catch reporting is not required.

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

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

Groundfish catches are managed against TAC specifications for the EEZ and near coastal waters of the GOA. State of Alaska internal water groundfish populations are typically not covered by NMFS surveys and catches from internal water fisheries generally not counted against the TAC. The Team has recommended that these catches represent fish outside of the assessed region, and should not be counted against an ABC or TAC. Beginning in 2000, the pollock assessment incorporated the ADF&G survey pollock biomass, therefore, the Plan Team acknowledged that it is appropriate to reduce the Western (W), Central (C) and West Yakutat (WY) combined GOA pollock ABC by the anticipated Prince William Sound (PWS) harvest level for the State fishery. Therefore, the 2010 PWS GHL of 1,650 t should be deducted from the W/C/WY pollock ABC before area apportionments are made.

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

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

New data summary

Since the Stock Assessment and Fishery Evaluation Report (SAFE) for 2009 was issued (NPFMC 2008), the following new information has been incorporated in the stock assessments:

1) Pollock: (a) Total fishery catch from the 2008 fishery and preliminary catch estimates for the 2009 fishery, (b) age composition from the 2008 fishery; (c) biomass and age compositions from the 2009 Shelikof Strait echo integration trawl (EIT) survey, (d) 2009 bottom trawl survey biomass estimates and length compositions, (e) 2009 biomass and length composition from the ADF&G crab/groundfish trawl survey, and (f) 2008 age composition from the ADF&G crab/groundfish trawl survey.
2) Pacific cod: (a) Catch data for 1991-2008 were updated, and preliminary catch data for 2009 were incorporated (b) commercial fishery size composition data for 2008 were updated, and preliminary size composition data from the 2009 commercial fisheries were incorporated, (c) age composition and mean-length-at-age data from the 2007 bottom trawl survey were incorporated into some models, (d) age composition data from the 2008 January-May longline fishery were incorporated into some of the models, (e) mean length at age data from the 2008 January-May longline fishery were incorporated into some of the models, (f) size composition data from the 2009 bottom trawl survey were incorporated, (g) the numeric abundance estimate from the 2009 GOA bottom trawl survey was incorporated (the 2009 estimate of 574 million fish was up about 199% from the 2007 estimate), (h) the variances in the ageing error matrix were updated in all of the models that use age data, and possible biases in age data were corrected for in some of the models that use age data, (i) seasonal catch per unit effort (CPUE) data for the trawl, longline, and pot fisheries from 2008 were updated, and preliminary catch rates for the trawl, longline, and pot fisheries from 2009 were incorporated.
3) Sablefish: (a) Relative abundance and length data from the 2009 longline survey, (b) relative abundance and length data from the 2008 longline and trawl fisheries, (c) age data from the 2008 longline survey and longline fishery, and (d) biomass estimates and length data from the 2009 bottom trawl survey.
4) Flatfish: Flatfish have been moved to a biennial stock assessment schedule to coincide with new survey data. Full assessments are presented this year to include the 2009 bottom trawl survey information. New information since the last assessment includes:
5) Shallow-water flatfish: (a) updated catches since 2007 and (b) biomass and length data from the 2009 bottom trawl survey.
6) Deepwater flatfish: (a) updated catch data for 2008 and preliminary 2009 catches, (b) the 2008 and 2009 fishery size compositions for Dover sole, (c) recalculated fishery size compositions for all available years (1991-2009), (d) survey biomass and length composition data for Dover sole from the 2009 GOA groundfish survey, (e) survey age compositions for Dover sole from the 1987 and 2007 surveys
7) Rex sole: (a) updated 2007 fishery catch and length composition, (b) fishery catch and length composition data for 2008 and 2009, (c) 2009 survey biomass estimates and length information, (d) four years (2001, 2003, 2005, 2007) of survey age compositions, and (e) the 1990 survey age composition was removed for re-evaluation.
8) Arrowtooth flounder: (a) updated catch for 2007 and 2008, and preliminary 2009 catch, (b) fishery length data for 2007 and 2009, and (c) biomass and length data from the 2009 bottom trawl survey.
9) Flathead sole: (a) updated 2007 fishery catch and length distributions, (b) fishery catch and length distributions for 2008 and 2009, (c) 2009 survey biomass and length information, (d) recalculated survey biomass estimates and length compositions for all survey years, (e) age compositions from the 1990, 1999, and 2007 groundfish surveys, and (f) an alternative model with an estimable scaling offset parameter for male fishery and survey selectivity functions.

10) Rockfish: Rockfish have been moved to a biennial stock assessment schedule to coincide with new survey data. Full assessments are presented this year to include the 2009 bottom trawl survey information. New information since the last assessment includes:
11) Pacific ocean perch: (a) updated 2008 catch data and preliminary 2009 catch data, (b) 2006 and 2008 fishery age compositions, (c) 2009 survey biomass estimates, (d) 2007 survey age composition, (e) revised historic data to reflect database changes, and (f) new fishery selectivity functions.
12) Northern rockfish: (a) updated 2008 catch data and preliminary 2009 catch data, (b) fishery size compositions for 2007, (c) 2009 trawl survey biomass estimate, (d) survey age compositions for 2007, and (e) an alternative model (Model 2) with a consistent method of assigning year specific likelihood weights.
13) Rougheye and blackspotted rockfish: (a) updated estimates of 2007-2009 fishery catch, (b) 2004 and 2006 fishery ages, (c) 2007 fishery length compositions, (d) 2009 trawl survey biomass estimates, (e) 1987 and 2007 trawl survey age compositions, (f) 2008-2009 longline survey relative population weights, and (g) 2008-2009 longline survey size compositions.
14) Shortraker and other slope rockfish: (a) biomass estimates from the 2009 bottom trawl survey.
15) Pelagic shelf rockfish: (a) updated 2008 catch data and preliminary 2009 catch data, (b) three new years of fishery age compositions (2003, 2005, 2006), (c) 2007 survey ages, (d) 2009 survey biomass, and (e) an alternative model which divides the fishery catch time series into 2 periods and downweights the earlier period and increases weight on the 2nd time period.
16) Demersal shelf rockfish: (a) new estimates of yelloweye density for the East Yakutat Section (EYKT) from the 2009 survey, (b) yelloweye average weight and standard error data were updated for all areas using incidental catch from the halibut fishery and fish caught in the directed commercial longline fishery for DSR during 2009, (c) new age data for the Central Southeast Outside Section (CSEO) for 2004 and for EYKT for 2005.
17) Thornyheads: (a) updated 2007, 2008, and partial 2009 catch data, (b) length compositions from the 2007 and 2008 longline fisheries, (c) biomass and length composition information from the 2009 GOA bottom trawl survey, and (d) relative population numbers and weights and size compositions from the 2008 and 2009 longline surveys.
18) Atka mackerel: Atka mackerel have been moved to a biennial stock assessment schedule to coincide with new survey data. A full assessment is presented this year to include the 2009 bottom trawl survey information. New information since the last assessment includes: (a) length data from the 2007, 2008, and preliminary 2009 GOA fisheries, (b) age data from the 2007 and 2008 GOA fisheries, (c) age data from the 2007 GOA bottom trawl survey, (d) biomass estimates from the 2009 GOA bottom trawl survey, and (e) length frequency data from the 2009 GOA bottom trawl survey.
19) Skates: Skates have been moved to a biennial stock assessment schedule to coincide with new survey data. A full assessment is presented this year to include the 2009 bottom trawl survey information. New information since the last assessment includes: (a)
20) Other species: The other species complex in the GOA contains the following species: sculpins, squids, sharks, and octopus. In the past, assessments for these species in the GOA were done periodically since ABCs and OFLs were not specified, and provided as appendices to the SAFE report. The TAC calculation for other species (previously TAC=5% of the sum of target TACs), was modified in 2005 such that the Council may recommend a TAC at or below 5% of the sum of the target species TACs during the annual specifications process. Amendment 79 to the GOA FMP which will be implemented in 2009, provides for the specification of ABC and OFL for the other species complex. This year full assessments are presented in the SAFE report to be used for the setting of harvest specifications for the other species complex which are the sums of the ABCs and OFLs of the individual species groups.

21) Sculpins: (a) updated total catch for GOA sculpins from 2003-2008 due to changes to Catch Accounting System, (b) preliminary 2009 catch data, (c) information on catch by target fishery, retention, and catch species composition updated through 2009, (d) biomass estimates and length composition from the 2009 GOA bottom trawl survey.
22) Squid: (a) updated 2003-2007 catch data due to changes in the Catch Accounting system, (b) updated 2008 catch and preliminary 2009 catch data; (b) biomass information from the 2009 GOA bottom trawl survey, (c) data on retention of squids in observed catches have been added to the catch reporting, (d) a new map of squid catch distribution, (e) information on squid predation by seabirds has been added to the Ecosystem Considerations section.
23) Octopus: (a) revised catch data for 2003-2009, (b) 2009 bottom trawl survey biomass estimates; (c) preliminary results from observer special projects.
24) Sharks: (a) Total catch for GOA sharks from 2003-2008 updated due to changes to Catch Accounting System, (b) preliminary 2009 catch data, (c) biomass estimates from the 2009 GOA bottom trawl survey, (d) preliminary estimates of bycatch in unobserved IFQ Halibut fisheries are examined in the appendix; these catches are not included in the ABC calculations.
25) Groundfish, generally: Updated catch data from the NMFS Observer Program and Regional Office for 2009 and through November 7th, 2009.

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

1) Information available: *Reliable point estimates of B and B_{MSY} and reliable pdf of F_{MSY}.*
   - 1a) Stock status: $B/B_{MSY} > 1$
     $F_{OFL} = \mu_A$, *the arithmetic mean of the pdf*
     $F_{ABC} \le \mu_H$, *the harmonic mean of the pdf*
   - 1b) Stock status: $\alpha < B/B_{MSY} \le 1$
     $F_{OFL} = \mu_A \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
     $F_{ABC} \le \mu_H \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
   - 1c) Stock status: $B/B_{MSY} \le \alpha$
     $F_{OFL} = 0$
     $F_{ABC} = 0$

2) Information available: *Reliable point estimates of B, B_{MSY}, F_{MSY}, $F_{35\%}$, and $F_{40\%}$.*
   - 2a) Stock status: $B/B_{MSY} > 1$
     $F_{OFL} = F_{MSY}$
     $F_{ABC} \le F_{MSY} \times (F_{40\%}/F_{35\%})$
   - 2b) Stock status: $\alpha < B/B_{MSY} \le 1$
     $F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
     $F_{ABC} \le F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
   - 2c) Stock status: $B/B_{MSY} \le \alpha$
     $F_{OFL} = 0$
     $F_{ABC} = 0$

3) Information available: *Reliable point estimates of B, $B_{40\%}$, $F_{35\%}$, and $F_{40\%}$.*
   - *3a) Stock status: $B/B_{40\%} > 1$*
     $F_{OFL} = F_{35\%}$
     $F_{ABC} \le F_{40\%}$
   - *3b) Stock status: $\alpha < B/B_{40\%} \le 1$*
     $F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$
     $F_{ABC} \le F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$
   - *3c) Stock status: $B/B_{40\%} \le \alpha$*
     $F_{OFL} = 0$
     $F_{ABC} = 0$

4) Information available: *Reliable point estimates of B, $F_{35\%}$, and $F_{40\%}$.*
   $F_{OFL} = F_{35\%}$
   $F_{ABC} \le F_{40\%}$

5) Information available: *Reliable point estimates of B and natural mortality rate M.*
   $F_{OFL} = M$
   $F_{ABC} \le 0.75 \times M$

6) Information available: *Reliable catch history from 1978 through 1995.*
   OFL = the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information
   $ABC \le 0.75 \times OFL$

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 2009 or 2) above ½ of its MSY level in 2009 and above its MSY level in 2019 under this scenario, thePn the stock is not overfished.)

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

In 2010 and 2011, 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 2022 under this scenario, then the stock is not approaching an overfished condition.)

For stocks in Tiers 4-6, no determination can be made of overfished status or approaching an overfished condition as information is insufficient to estimate the MSY stock level.

Overview of Stock Assessments

The current status of individual groundfish stocks managed under the FMP is summarized in this section. The abundances of Pacific cod, Dover sole, flathead sole, arrowtooth flounder, Pacific ocean perch, 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 (Figure 1). The target biomass levels for other deep-water flatfish, shallow-water flatfish, rex sole, shortraker rockfish, demersal shelf rockfish, other pelagic shelf rockfish, other slope rockfish, thornyhead rockfish, Atka mackerel, skates, sculpins, squid, octopus, and sharks are unknown.

Summary and Use of Terms

Tables 1 and 2 provide a summary of the current status of the groundfish stocks, including catch statistics, ABCs, and TACs for 2009, and recommendations for ABCs and overfishing levels (OFLs) for 2010 and 2011. 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 2. 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, 1956-2008.

The sum of the preliminary 2010, 2011 ABCs for target species are 565,501 t (2010), 605,088 t (2011) which are within the FMP-approved optimum yield (OY) of 116,000 - 800,000 t for the Gulf of Alaska. The sum of 2010 and 2011 OFLs are 693,253 t and 742,559 t, respectively. The Team notes that because of halibut bycatch mortality considerations in the high-biomass flatfish fisheries, an overall OY for 2010 will be considerably under this upper limit. For perspective, the sum of the 2009 TACs was 242,727 t, and the sum of the ABCs was 516,055 t.

The following conventions in this SAFE are used:

(1) "Fishing mortality rate" refers to the full-selection *F* (i.e., the rate that applies to fish of fully selected sizes or ages). A full-selection *F* should be interpreted in the context of the selectivity schedule to which it applies.

(2) For consistency and comparability, "exploitable biomass" refers to projected age+ biomass, which is the total biomass of all cohorts greater than or equal to some minimum age. The minimum age varies from species to species and generally corresponds to the age of recruitment listed in the stock assessment. Trawl survey data may be used as a proxy for age+ biomass. The minimum age (or size), and the source of the exploitable biomass values are defined in the summaries. These values of exploitable biomass may differ from listed in the corresponding stock assessments if the technical definition is used (which requires multiplying biomass at age by selectivity at age and summing over all ages). In those models assuming knife-edge recruitment, age+ biomass and the technical definitions of exploitable biomass are equivalent.

(3) The values listed as 2008 and 2009 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 2010 and 2011 correspond to the Plan Team recommendations.

(4) The exploitable biomass for 2008 and 2009 that are reported in the following summaries were estimated by the assessments in those years. Comparisons of the projected 2010 biomass with

previous years' levels should be made with biomass levels from the revised hindcast reported in each assessment.

(5) The values used for 2010 and 2011 were either rolled over (typically for Tiers 4-6) or based on projections. Note that projection values often assume catches and hence their values are likely to change (as are the Tiers 4-6 numbers when new data become available).

Two year OFL and ABC Determinations

Amendment 48/48 to the GOA and BSAI Groundfish FMPs, implemented in 2005, made two significant changes with respect to the stock assessment process. First, annual assessments are no longer required for rockfishes, flatfish, and Atka mackerel since new data during years when no groundfish surveys are conducted are limited. For example, since 2008 was an off-year for the NMFS GOA groundfish trawl survey, only summaries for these species were produced.

The second significant change is that the proposed and final specifications are to be specified for a period of up to two years. This requires providing ABC and OFL levels for 2010 and 2011 (Table 1). In the case of stocks managed under Tier 3, 2010 and 2011 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.

In 2009 (a survey year), the 2010 and 2011 projections for stocks managed under Tiers 4-5 will incorporate the latest survey data. In off years (even years) in the case of stocks managed under Tiers 4-6, projections are set equal to the Plan Team's recommended values for the last full assessment presented.

The 2011 ABC and OFL values recommended in next year's SAFE report are likely to differ from this year's projections for 2011, for the same reasons that the 2010 projections in this SAFE report differ from the projected values from last year's SAFE report.

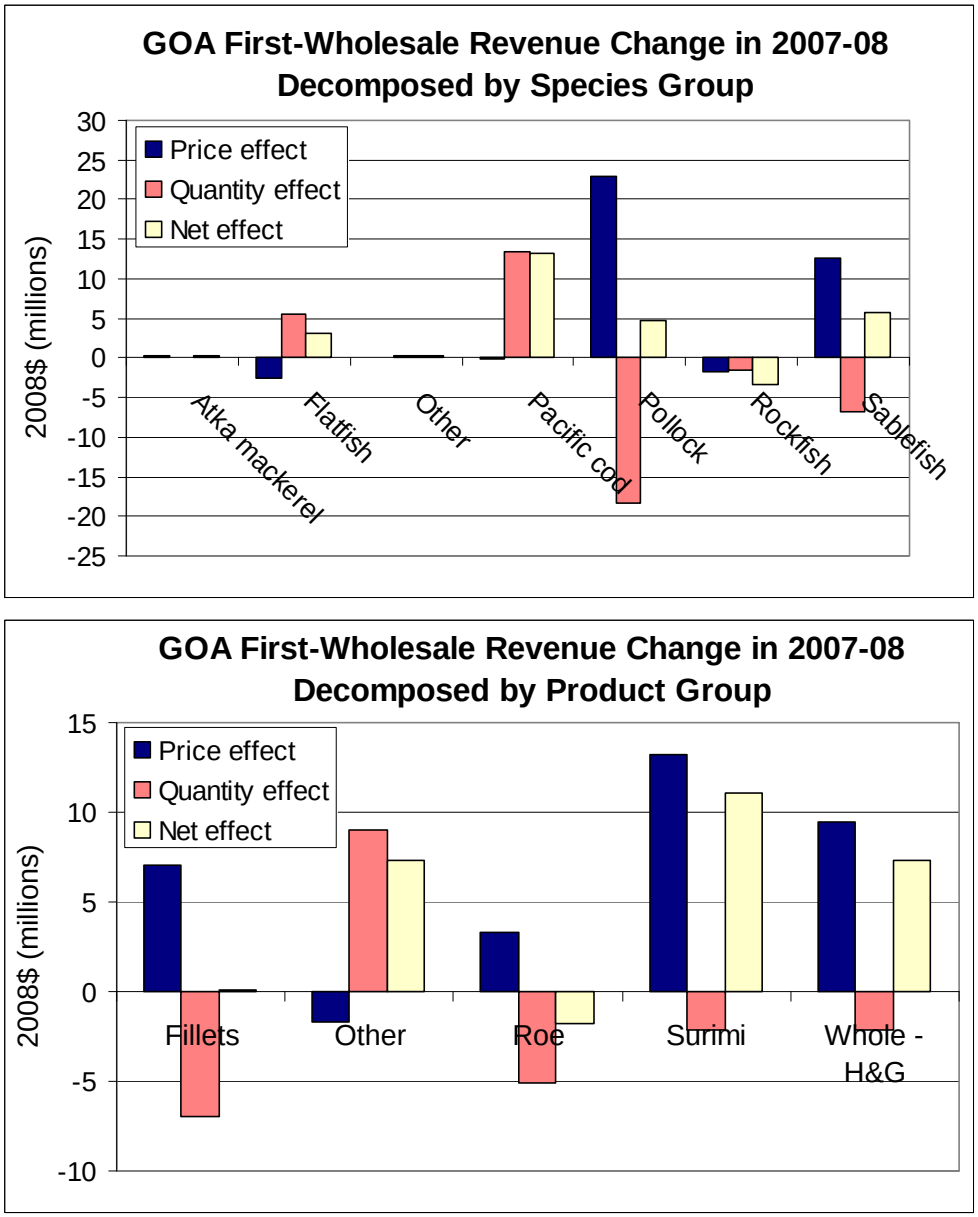
Economic Summary of the GOA Commercial Groundfish Fisheries in 2007-08

According to data taken from the 2009 Economics SAFE report, first-wholesale revenues from the processing and production of Alaska groundfish in the Gulf of Alaska (GOA) rose from $313.7 million in 2007 to $337.7 million in 2008, a difference of $24.0 million. During that same time-period, the total quantity of groundfish products from the GOA decreased from 85.1 thousand metric tons to 84.4 thousand metric tons, a difference of 634.0 metric tons. In general, a decrease in production can be accompanied by an increase in revenues if (i) prices increase, for example, as a demand-side response to the decrease in production, or (ii) the pattern of production changes to favor higher-valued species or products. This section reports on the change in groundfish revenues in 2007-08, across species and products, to identify where the largest changes, both positive and negative, occurred. Further details of the analysis are included in Appendix 5 to this SAFE report.

By species, decreases in the Total Allowable Catch (TAC) in 2007-08 for pollock dominate the results of the first-wholesale revenue decomposition with negative quantity effects in the GOA (i.e., from 63.8 thousand tons to 53.6 thousand tons). However, the positive price effects for GOA pollock were more than strong enough to compensate for the negative quantity effects. The net effect was $4.7 million for GOA pollock. In addition, the GOA experienced a substantial positive quantity effect for Pacific cod that raised revenues there by $13.2 million. The GOA also experienced a negative quantity effect for sablefish which was more than compensated by the corresponding price effect, and the net result for GOA sablefish raised groundfish revenues on the whole by $5.7 million. Flatfish revenues experienced positive quantity effects and negative price effects in the GOA, which are (like pollock) consistent with the law of demand in economics. By product group, negative quantity effects on pollock in the GOA are roughly similar for fillets and roe, and somewhat less for surimi. The negative quantity effect for each of these pollock product groups is accompanied by a positive price effect. The price and quantity effects for fillets and roe are largely offsetting in the GOA.

The decrease in the GOA pollock TAC in 2008 contributed to a global whitefish shortage in that year, which along with competition for fillet products, put pressure on surimi markets that responded by roughly doubling the market price. This textbook economic response in surimi markets produced a very strong positive price effect for the GOA in 2007-08 with a positive net effect of $11.0 million. In addition, a positive quantity effect for Pacific cod in the GOA was associated with a negligible price effect, giving a positive net effect of $13.2 million. The negative quantity effect for sablefish in the GOA was accompanied by a relatively strong price effect that implied a positive net effect of $5.7 million. The quantity effect for the whole head & gut group is negative in the GOA, but the associated price effect is positive and strong, almost as strong as the price effect for surimi, leading to a positive net effect of $7.3 million.

Overall, the GOA had negative quantity and positive price effects in the decomposition of the 2007-08 change in first-wholesale revenues. To summarize, the positive net effects were $24.0 million for the GOA, which implies that 12.9% of the total increase of $186.5 million in Alaska groundfish first-wholesale revenues in 2007-08 is attributable to the GOA.



Decomposition of the change in first-wholesale revenues from 2007-08 in the GOA area. The first decomposition is by the species groups used in the Economics SAFE report, and the second decomposition is by product group. The price effect refers to the change in revenues due to the change in the first-wholesale price index (2008 dollars per metric ton) for each group. The quantity effect refers to the change in revenues due to the change in production (in tons) for each group. The net effect is the sum of price and quantity effects.

Ecosystem Considerations-Gulf of Alaska

A summary of the ecosystem considerations chapter highlighting recent GOA trends is provided below. The explicit incorporation of ecosystem assessment data and modeling results in specific stock assessment chapters is also summarized. Additional information is available in individual stock assessment chapters and the ecosystem considerations chapter.

The ecosystem considerations chapter consists of three sections: ecosystem assessment, ecosystem status indicators, and ecosystem-based management indices and information. The ecosystem assessment section,

introduced in 2003, combines information from the stock assessment chapters with the two other sections of this chapter to summarize the climate and fishery effects.

New trends highlighted in the 2009 ecosystem considerations chapter include:

- Physical conditions: La Nina prevailed in winter 2008-09, shifting to El Nino in winter 2009-10. In spring 2009, the eddy kinetic energy in the GOA was estimated to be lower than average, reducing cross shelf transport. Conditions east of the Alaska Peninsula were less stormy with more transport through shallow Aleutian passes. A weak and broad Alaska Current in Southeast Alaska led to shallow mixed layer depths along the continental shelf.
- A new evaluation of GOA bottom trawl survey temperatures-at-depth for 2007 and 2009 indicated a reversed a pattern of surface warming compared to surveys from 1993-2005. In the two recent surveys the surface temperature cooled markedly and there was a distinct temperature inversion at the 100 m depth contour with cooler water above warmer water at depth. The pattern was observed throughout the GOA on both surveys but not in earlier years.
- Mesozooplankton abundance peaked relatively late and persisted longer than average in 2008, a cold year.
- Central and Eastern GOA eulachon appear to have increased in recent years. Southeast Alaska herring are increasing, with 2005 and 2008 estimated to have the highest spawning biomass in 25 years, and some indications of older spawning fish.
- ADFG trawl surveys were still flatfish dominated but with a decrease in total biomass in 2007-08, mostly due to a decline in flathead sole and arrowtooth flounder. Mean distributions of rockfish were farther north and east and more contracted in 2007 relative to prior years, suggesting a recent shift.
- Steller sea lion non-pup trends were slightly up in the eastern GOA, flat in the central GOA, and slightly up in the western GOA.
- Guild analysis combining 2009 stock assessments and surveys in an ecosystem model shows high current biomass for apex predators and benthic foragers, and an increasing trend for benthic foragers. The apex predator guild is driven by high biomass of arrowtooth flounder, while the benthic forager guild is driven by an increase in flathead sole, rex sole and skates. In contrast, pelagic foragers recent mean biomass is low, driven by the decline in pollock. GOA shrimp are above long term mean biomass, due to a long term trend which agrees with trawl survey results.
- Catch of apex predators and benthic foragers shows increasing trends in recent years, with similar increases in exploitation rates for these guilds. Catch and exploitation rates for pelagic foragers and motile epifauna remain near long term mean levels.
- GOA total catch remained close to the long term mean in 2008. Bottom trawl effort trended up from its 2005 low, pelagic trawl effort trended down, while longline and pot effort showed no clear recent trends. Discards have increased in the GOA from a low point in 2005, but remain below the long term mean. The number of vessels fishing in Alaska has been declining but stabilized in 2008.

Trends in common between stock assessments:

Both GOA pollock and Pacific cod showed increases in 2009 bottom trawl survey biomass which were difficult to reconcile with size and age data within stock assessment models. 2009 size and age compositions indicated a full set of age groups comprised the increased biomass, not a single new strong year class. An increase in the availability of both species to the survey might explain this pattern, perhaps due to environmental factors. Gulf of Alaska rockfish also showed a synchronous pattern of reduced sampling error compared to other years indicating a possible shift in distribution/availability.

Ecosystem considerations for individual species:

Seven stock assessments incorporated information from the GOA ECOPATH model (Aydin et al. 2007): walleye pollock, thornyhead rockfish, and skates have since 2005, and in 2007 rex sole, flathead sole, Dover sole, and arrowtooth flounder assessments incorporated model results whereas the sablefish section

summarized diet data. Rockfish assessments included recent updates to habitat descriptions provided for the EFH EIS update.

The pollock assessment evaluated the impacts of perturbation in pollock abundance and pollock fishery on other species in the Gulf of Alaska ecosystem. In general, pollock abundance is positively correlated to abundances of Steller sea lions, arrowtooth flounder, halibut, and Pacific cod. Although arrowtooth flounder is responsible for more than one third of pollock mortality, this positive relationship between arrowtooth and pollock is not as strong as that between Steller sea lions and pollock. It was noted that Steller sea lion abundance is negatively correlated to arrowtooth flounder and halibut.

The following table summarizes the ecosystem considerations data documented within each species or complex assessment. Data were assessed as being "briefly" described, "evaluated" with an ecosystem indicators table, and/or quantified using a "model" to describe trophic interactions and environmental interactions. The abbreviation, "spp. comp", is used to indicate that bycatch levels by species were reported.

	Ecosystem Effects on Stock						**Fishery Effects on Ecosystem**					
	Prey		**Predator**		**Abiota**		**Bycatch**		**Discard**		**Abiota**	
Species/Assemblage	Desc.	Quant.	Desc.	Quant.	Desc.	Quant.	Desc.	Quant.	Desc.	Quant.	Desc.	Quant.
Walleye pollock		model		model				spp comp		model		
Pacific cod												
Sablefish	eval.	model	eval.		briefly		eval.	spp comp	eval.		briefly	
Deep water flatfish complex		model		model			eval.	spp comp	eval			
Shallow water flatfish complex	briefly						briefly		briefly			
Rex sole		model		model			eval	spp comp	eval			
Arrowtooth flounder		model		model			briefly		briefly			
Flathead sole		model		model			eval	spp comp	eval			
Pacific ocean perch	briefly		briefly		briefly		eval.	spp comp	eval.		briefly	
Northern rockfish	briefly		briefly				eval.	spp comp	eval.		briefly	
Shortraker and Other slope	eval.		eval.				eval.	spp comp	eval.		briefly	
Rougheye rockfish	eval.		eval.		briefly		eval.	spp comp	eval.		briefly	
Pelagic shelf rockfish	eval.		eval.		briefly		eval.	spp comp	eval.		briefly	
Dermersal shelf rockfish	briefly		briefly				eval.		eval.			
Thornyhead rockfish		model		model	briefly		eval.		eval.		briefly	
Atka mackerel	eval.		eval.		eval.		eval.		eval.		briefly	
Skates	eval.	model		model	briefly		eval.		eval.		briefly	
Forage fish	model		model									

Stock status summaries

1. Walleye Pollock

Status and catch specifications (t) of pollock and projections for 2010 and 2011. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2010 and 2011 are those recommended by the Plan Team. Catch data are current through November 7th 2009. Note that the projections for 2011 are subject to change in 2010. The 2010 and 2011 ABCs have been reduced by 1,650 t to accommodate the anticipated Prince William Sound GHL.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
GOA	2008	741,819	83,150	60,180	60,180	51,721
	2009	675,749	69,630	49,900	49,900	42,297
	2010	797,638	115,536	84,745		
	2011		147,336	109,105		
W/C/WYK	2008	705,020	72,110	51,940	51,940	51,721
	2009	638,950	58,590	41,620	41,620	42,297
	2010	756,550	103,210	75,500		
	2011		135,010	99,860		
EYK/SEO	2008	36,799	11,040	8,240	8,240	0
	2009	36,799	11,040	8,280	8,280	0
	2010	41,088	12,326	9,245		
	2011		12,326	9,245		

Changes from previous assessment

The age-structured model developed using AD Model Builder and used for GOA W/C/WYK pollock assessments in 1999-2008 is fundamentally unchanged. This year's pollock chapter features the following new data: (1) 2008 total catch and catch at age from the fishery, (2) 2009 biomass and age composition from the Shelikof Strait EIT survey, (3) 2009 biomass and length composition from the NMFS bottom trawl survey, and (4) 2009 biomass and length composition and 2008 age composition from the ADF&G crab/groundfish trawl survey. Model fits to fishery age composition data were good in most years. The fit of Shelikof Strait EIT survey age composition show large residuals at age 2 and age 3 in 2006-2009 due to inconsistencies between the initial estimates of abundance and subsequent information about the magnitude of these year classes. General trends in survey time series fit reasonably well and model fits to survey biomass estimates were similar to previous assessments. The model was unable to fit all the 2009 survey estimates simultaneously. Both the NMFS bottom trawl survey and the ADF&G surveys showed large increases in biomass in 2009, while the Shelikof Strait EIT showed only a slight increase and remains close to historically low levels. For a pollock population to increase by the amount indicated by the NMFS bottom trawl survey, recruitment to the population would have to have been very large, yet available information (including the length information from the NFMS and the ADF&G surveys) does not support recruitment of this magnitude.

Spawning biomass and stock status trends

The 2009 biomass estimate of Shelikof Strait fish ≥43 cm (a proxy for spawning biomass) increased by 60% from the 2007 estimate, apparently due to above average recruitment to the spawning population. Additional EIT surveys in winter 2009 covered the Shumagin Islands spawning area, Sanak Gully, Chirikof, and Marmot Bay. In comparison to 2008, biomass estimates were higher with the exception of Chirikof, where very few pollock were found. An exploratory survey along the shelf break from Sanak

Island west to Unimak Island did not detect significant quantities of pollock. The 2009 ADF&G crab/groundfish survey biomass estimate increased 43% from 2008.

The initial estimate 2007 year class is 1.7 times average recruitment, and was abundant in both Shumagin area and Shelikof Strait in the 2008 EIT surveys. Initial estimates of year-class strength are highly uncertain, and there have been several instances recently when an initial estimate of year class size decreased as more information accumulated.

The Plan Team concurred with the author's choice to use the same model as last year with three elements to make it more precautionary. This model fixed the NMFS bottom trawl survey catchability (q) at 1.0, applied a more conservative harvest rate than the maximum permissible F_{ABC} and set the 2007 year class equal to the average. These conservative elements reduce the recommended ABC to approximately 50% of the model point estimate. However, they seem warranted given the above average estimate of the 2007 year class, inconsistencies in the 2009 survey data, and the continued low spawning biomass in Shelikof Strait and other spawning areas.

The model results produced an estimated 2010 spawning biomass of 184,567 t, or 30% of unfished spawning biomass. The $B_{40\%}$ estimate is 248,000 t. This represents a 4% increase from the 2008 assessment, and reflects both the increase in mean weight at age during spawning and a decrease in average recruitment. Estimates of 2009 stock status indicate that spawning biomass remains low.

Status determination

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

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Because model estimated 2010 female spawning biomass is below $B_{40\%}$, the W/C/WYK Gulf of Alaska pollock are in Tier 3b. The Plan Team accepted the author's recommendation to reduce F_{ABC} from the maximum permissible using the "constant buffer" approach (first accepted in the 2001 GOA pollock assessment) and using an average value for the 2007 year class (the estimate was 70% above average). The projected 2010 age-3+ biomass estimate is 756,550 t (for the W/C/WYK areas). Markov Chain Monte Carlo analysis indicated the probability of the stock being below $B_{20\%}$ will be negligible in all years. Therefore, the ABC for 2010 based on this precautionary model configuration, adjusted harvest control rule, and average 2007 year class is 77,150 t (F_{ABC} = 0.14) for GOA waters west of 140°W longitude. **The ABC is 75,500 for 2010** (reduced by 1,650 t to account for the Prince William Sound GHL). The 2010 OFL under Tier 3b is 103,210 t (F_{OFL}= 0.19).

Southeast Alaska pollock are in Tier 5 and the ABC and OFL recommendations are based on natural mortality (0.30) and the biomass from the 2009 survey. The biomass from the 2009 NMFS bottom trawl survey increased to 41,088 t. This results in a **2010 ABC of 9,245 t**, and a **2010 OFL of 12,326 t**.

Additional Plan Team Recommendations

The Team received a presentation on the FOCI report to assist in evaluating the magnitude of the 2009 year class of pollock in the GOA. This year most of the indices indicated the year class to be "average." The Team appreciated the detailed explanation of the approach and this helped with interpretation of their results.

After some discussion, the Team felt that the direct observations of pre-recruit pollock have more influence on projection specifications than those derived from indirect observations (e.g., via covariates). For example, juveniles observed in the winter surveys generally provide more reliable estimates of subsequent year-classes. The Team requests that clearer scenarios on the application of the FOCI prediction for actual management be developed since the applicability to near-term management

questions appear to be limited. Perhaps FOCI resources would be better applied to predicting medium-term productivity changes that can be applied to pollock and other species.

The Team requests that the SSC provide feedback on this issue.

Ecosystem Considerations

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

Area apportionment

The assessment was updated to include the most recent data available for area apportionments within each season (Appendix C of the GOA pollock chapter). The assessment accounted for results of vessel comparison experiments conducted between the *R/V Miller Freeman* and the *R/V Oscar Dyson* in Shelikof Strait in 2007 and in the Shumagin/Sanak area in 2008 which found significant differences in the OD/MF ratio. The estimated ratio for the Shelikof Strait was 1.132, while the ratio for the Shumagin and Sanak areas (taken together) was 1.31. When calculating the distribution of biomass by area, multipliers were applied to surveys conducted by the *R/V Miller Freeman* to make them comparable to the *R/V Oscar Dyson*. Adding the vessel comparison to the apportionment analysis is a transitional step until all recent surveys are done by the *R/V Oscar Dyson*. The Team concurred with these updates since they are more likely to represent the current distribution. Area apportionments, reduced by 1,650 t for the State of Alaska managed pollock fishery in Prince William Sound, are tabulated below:

Area apportionments (reduced by 1,650 t) for 2010 and 2011 pollock ABCs for the Gulf of Alaska (t).

Year	610	620	630	640	650	
	W	Central	Central	W. Yakutat	E.Yak/SE	Total
2010	26,256	28,095	19,118	2,031	9,245	84,745
2011	34,728	37,159	25,287	2,686	9,245	109,105

2. Pacific cod

Status and catch specifications (t) of Pacific cod and projections for 2010 and 2011. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch includes the federally reported catch (Federal and parallel state fisheries catch; excluding state waters only fishery inside 3-miles) and is current through November 7th 2009.

Area	Year	Biomass	OFL	ABC	TAC	Catch
GOA	2008	*233,310**	88,660	66,493	50,269	43,481
	2009	520,000	66,600	55,300	41,807	38,401
	2010	701,200	94,100	79,100		
	2011		116,700	97,900		

*the 2008 biomass is the trawl survey biomass from 2007

Changes from previous assessments

Ten models were included in the GOA Pacific cod assessment which addresses many of the comments and requests from the Plan Teams, SSC, and the public. The models were divided into three groups. The first group contained four models, each of which used the analytical model accepted for GOA Pacific cod in 2008 but differed in the data applied to the model. Each of the four models in this group drastically

downweighted the age composition data, and in one case removed it entirely. A second group contained three models that included the age composition data and included features such as cohort-specific growth and attempted to correct for potential bias in age readings. A final group of models contained a set of three models which omitted age composition data but were otherwise identical to the models in the second group.

The authors' criteria for selecting the final model considered: 1) the inclusion of age composition data (which has been consistently been requested by the Plan Team and SSC); 2) the response to requests such as the correction of age reading bias and cohort-specific growth; and 3) the best statistical fit to the data. Based on these criteria, the model with the best statistical fit from the second group (model "B1") was chosen as the preferred model. This model included mean length at age values as input data to the model, and estimates the standard deviation of length at age for the maximum and minimum ages outside the model (the modeling software only allows a linear relationship between the maximum and minimum ages). The model provided several improvements to the 2008 model, notably in the improvement of the fit to the survey abundance.

The authors' procedure to correct for the perceived age reading bias was to use a constant bias (across ages) that gave the best model fit; thus, the age reading bias was estimated within the model. It was unclear that the age reading bias was truly constant across ages, or if this bias could have been reasonably estimated within the model. By simultaneously estimating this bias with all other model parameters, it may have been that the age bias matrix affected related parameters in complex ways. Thus, any improvement in model fit may result not simply from correcting an age reading bias, but also from other features of the model fit that are difficult to interpret. A more straightforward method of estimating age reading bias would be to obtain age readings of known age fish. We recommend continued research on age validation and on age-determination errors and potential biases.

All of the GOA models presented used age information in some manner, either in the age composition data or in the length at age data. Thus, although there may be concerns about the quality of the age readings, a model that is truly free of age readings is not presently available. The Plan Team was concerned about the ad-hoc procedure used to account for age reading bias but accept it as a reasonable short-term measure until data becomes available to estimate the bias more reliably (i.e., outside the model).

Spawning biomass and stock status trends

Model B1 results produced an estimated 2010 spawning biomass of 117,600 t, or 40% of unfished spawning biomass. The $B_{40\%}$ estimate was 116,600 t. The estimated stock biomass increased relative to the 2008 assessment, due in part to a large biomass estimate in the 2009 GOA trawl survey. Spawning biomass was projected to increase dramatically in subsequent years due to a number of young year classes in the population.

Status determination

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

Tier Determination/Plan Team discussion and resulting ABCs and OFLs

The Plan Team accepts the author's preferred model and therefore recommends Tier 3 for this stock. The model estimate of 2010 spawning biomass exceeds $B_{40\%}$, thus Gulf of Alaska Pacific cod are in Tier 3a. Note that this is a change from the 2008 assessment, when Pacific cod were classified in Tier 3b. The Plan Team accepted the author's recommendation to use the maximum permissible F value from Tier 3a. The projected 2010 age-0+ biomass estimate is 738,300 t. The probability of the stock being below $B_{20\%}$ was estimated to be less than 1% in 2010 and subsequent years. **Therefore, the ABC for 2010 is 79,100 t (**F_{ABC} =0.49). **The 2010 OFL under Tier 3a is 94,100 t** (F_{OFL} = 0.60).

Additional Plan Team recommendations

The GOA Plan Team recommends conducting a truly age-free model with cohort-specific growth in order to see if reasonable fits can be obtained without age data.

There were concerns over the number of model runs that were presented and technical issues that appear to be related to the software and data complexity. The Team appreciated the efforts but hope that some distillation of models can be made in the future to facilitate model evaluations. Specific model recommendations are contained in the Plan Team minutes.

Ecosystem considerations

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

Area apportionment

Consistent with previous years, apportionment of the 2010 and 2011 ABCs is based on the average of the biomass distribution in the three most recent surveys. Relative to apportionments by area in 2009, the western Gulf declined by 4%, the central Gulf increased by 4% and the Eastern Gulf remained the same. The 2010-2011 ABC apportionments are the following:

Apportionment		2010	2011
West	35%	27,685	34,265
Central	62%	49,042	60,698
East	3%	2,373	2,937
Total		79,100	97,900

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 2010 and 2011 are those recommended by the Plan Team. Catch data are current through 11/07/2009.

Area	Year	Age 4+ Biomass	OFL	ABC	TAC	Catch
GOA	2008	167,000	15,040	12,730	12,730	12,329
	2009	149,000	13,190	11,160	11,160	10,698
	2010	140,000	12,270	10,370		
	2011		11,008	9,300		

Changes from previous assessment

As in previous assessments, sablefish are treated as a single Alaska-wide stock covering the BSAI and GOA using a split sex age structured model. The split sex model approach was fully implemented beginning in 2006 and was deemed appropriate given differences in growth between males and females. The assessment model incorporates the following new data: relative abundance and length data from the 2009 longline survey, relative abundance and length data from the 2008 longline and trawl fisheries, and age data from the 2008 longline survey and longline fishery. Additionally a NMFS GOA trawl survey was conducted in 2009 and the biomass estimate from that survey and associated lengths were also added. No model changes were made for 2010. A CIE review was conducted in 2009 and those recommendations and the author's responses are included in the assessment's Appendix.

Spawning biomass and stock status trends

The survey abundance index increased 2% from 2008 to 2009, following a 16% decrease from 2006 to 2008. Similar to last year the fishery abundance index was up 5% from 2007 to 2008 (2009 data not yet

available). The spawning biomass is projected to be lower from 2010 to 2012, and then stabilize. The GOA 2009 trawl survey estimate fell 2% from 2007 and is now the lowest since 1999. The projected 2010 spawning biomass is 35% of unfished biomass compared with about 29% of unfished biomass estimated during the 1998 to 2001 period. The 2000 year class appears to be larger than the 1997 year class, and is now 92% mature. The spawning stock is estimated to be primarily comprised of two strong year-classes (2000 and 1997) which may be a cause for concern for this relatively long-lived species.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The accepted model and projections indicate that this stock qualifies for management under Tier 3b. The updated point estimate of $B_{40\%}$ is 112,726 t (**combined across the EBS, AI, and GOA**) . Projected spawning biomass (combined areas) for 2010 is 99,897 t (89% of $B_{40\%}$), placing sablefish in Tier 3b.

The maximum permissible value of F_{ABC} under Tier 3b is 0.084, resulting in a 2010 GOA ABC of 10,370 t. The recommended 2010 ABC is 7% lower than the 2009 ABC of 11,160 t. The OFL fishing mortality rate under Tier 3b is 0.100 resulting in a GOA OFL of 12,270 t.

The Teams were apprised of upcoming meetings with industry to discuss changes to this assessment model anticipated to be addressed in advance of the September 2010 Plan Team meeting.

Status determination

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

Additional Plan Team recommendations

During the joint team meeting there was discussion about the use of IPHC survey data as a separate indicator of stock relative abundance. The Teams agreed that this was useful and a recommendation was made to the author to make a request to the IPHC for the collection of length and weight data from incidentally caught sablefish from that survey.

There is continued concern regarding sperm whale interactions and the likelihood that the population of sperm whales has increased. It was noted that a sperm whale assessment is still unavailable hence potential biological removals (PBR) are undefined. The Team encourages AFSC to pursue funding for research on sperm whales and fishery/survey interactions.

Ecosystem Considerations

The ecosystem considerations section of the assessment was updated with preliminary results of first-order trophic interactions for sablefish from the ECOPATH model. Results from sampling in 2005 are presented in the document and updated information on prey of sablefish is provided.

Area apportionment

A 5-year exponential weighting of longline survey and fishery relative abundance indices (the survey index is weighted double the fishery index) may be used to apportion the combined 2010 ABC among regions, resulting in the following values: 2,790 t for EBS, 2,070 t for AI, and 10,370 t for GOA. Relative to 2009, apportionments to the EBS increased by 3 %, while AI and GOA decreased 6% and 7% respectively.

Using the survey/fishery based apportionment scheme described above, the 2010 OFL is apportioned among regions and results in the following values: 3,310 t for EBS, 2,450 t for AI, and 12,270 t for GOA. These values represent a decrease from 2009 OFL levels for the AI and GOA and a slight increase for the EBS.

GOA area apportionments of sablefish ABC's for 2010 and 2011 (includes allocation of 5% of combined EGOA ABC to West Yakutat)

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2010	1,660	4,510	1,480	2,720	10,370
2011	1,488	4,042	1,450	2,320	9,300

4. Shallow water flatfish

Status and catch specifications (t) of shallow water flatfish and projections for 2010 and 2011. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/07/2009.

Year	Biomass	OFL	ABC	TAC	Catch
2008	436,591	74,364	60,989	19,972	9,708
2009	436,590	74,364	60,989	19,972	8,292
2010	398,961	67,768	56,242	-	-
2011	-	67,768	56,242	-	-

Changes from previous assessment

The shallow water flatfish complex is made up of northern rock sole, southern rock sole, yellowfin sole, butter sole, starry flounder, English sole, sand sole, Alaska plaice and other minor species. New data for the shallow water flatfish complex from the 2009 assessment included final total catch from 2008, current catch for 2009 and the 2009 NMFS bottom-trawl survey biomass estimates.

Spawning biomass and stock status trends

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

Tier determination/Plan Team discussion resulting ABCs and OFLs and future plans

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

The ABC and OFL for 2010 and 2011 shallow-water flatfish are lower than the 2008 and 2009. The GOA Plan Team agrees with authors recommended ABC for the shallow water flatfish complex which was equivalent to maximum permissible ABC.

Status determination

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

Ecosystem Considerations summary

Flatfish consume a variety of benthic organisms. Fish prey make up a large part of the diet of rock sole adults and possibly sand sole (although the sample size was small for sand sole). Other flatfishes consume mostly polychaetes, crustaceans and mollusks.

Area apportionment

Area apportionments of shallow water flatfish ABC's (using $F_{40\%} = F_{ABC}$) for 2010 and 2011 are based on the fraction of the 2009 survey biomass in each area:

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2010	23,681	29,999	1,228	1,334	56,242
2011	23,681	29,999	1,228	1,334	56,242

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

Status and catch specifications (t) of deep water flatfish (*Dover sole and others*) and projections for 2010 and 2011. Biomass for each year corresponds to the estimate given when the ABC was determined. Catch data in this table are current through 11/07/2009

Year	Biomass	OFL	ABC	TAC	Catch
2008	132,625	11,343	8,903	8,903	563
2009	133,025	11,578	9,168	9,168	442
2010	89,682	7,680	6,190		
2011		7,847	6,325		

Changes from previous assessment

The deep water flatfish complex is comprised of Dover sole, Greenland turbot, and deep sea sole. Catch and trawl survey biomass data for Greenland turbot and deepsea sole are updated for 2009. For Dover sole, the assessment model presented in 2007 is updated with 2008 and 2009 fishery catch and size compositions, 2009 trawl survey biomass, and 1987 and 2007 trawl survey age compositions. Six alternative model configurations exploring selectivity parameterizations are presented, but none outperform the base model.

Spawning biomass and stock status trends

An age-structured model is used to determine stock status for Dover sole. Dover sole female spawning biomass was relatively flat until 1991 and then declined until 2006. Spawning biomass has been unchanged since 2006.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Dover Sole are in Tier 3a while 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 2010 and 2011 ABC and OFLs.

For the Dover sole Tier 3a assessment the 2010 ABC using $F_{40\%}$=0.119 is 6,007 and 6,142 t for 2011. The 2010 OFL using $F_{35\%}$=0.149 is 7,436 t and 7,603 t for the 2011 OFL..

The GOA Plan Team agrees with the authors' recommended 2010 and 2011 ABC's and OFL's for the deep water flatfish complex, which are equivalent to the maximum permissible ABC.

The stock assessment author noted that the 2008 catch of deepsea sole (8 t) exceeded the average catch of deepsea sole for 1978-1995 (6 t). The Plan Team discussed whether biomass data were reliable for application of Tier 5 assessment methods to deepsea sole and Greenland turbot, and requested that the authors include survey CV and M estimates for all species in the complex in the next assessment.

Specific recommendations regarding fishery selectivity in the Dover sole model are contained in the Plan Team minutes.

Status determination

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

Ecosystem Considerations summary

There were no updates to the ecosystem considerations section of the assessment.

Area apportionment

Area apportionments of deep water flatfish (*excluding Dover sole*) are based on proportions of historical catch. Area apportionments of Dover sole (using $F_{40\%}$) are based on the fraction of the 2009 survey biomass in each area.

Area apportionments of deep water flatfish (*Dover sole and others*) ABC's for 2010 and 2011 (using $F_{40\%}$) are based on the fraction of the 2009 survey biomass in each area.

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2010	521	2,865	2,044	760	6,190
2011	530	2,928	2,089	778	6,325

6. Rex Sole

Status and catch specifications (t) of rex sole and projections for 2010 and 2011. Catch data are current through 11/07/2009.

Year	Adult Biomass	OFL	ABC*	TAC	Catch
2008	82,801	11,933	9,132	9,132	2,703
2009	81,572	11,756	8,996	8,996	4,505
2010	88,221	12,714	9,729		
2011		12,534	9,592		

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

Changes from previous assessment

An age-structured model for rex sole was first presented in 2004. The authors explored different model forms of sex-specific scaling of selectivity. The authors' and Team's preferred model was the same as the base model used in 2007. The assessment was updated as follows:

1. The fishery catch and length compositions for 2008 and 2009 (through Sept. 26, 2009) were incorporated in the model.
2. The 2007 fishery catch and length compositions were updated.
3. The 2009 GOA groundfish survey biomass estimate and length composition data were added to the model.. Survey biomass estimates and length compositions were recalculated for all survey years.
4. Four years (2001, 2003, 2005, 2007) of survey age compositions were added to the model. Based on the advice of AFSC's Age and Growth staff, the survey age composition for one year (1990) was removed from consideration because the underlying ages were probably underestimated due to the technique (surface age reading) used.

Spawning biomass and stock status trends

Survey biomass increased from 103,776 t in 2007 to 124,744 t in 2009. The assessment model indicates that adult biomass, spawning biomass, 3+biomass, and total biomass had been increasing since 2000 but projects that age 3+ biomass and female spawning biomass will decrease slightly from 2010 to 2011.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Beginning 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 resulted in a 2009 ABC of 8,966 t. In this year's assessment the authors provided a Tier 3a calculation using the female maturity as fishery selectivity as suggested by the SSC. If the $F_{40\%}$ (= 0.223) resulting from this approach were applied the ABC would be 16,756 t and OFL would be 20,207 t. However, the Plan Team determined that $F_{40\%}$ was unreliably estimated and therefore rex sole qualifies for Tier 5 approach. The Team chose to continue using the model's estimate of adult biomass applied to Tier 5. This resulted in a 2010 ABC of 9,729 t and an OFL of 12,714 t, which are 8% greater than their 2009 values. Using the model's projection of 86,974 t adult biomass for 2011 results in an ABC of 9,592 t and an OFL of 12,534 t.

The Team recommended the author consider obtaining fishery age composition data for input into the model.

Status determination

Information is insufficient to determine stock status relative to overfished criteria. Catches of rex sole are well below TACs and below levels where overfishing would be a concern.

Ecosystem Considerations summary

Rex sole are benthic feeders and little is known about prey species abundance trends. Major predators are longnose skates and arrowtooth flounder. Prohibited species such as halibut, salmon, and crab are taken to some extent in the rex sole-directed fishery. In 2009 (through September), the overall prohibited species catch (PSC) for halibut was 384 t—more than double that of the 2008 catch of 173 t and the largest since 2003.

Area apportionment

Area apportionments of rex sole ABC's (using $F_{40\%}$) for 2010 and 2011 are based on the fraction of the 2009 survey biomass in each area.

	Western	Central	West Yakutat	East Yakutat/SE	Total
2010	1,543	6,403	883	900	9,729
2011	1,521	6,312	871	888	9,592

7. Arrowtooth flounder

Status and catch specifications (t) of arrowtooth flounder in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2010 and 2011 are those recommended by the Plan Team. Catch data are current through 11/07/2009.

Area	Year	Age 3+ Biomass	OFL	ABC	TAC	Catch
GOA	2008	2,244,870	266,914	226,470	43,000	29,293
	2009	2,155,780	261,022	221,512	43,000	24,438
	2010	2,139,000	254,271	215,882		
	2011		250,559	212,719		

Changes from previous assessment

The 2009 survey biomass and length data, catch for 2008 and 2009, 2007 and 2008 fishery length data were added to the model.

Spawning biomass and stock status trends

The estimated age 3+ biomass from the model increased by an order of magnitude since 1961 and peaked at about 2. 2 million t in 2006. Since then the stock has stabilized. Female spawning biomass in 2009 was estimated at 1,252,550 t, a 4% decline from the projected biomass from the 2007 assessment.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Arrowtooth flounder has been determined to fall under Tier 3a. The 2010 ABC using $F_{40\%}$=0.183 is 215,882 t, which is 5,630 t less than the 2009 ABC. The 2010 OFL using $F_{35\%}$ (0.219) is 254,271 t. The 2011 ABC and OFL were projected by setting 2010 catches equivalent to the average 5 year F (0.0206).

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

Status determination

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

Ecosystem Considerations summary

The ecosystem considerations chapter was updated in the 2007 assessment to include an expanded appendix of trends and model-based information on the role of arrowtooth flounder in the GOA ecosystem. Arrowtooth flounder are important predators affecting the Gulf of Alaska ecosystem.

Area apportionment

Area apportionments of arrowtooth flounder ABCs for 2010 and 2011 are based on the fraction of the 2009 survey biomass in each area.

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2010	34,773	146,407	22,835	11,867	215,882
2011	34,263	144,262	22,501	11,693	212,719

8. Flathead Sole

Status and catch specifications (t) of flathead sole in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2010 and 2011 are those recommended by the Plan Team. Catch data are current through 11/07/2009.

Area	Year	Age 3+ Biomass	OFL	ABC	TAC	Catch
GOA	2008	324,197	55,787	44,735	11,054	3,419
	2009	323,937	57,911	46,464	11,181	3,418
	2010	328,862	59,295	47,422		
	2011		61,601	49,286		

Changes from previous assessment

Two models were presented for this assessment. The base model was an age-structured model that was unchanged from 2007. A new model was presented that estimated selectivity between sexes. The fishery catch and length compositions for 2008 and 2009 were incorporated in the models. The 2007 fishery catch and length compositions were updated. The 2009 GOA groundfish survey biomass estimate and length composition data were added to the model. Survey biomass estimates and length compositions were recalculated for all survey years.

Spawning biomass and stock status trends

Survey biomass decreased from 280,290 t in 2007 to 225,377 t in 2009. Projected female spawning biomass is estimated at 110,387 t for 2010.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Plan Team encouraged the author to continue investigating approaches to model selectivity, but recommended using the authors' base model. The Plan Team disagreed with the authors' choice to use the different scaling of male selectivity relative to females. The mechanisms for the resulting differences between the sex-specific survey and fishery selectivities were unclear. The Plan Team also encouraged the author to investigate length based selectivity and examine age data from the fishery. Flathead sole are determined to be in Tier 3a based on the age-structured model. The Team's preferred model gives a 2010 ABC using $F_{40\%}$ (0.406) of 47,422 t which is 958 t higher than the 2009 ABC. The 2010 OFL using $F_{35\%}$ (0.530) is 59,295 t.

Status determination

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

Ecosystem Considerations summary

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

Area apportionment

Area apportionments of flathead sole ABCs for 2010 and 2011 are based on the fraction of the 2009 survey biomass in each area.

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2010	16,857	27,124	1,990	1,451	47,422
2011	17,520	28,190	2,068	1,508	49,286

Slope Rockfish

Status and catch specifications (t) of slope rockfish management category and projections for 2010 and 2011. Projections are made using authors' estimate of 2009 and 2010 catch. Catch data in table below are current through 11/07/2009.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Pacific ocean perch	2008	317,511	17,807	14,999	14,999	12,400
	2009	318,336	17,940	15,111	15,111	12,980
	2010	334,797	20,243	17,584		
	2011		19,560	16,993		
Northern rockfish	2008	93,391	5,430	4,549	4,549	4,054
	2009	90,557	5,204	4,362	4,362	3,888
	2010	103,300	6,070	5,098		
	2011		5,730	4,808		
Shortraker rockfish	2008	39,905	1,197	898	898	598
	2009	39,905	1,197	898	898	550
	2010	40,626	1,219	914		
	2011		1,219	914		
Rougheye and blackspotted rockfish	2008	46,121	1,548	1,286	1,286	389
	2009	46,385	1,545	1,284	1,284	280
	2010	45,751	1,568	1,302		
	2011		1,581	1,313		
Other slope rockfish	2008	90,283	5,624	4,297	1,730	809
	2009	90,283	5,624	4,297	1,730	879
	2010	76,867	4,881	3,749		
	2011		4,881	3,749		

GOA slope rockfish are on a biennial stock assessment schedule to coincide with new survey data. This year's SAFE chapters consist of updated stock assessments. Area apportionments for rockfish ABC are based on a weighted average of the percent exploitable biomass distribution for each area in the three most recent trawl surveys (2005, 2007, and 2009). Each successive survey is given a progressively heavier weighting using factors of 4, 6, and 9, respectively. For all rockfish stocks with the exception of Pacific Ocean Perch, the OFL is specified Gulfwide. For POP, the OFL is apportioned to individual area by the same weighting scheme used un apportioning the ABC.

Area apportionments of ABC for slope rockfish for 2010.

Species	Western	Central	Eastern	West Yakutat	E Yak./SE	Total
Pacific ocean perch	2,895	10,737	-	2,004	1,948	17,584
Northern rockfish	2,703	2,395	2	-	-	5,100
Rougheye and blackspotted rockfish	80	862	360	-	-	1,302
Shortraker rockfish	134	325	455	-	-	914
Other slope rockfish	212	507	-	273	2,757	3,749

9. Pacific ocean perch

Status and catch specifications (t) of Pacific ocean perch and projections for 2010 and 2011. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. ABC and OFL for 2010 and 2011 are projected using author's estimate of 2009 and 2010 catch. Catch data are current through 11/07/2009.

Year	Biomass[1]	OFL	ABC	TAC	Catch
2008	317,511	17,807	14,999	14,999	12,459
2009	318,336	17,940	15,111	15,111	12,980
2010	334,797	20,243	17,584		
2011		19,560	16,993		

[1]Total biomass from the age-structured model

Changes from previous assessment

Pacific ocean perch are assessed on a biennial schedule to coincide with the timing of survey data. This year a full assessment was presented which included 2009 bottom trawl survey information, 2007 survey age compositions, 2006 and 2008 fishery age compositions, and updated catch estimates for 2008 and 2009. Model changes included an alternative approach to estimating fishery selectivity.

Spawning biomass and stock status trends

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

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Pacific ocean perch are determined to be in Tier 3a. The Plan Team concurred with the authors' recommendation for the change in fishery selectivity, noting that this resulted in better model fits to fishery ages, had fewer parameters, and a more plausible value for survey catchability. The new fishery selectivity affected the $F_{40\%}$ relative to the previous assessment (increased from 0.06 to 0.12). However, this reflected a change in target ages of the fishery rather than a large increase in overall exploitation rate (i.e., the fishing mortality for older ages is less than in previous assessments). The F_{OFL} is set at $F_{35\%}$ (0.142) and gives an OFL of 20,243 t.

The Team accepted the model estimated ABC of 17,584 t. This ABC is a 16% increase from last year's ABC of 15,111 t compared to a 5% increase in age 2+ biomass and 11% increase in spawning biomass relative to the previous assessment. This ABC increase (relative to biomass levels) was attributed to a change in the available age structure of the population.

Status determination

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

Additional Plan Team Recommendations

The Team appreciated the effort to evaluate evidence supporting dome-shaped fishery selectivity. However, the Team requests that the authors investigate age-composition patterns at depth. Also, changes in fleet-specific depth patterns may provide better support for dome-shaped selectivity.

Ecosystem Considerations summary

Some habitat information from the EFH EIS update has been added to the ecosystem considerations section of the assessment.

Area apportionment

Apportionment of the ABCs and OFLs is based on a weighted average of the percent exploitable biomass distribution for each area in the three most recent trawl surveys (2005, 2007, and 2009). Each successive survey is given a progressively heavier weighting using factors of 4, 6, and 9, respectively. The revised apportionment values are: Western area, 16%; Central area, 61%; and Eastern area, 23%. For comparison with 2009 apportionments, the Western decreased by 9%, while the Central increased by 6% and the Eastern increased 3%.

Amendment 41 prohibited trawling in the Eastern area east of 140° W longitude. Since Pacific ocean perch are caught exclusively with trawl gear, there is concern that the entire Eastern area TAC could be taken in the area that remains open to trawling (between 140° and 147° W longitude). Thus, as was done for the last three years, the Team recommends that a separate ABC be set for Pacific ocean perch in WYAK. The ratio of biomass still obtainable in the W. Yakutat area (between 140° W and 147° W) is higher than last year at 0.50. This corresponds to a 2010 ABC of 2,004 t for WYAK. Under this apportionment strategy, very little of the 1,948 t assigned to the remaining Eastern area (East Yakutat/Southeast Outside area) will be harvested.

Area apportionment of 2010-2011 ABC and OFL for POP in the Gulf of Alaska:

Year		Western	Central	Eastern	WYAK	SEO	Total
2010	ABC	2,895	10,737	-	2,004	1,948	17,584
2011		2,797	10,377	-	1,937	1,882	16,993
2010	OFL	3,332	12,361	4,550	-	-	20,243
2011		3,220	11,944	4,396	-	-	19,560

10. Northern Rockfish

Status and catch specifications (t) of northern rockfish and projections for 2010 and 2011. Projections are made using author's best estimate of 2009 and 2010 catch. Catch data in table are current through 11/07/2009

Year	Biomass[1]	OFL	ABC	TAC	Catch
2008	93,391	5,430	4,549	4,549	4,054
2009	90,557	5,204	4,362	4,362	3,888
2010	103,300	6,070	5,100		
2011		5,730	4,810		

[1]Total biomass estimates from the age-structured model.

Changes from previous assessment

A full assessment is presented this year, with updated 2009 trawl survey biomass and 2007 survey age compositions, 2008-2009 fishery catch, and 2007 fishery size compositions. Two model configurations are presented. Model 1 is the 2007 assessment model with updated data, and Model 2 is the same as Model 1 but with standardized year-specific weightings on age and size data likelihoods.

Spawning biomass and stock status trends

Northern rockfish female spawning biomass was estimated to be highest at the beginning of the modeled period prior to the POP fisheries in the early 1960s. Biomass was lowest during the late 1970s and early 1980s, recovered to a recent peak in the early 1990s and has remained steady to slightly decreasing since then.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Plan Team agrees with the authors that Model 2 represents an improvement over Model 1 and therefore uses Model 2 as a basis for ABC and OFL recommendations.

Northern rockfish are determined to be in Tier 3a. The recommended ABC for 2010 is 5,100 t. The corresponding reference values for northern rockfish recommended for this year and projected one additional year are summarized below. The value for $B_{40\%}$ is 24,550 t compared to a 2010 estimate of 34,790 t of female spawning biomass. The F_{ABC} is set to $F_{40\%}$ (0.059) and F_{OFL} set to $F_{35\%}$ (0.071). The 2010 OFL is 6,070 t.

Status determination

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

Additional Plan Team Recommendations

The Team suggested that extending the number of ages considered may improve model fits and recruitment estimates.

They also noted that a maturity curve published for northern rockfish should be considered in the future. The Team requests that the authors bring relevant age data analyses and maturity comparisons forward next September during the off year for this assessment.

Ecosystem Considerations summary

Some habitat information from the EFH EIS update has been added to the ecosystem considerations section of the assessment.

Area apportionment

Apportioning the 2010 and 2011 ABC is based on weighted average of the percent exploitable biomass distribution for each area in the three most recent trawl surveys (2005, 2007, and 2009). This resulted in the following percentage apportionments by area: Western 53% and Central 47%. Compared to previous area apportionments the 2009 values for the Western area increased by 6% and the Central declined 6% . Northern rockfish ABC apportionments include the movement of 2 t from the Eastern Gulf with Other Slope Rockfish in West Yakutat.

Northern rockfish ABC apportionments 2010-2011:

	Western	Central	Eastern	West Yakutat	East Yak./SE	Total
2010	2,703	2,395	2	-	-	5,100
2011	2,549	2,259	2	-	-	4,810

11. Shortraker and other slope rockfish

Shortraker rockfish

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

Species	Year	Biomass	OFL	ABC	TAC	Catch
Shortraker rockfish	2008	39,905	1,197	898	898	598
	2009	39,905	1,197	898	898	550
	2010	40,626	1,219	914		
	2011		1,219	914		

Other slope rockfish

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

Species	Year	Biomass	OFL	ABC	TAC	Catch
Other Slope rockfish	2008	90,283	5,624	4,297	1,730	809
	2009	90,283	5,624	4,297	1,730	879
	2010	76,867	4,881	3,749		
	2011		4,881	3,749		

Changes from previous assessment

New information in this assessment includes biomass estimates from the 2009 trawl survey. Assessment methodology in this report is similar to that used in past assessments for shortraker rockfish and "other slope rockfish".

Spawning biomass and stock status trends

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

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Shortraker rockfish and the various "other slope rockfish" species are Tier 5 species for specifications while sharpchin rockfish are in Tier 4. The Tier 5 definitions state that $F_{ABC} \leq 0.75M$. Applying this definition to the exploitable biomass of shortraker rockfish results in a recommended ABC of 914 t in 2010. For "other slope rockfish", applying an $F_{ABC} \leq F40\%$ rate to the exploitable biomass of sharpchin rockfish (Tier 4) and an $F_{ABC} \leq 0.75M$ rate to that of the other species (Tier 5) results in ABCs of 931 t and 2,818 t, respectively, or a combined recommended ABC of 3,749 t for the "other slope rockfish" management group in 2010. Given the lack of direct validation for the aging method for shortraker rockfish and thus the uncertainty about the ages, use of an age-structured model is not recommended for assessing this species at this time.

Status determination

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

Ecosystem Considerations summary

Some habitat information from the EFH EIS update has been added to the ecosystem considerations section of the assessment.

Area apportionment

Apportionment of the ABCs amongst management areas of the Gulf of Alaska is based on a weighted average of the percent exploitable biomass distribution for each area in the three most recent trawl surveys (2005, 2007, and 2009). Each successive survey is given a progressively heavier weighting using factors of 4, 6, and 9, respectively. The new apportionment values for shortraker rockfish are: Western area, 15%; Central area, 35%; and Eastern area, 50%. For comparison with the 2009 apportionments, the Western area increased 2%, Central remained stable and the Eastern area declined 2%. Apportionment values for "other slope rockfish" are: Western area, 6%; Central area, 14%; and Eastern area, 80%. For comparison with the 2009 apportionments, the Western area declined 2%, the Central area increased 1% and the Eastern area declined 2%. The Eastern area for "other slope rockfish" is further divided into the West Yakutat area and the East Yakutat/Southeast Outside area. Based on the weighted calculation procedure, the Eastern area apportionment is subdivided as follows: West Yakutat, 9%; and East Yakutat/Southeast Outside, 91%.

Area apportionment of 2010 and 2011 ABC for shortraker rockfish in the Gulf of Alaska:

Western	Central	Eastern	Total
134	325	455	914

Area apportionment of 2010 and 2011 ABC for Other Slope rockfish in the Gulf of Alaska:

Western	Central	WYAK	SEO	Total
212	507	273	2,757	3,749

12. Pelagic shelf rockfish

Pelagic shelf rockfish

Status and catch specifications (t) of pelagic shelf rockfish and projections for 2010 and 2011. ABC and OFL are projected using author's estimates of catch for 2009 and 2010 for dusky rockfish. Catch data in this table are current through 11/07/2009. Biomass levels are based on trawl survey estimates and the age structured model for dusky rockfish.

Area	Year	Biomass[1]	OFL	ABC	TAC	Catch
GOA	2008	70,823	6,400	5,227	5,227	3,634
	2009	66,603	5,803	4,781	4,781	3,037
	2010	69,632	6,142	5,059		
	2011		5,739	4,727		

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

Changes from previous assessment

New data for 2009 includes updated 2008 fishery catch, estimated 2009 fishery catch, three new years of fishery ages (2003, 2005, 2006), 2007 survey ages, and 2009 survey biomass. For dusky rockfish, two

alternative models are presented. Model 1 is the same as last year's author recommended 2007 model with updated fishery and survey data. Model 2 is identical to the recommended 2007 model with one change. The fishery catch time series has been split into two time periods (1977-1990 and 1991-2009) and the weight on catch has been reduced for the earlier time period and increased for the most recent time period. Implementing this change resulted in an improved model fit to fishery catch.

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

Spawning biomass and stock status trends

The 2010 female spawning biomass for dusky rockfish (25,800 t) is well above $B_{40\%}$ (19,159 t).

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The average exploitable biomass from the 2005, 2007, and 2009 surveys was 1,947 t (158 t for widow rockfish and 1,789 t for yellowtail rockfish). The 2010 recommended ABC for widow and yellowtail rockfish combined is 102 t based on Tier 5 calculations (F=0.75M). The 2010 OFL (F=M=0.07) for widow and yellowtail rockfish is 136 t. For dusky rockfish, the maximum allowable ABC for 2010 is 4,957 t based on Tier 3 and derived from the recommended model. This ABC is 5% more than last year's ABC of 4,719 t and nearly identical the 2005 recommended ABC. The slight changes in ABC are likely due to a 2.5 fold increase in survey biomass in 2005 compared to relatively stable biomass estimates in 2003, 2007, and 2009. The 2010 OFL for dusky rockfish is 6,006 t. For the pelagic shelf rockfish assemblage, ABC and OFL for dusky rockfish are combined with ABC and OFL for widow and yellowtail rockfish. The 2010 recommended ABC for pelagic shelf rockfish is 5,059 t with area apportionments of 650 t for the Western area, 3,249 t for the Central area, 434 t for the West Yakutat area, and 726 t for the Southeast/Outside area. The 2010 OFL for pelagic shelf rockfish is 6,142 t.

Status determination

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

Ecosystem Considerations summary

Some habitat information from the EFH EIS update has been added to the ecosystem considerations section of the assessment.

Area apportionment

Apportionment of the ABCs and OFLs is based on a weighted average of the percent exploitable biomass distribution for each area in the three most recent trawl surveys (2005, 2007, and 2009). Each successive survey is given a progressively heavier weighting using factors of 4, 6, and 9, respectively. The new apportionment values are: Western area, 13%; Central area, 64%; and Eastern area, 23%. For comparison with the 2009 apportionments, the Western area declined 7%, Central declined 5% and Eastern area increased 12%.

Amendment 41 prohibited trawling in the Eastern area east of 140^{o} W longitude. As was done for the last three years, the Team recommends that a separate ABC be set for Pelagic shelf rockfish in WYAK. The ratio of biomass still obtainable in the W. Yakutat area (between 140° W and 147° W) is 0.37 which is

lower than the value in 2007 (0.42). This corresponds to a 2010 ABC of 434 t for WYAK and 725 t for the remaining Eastern area (East Yakutat/Southeast Outside area).

The 2010-2011 recommended area apportionments for pelagic shelf rockfish:

	Western	Central	W. Yakutat	E. Yakutat/SE	Total
2010	650	3,249	434	726	5,059
2011	607	3,035	405	680	4,727

13. Rougheye and blackspotted rockfish

Status and catch specifications (t) of rougheye and blackspotted rockfish and projections for 2010 and 2011. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Projections to 2010 and 2011 use author's estimate of 2009 and 2010 catch. Catch data are current through 11/07/2009.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Rougheye and blackspotted rockfish	2008	46,121	1,548	1,286	1,286	389
	2009	46,385	1,545	1,284	1,284	280
	2010	45,751	1,568	1,302		
	2011		1,581	1,313		

Changes from previous assessment

New data added to this model were the updated estimates of 2007-2009 fishery catch, 2004 and 2006 fishery ages, 2007 fishery length compositions, 2009 trawl survey biomass estimate, 1987 and 2007 trawl survey age compositions, 2008-2009 longline survey relative population weights, and 2008-2009 longline survey size compositions.

The assessment methodology is very similar to the 2007 model which utilized the age error structure based on rougheye/blackspotted rockfish and the more accurate estimates of historical rougheye/blackspotted catch for 1993-2004. Additionally, the authors split the catch time series into two periods from 1977-1992 and 1993-2009 because of less reliable historical catch data. A CV of approximately 30% is implemented for the earlier part of the catch time series (1977-1992) where catches are not as well known, while a CV of 5% was used for the rest of the time series.

Spawning biomass and stock status trends

Female spawning biomass (13,638 t) is well above $B_{40\%}$ (10,185 t) with projected biomass stable.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Plan Team endorsed the recommended model with increased weight on the catch time series.

The rougheye/blackspotted complex is in Tier 3a because 2010 female spawning biomass (13,638 t) is above $B_{40\%}$ (10,185 t). For the 2010 fishery, the Plan Team accepts the authors' recommended maximum allowable ABC of 1,302 t ($F_{ABC} = F_{40\%} = 0.04$) and OFL ($F_{OFL}=F_{35\%} = 0.048$) of 1,568 t. This is a 1.4 % increase from last year's ABC of 1,284 t.

Status determination

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

Ecosystem considerations

Some habitat information from the EFH EIS update has been added to the ecosystem considerations section of the assessment. Furthermore with the two species being identified separately, additional species-specific information on blackspotted and rougheye have been added.

Area apportionment

Area apportionments using the weighted average of the percent exploitable biomass distribution for each area in the three most recent trawl surveys (2005, 2007, and 2009). result in the following by area: 6% Western, 66% Central and 28% Eastern. For comparison with the 2009 apportionments, the Western area declined by 4%, the Central area increased 1% and the Eastern area increased 3%.

The 2010 and 2011 ABC apportionments for the rougheye and blackspotted rockfish complex in the Gulf of Alaska:

	Western	Central	Eastern	Total
2010	80	862	360	1,302
2011	81	869	363	1,313

Additional Plan Team recommendations

The authors reported on a large collection of genetic samples of rougheye and blackspotted rockfish from the 2009 trawl survey. The purpose of this collection is to aid in at sea species identification which is especially problematic for this complex. The Plan Team supports this research endeavor.

14. Demersal shelf rockfish

Status and catch specifications (t) of demersal shelf rockfish and projections for 2010 and 2011. Biomass for each year corresponds to the survey biomass estimates given in the SAFE report issued in the preceding year(s). 2009 catch data are from the NMFS Catch Accounting System through 11/7/2009.

Year	Biomass	OFL	ABC	TAC	Catch
2008	18,329	611	382	382	149
2009	17,390	580	362	362	137
2010	14,321	472	295		
2011		472	295		

[1] ABC, TAC, and catch reflect contributions from commercial and sport fisheries.

Changes from previous assessment

Density surveys were conducted in 2009 for Eastern Yakutat (EYKT) which provided updated density estimates for yelloweye rockfish. The previous set of surveys in this area was conducted in 2003. Yelloweye average weight and standard error estimates were updated for all 4 areas in the assessment using data from the 2009 directed fishery for demersal shelf rockfish (DSR) and incidental catch in the halibut fishery. New age data were incorporated into the assessment for the Central Southeast Outside Section (CSEO) for 2004, and EYKT for 2005.

Spawning biomass and stock status trends

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

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. 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 **2010 ABC of 295 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 2010 of 472 t for DSR**.

Ecosystem Considerations summary

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

Area apportionment

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

15. Thornyheads

Status and catch specifications (t) of thornyheads in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data for 2009 are current through 11/07/2009.

Year	Biomass	OFL	ABC	TAC	Catch
2008	84,775	2,540	1,910	1,910	741
2009	84,775	2,540	1,910	1,910	657
2010	78,795	2,360	1,770		
2011		2,360	1,770		

Changes from previous assessment

Thornyheads continue to be on a biennial stock assessment schedule to coincide with the timing of the NMFS trawl survey data. New assessment information includes updated biomass and length compositions from the 2009 NMFS trawl survey data, total catch weight for 2007, 2008 and partial 2009 data and length composition from the 2007 and 2008 longline fisheries. Additionally, Relative Population Numbers (RPN's) and weight and size composition from the AFSC 2008 and 2009 longline surveys were included.

Spawning biomass and stock status trends

Estimates of spawning biomass are not available for thornyheads which are assessed under Tier 5. Thornyhead biomass from the 2009 GOA trawl survey showed a decline of 9% relative to the 2007 survey results. However, most of this decrease was observed in the central GOA with a decrease of 24%. Biomass increased by 54% and 10% in the Western and Eastern Gulf areas, respectively.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Thornyhead rockfish are in Tier 5 and will likely remain there until such time as satisfactory age data can be generated and an age structured model can be developed. Age assessment is currently hampered by insufficient age data for this species; two recent studies showed widely variable maximum ages of 115 and 150 years, highlighting the difficulty in ageing thornyheads. It is possible that production ageing could occur, but only for individuals younger than 10 years of age. An average natural mortality (M) of 0.03 is used in this assessment as it is currently considered the best estimate based on the age data available.

The GOA Plan Team approved of the authors recommendation for OFL and ABC for 2010 and 2011.

The 2010 ABC recommendation from the current assessment (where F_{ABC} =0.0225) is 1,770 t and the OFL (F_{OFL} =0.03) is 2,360 t.

Status determination

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

Additional Plan Team recommendations

The Team noted that for shortspine thornyhead (and a number of other species), it is critically important to the assessment that the GOA trawl surveys continue and that they extend to 500m in order to cover the range of primary habitat for this (and other) species.

Ecosystem Considerations summary

This section is unchanged from the previous assessment. Examining the trophic relationships of shortspine thornyheads suggests that the direct effects of fishing on the population are likely to be the major ecosystem factors to monitor for this species, because fishing is the dominant source of mortality for shortspine thornyheads in the Gulf of Alaska, and there are currently no major fisheries affecting their primary prey. However, if fisheries on the major prey of thornyheads—shrimp and to a lesser extent deepwater crabs—were to be re-established in the Gulf of Alaska, any potential indirect effects on thornyheads should be considered.

Area apportionment

Area apportionments are based upon the relative distribution of biomass by area from the 2009 GOA bottom trawl survey. Area apportionment of 2010-2011 ABC for thornyhead rockfish:

	Western	Central	Eastern	Total
2010	425	637	708	1,770
2011	425	637	708	1,770

16. Atka mackerel

Status and catch specifications (t) of Atka mackerel in recent years. Atka mackerel are managed under Tier 6 and reliable estimates of biomass are not available. The OFL and ABC for 2010 and 2011 are those recommended by the Plan Team. Catch data are current through 11/07/2009.

Year	Biomass	OFL	ABC	TAC	Catch
2008		6,200	4,700	1,500	2,109
2009		6,200	4,700	2,000	2,221
2010		6,200	4,700		
2011		6,200	4,700		

Changes from previous assessment

Atka mackerel are assessed on a biennial schedule to coincide with the timing of survey data. This year a full assessment is presented which includes 2009 bottom trawl survey information. New catch information includes updated 2008 catch (2,109 t), and 2009 catch (2,221 t) as of November 7, 2009. The 2009 GOA Atka mackerel catch through October is 10% over the 2009 TAC. Significant catches were taken in area 610 and to some extent from area 620 by rockfish fisheries mostly in July through October. Under the Rockfish Program, catcher processors who historically would move out of area 610 after the POP fishery closed, are now remaining in the area and targeting northern and pelagic shelf rockfish. This is contributing to greater catches (much of it discarded) of Atka mackerel. Since the 2007 assessment, ages from the 2007 GOA survey and the 2007 and 2008 fisheries have become available. The 1999 year class continues to dominate the age composition of GOA Atka mackerel. In the most recent 2009 survey,

over 95% of the GOA Atka mackerel biomass was caught in 2 hauls off Sanak Island in the 1-100 m depth strata resulting in a Gulf-wide *CV* of 83%. Survey biomass estimates are not considered consistent reliable indicators of absolute abundance or indices of trend.

Spawning biomass and stock status trends

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

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Since 1996, the maximum permissible ABC has been 4,700 t under Tier 6. However, ABC has been set lower than 4,700 t (1,000 t in 1997 and 600 t for 1998-2005) for conservation reasons to allow for bycatch needs of other trawl fisheries and minimize targeting. The 2006-2009 ABCs (under Tier 6), were increased to the maximum allowable of 4,700 t and the TACs were set at 1,500 t and 2,000 t in 2009 to accommodate an increase in GOA Atka mackerel, and still allow for bycatch in other directed fisheries and minimize targeting. Given the very patchy distribution of GOA Atka mackerel which results in highly variable estimates of abundance, the Plan Team continues to recommend that GOA Atka mackerel be managed under Tier 6. **The Plan Team recommends a 2010 ABC for GOA Atka mackerel equal to the maximum permissible value of 4,700 t. The 2010 OFL is 6,200 t under Tier 6.**

Status determination

Information is insufficient to determine stock status relative to overfished criteria. Up until 2008, catches have been below the TAC, however, the 2009 Atka mackerel catch is 10% over TAC but still under the ABC and below levels where overfishing would be a concern..

Additional Plan Team recommendations

Due to concerns over uncertainty with the ABC estimates using Tier 6, a low TAC is recommended to provide for anticipated incidental catch needs of other fisheries, principally for Pacific cod, rockfish and pollock fisheries. The 2009 TAC for GOA Atka mackerel was 2,000 t which the data suggests is insufficient to meet bycatch needs for 2010.

Ecosystem Considerations summary

This section is unchanged from the previous assessment. Steller sea lion food habits data from the western Gulf of Alaska are relatively sparse, so it is not known how important Atka mackerel is to sea lions in this area. However, the close proximity of fishery locations to sea lion rookeries in the western Gulf suggests that Atka mackerel could be a prey item at least during the summer. Overall, while Steller sea lions, Pacific cod, and arrowtooth flounder are all sources of significant mortality of Atka mackerel in the Aleutian Islands, predatory groundfish play a far larger numerical role than Steller sea lions in the Gulf of Alaska as even occasional predation events by these groundfish may add to a large degree of prey population suppression due to the large and increasing size of groundfish populations. Analyses of historic fishery CPUE revealed that the fishery may create temporary localized depletions of Atka mackerel and that these depletions may last for weeks after the vessels have left the area. Bottom contact fisheries could have direct negative impacts on Atka mackerel by destroying egg nests and/or removing the males that are guarding nests, however, quantitative studies are lacking. Indirect effects of bottom contact fishing gear, such as effects on fish habitat, may also have implications for Atka mackerel. Several types of living substrate have been found to be susceptible to fishing gear, and Atka mackerel sampled in the NMFS bottom trawl survey are primarily associated with emergent epifauna such as

sponges and corals. Effects of fishing gear on these living substrates could, in turn, affect fish species that are associated with them. The cumulative and long term effects from historic Atka mackerel fisheries are unknown.

17. Skates

Status and catch specifications (t) of skates and projections for 2010 and 2011. Average biomass for each group and area is based on 2003-2009 GOA bottom trawl surveys. Catch data are current through 11/07/2009.

Species group	Area	Average Biomass	OFL	ABC	TAC	2009 Catch	2010 and 2011 ABC	2010 and 2011 OFL
Big skate	W	7,979		632	632	68	598	
	C	27,325		2,065	2,065	1,656	2,049	
	E	9,077		633	633	87	681	
	Total	**44,381**	**4,439**	**3,330**	**3,330**	**1,811**	**3,328**	**4,438**
Longnose skate	W	1,086		78	78	62	81	
	C	26,790		2,041	2,041	890	2,009	
	E	10,155		768	768	175	762	
	Total	**38,031**	**3,849**	**2,887**	**2,887**	**1,117**	**2,852**	**3,803**
Bathyraja skates	GOA wide	**28,908**	**2,806**	**2,104**	**2,104**	**1,007**	**2,093**	**2,791**

Changes from previous assessment

Skates are on a biennial stock assessment schedule to coincide with new survey data. A full assessment was presented this year. Survey biomass and size compositions, and fishery catch, retention and size composition data were updated from the previous full assessment in 2007. A preliminary alternative estimate of skate bycatch in halibut IFQ fisheries was presented. These estimates are an order of magnitude lower than previous estimates.

ABC recommendations for skates are set according to Tier 5 using a natural mortality rate of 0.1 for all skates for 2010 and 2011.

Spawning biomass and stock status trends

GOA bottom trawl survey biomass for both big and longnose skates increased slightly from 2007 to 2009, although not to high levels observed in 1999-2003. GOA "other skate" survey biomass decreased slightly over the same period, primarily due to a decrease in Aleutian skate biomass. Information is presently insufficient for population dynamics modeling for GOA skates, although the authors suggested that age structured models might be possible for big and longnose skates in the near future. The Plan Team encourages this development as data improve.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Skates are managed in Tier 5. A single value of M=0.10 is applied to area-specific average biomass from the most recent four GOA trawl surveys to estimate the ABCs listed above using the maximum permissible F_{ABC} =0.075 (0.75*M), and the OFLs using F_{OFL} =0.10. While the assessment authors continued to recommend area-specific OFLs for big and longnose skates due to concerns about localized depletion and unknown stock structure, the Plan Team maintained that Gulfwide OFLs combined with the bycatch-only nature of the current catch provide adequate protection. This is the identical Plan Team recommendation for previous years.

The Alaska Department of Fish & Game (ADF&G) opened a fishery for skates in the state waters of Prince William Sound during March-April 2009. Scientists at ADF&G prepared harvest guidelines for

this fishery of 9.1 and 13.6 t for big skates inside and outside Prince William Sound waters, respectively. However, big skate harvests were 21.4 and 37.6 tons for each region, exceeding the GHL. Longnose skate catches of 31.3 and 27.1 t did not exceed GHLs of 45.5 and 68.2 t for the inside and outside districts, respectively.

Status determination

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

Additional Plan Team recommendations

The Plan Team concurs with the authors' recommendation that no directed fishing for skates be permitted in the GOA because the ABCs may to be taken incidentally in groundfish and IFQ halibut fisheries. The preliminary method for estimating incidental catch of skates in the IFQ halibut fisheries involved depth stratification and filtering to use only the survey stations with the highest third of halibut CPUE to estimate skate catch rates. The Plan Team recommends continued exploration of IPHC survey-based estimates of skate bycatch in IFQ halibut fisheries, recognizing that previous estimates likely represent an upper limit on actual skate catch in those fisheries. The Plan Team suggests looking at halibut fishery logbooks as an additional source of fishery information.

The Plan Teams also suggest exploring both ADF&G trawl surveys and NMFS longline surveys to determine whether they might provide additional time series of relative skate abundance and/or biological samples. Additionally, the Team suggested that if the age-structured modeling of BSAI skates is accepted and Tier 3 management is adopted, a comparison with Tier 5 management may have implications for the Tier 5 skate management in the GOA.

Ecosystem Considerations summary

This section is unchanged from previous assessments. Ecosystem considerations based on the early 1990's Gulf of Alaska food web model were presented in the 2009 assessment. The Plan Team encourages updating this information with diet data being collected by Moss Landing Marine Lab researchers as it becomes available.

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

Area apportionment

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

18. Other Species

Status and catch specifications (t) for the other species management category and projections for 2010 and 2011. Currently the other species category is managed with an aggregate TAC; no ABC or OFL specifications were made for other species category for 2008 and 2009. Catch data in the table below are current through 10/07/2009.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Sculpins	2008		NA	NA	NA	1,943
	2009	30,836	NA	NA	NA	1,146
	2010	33,307	6,328	4,746		
	2011					
Squid	2008		NA	NA	NA	84
	2009	Unknown	NA	NA	NA	336
	2010	Unknown	1,530	1,148		
	2011					
Octopus	2008		NA	NA	NA	339
	2009	Unknown	NA	NA	NA	238
	2010	Unknown	298	224		
	2011					
Sharks	2008		NA	NA	NA	410
	2009	Unknown	NA	NA	NA	365
	2010	Unknown	1,276	957		
	2011					
Other Species Total	2008		NA	NA	4,500	2,776
	2009		8,720	6,540	4,500	2,085
	2010		9,432	7,075		
	2011					

The other species complex in the GOA contains the following species groups: sculpins, squids, sharks, and octopus. In the past, assessments for these species in the GOA were done periodically since ABCs and OFLs were not specified, and provided as appendices to the SAFE report. The TAC calculation for other species (previously TAC=5% of the sum of target TACs), was modified in 2005 such that the Council may recommend a TAC at or below 5% of the sum of the target species TACs during the annual specifications process. Beginning in 2009, amendment 79 to the GOA FMP, provided for the specification of ABC and OFL for the other species complex in aggregate. It is anticipated that in 2011 in conjunction with amendments to comply with the revise MSA requirements, specifications will be established by individual species group rather than in aggregate for the complex. Until then, assessments are presented in the SAFE report to be used for the setting of harvest specifications for the other species complex which are the sums of the ABCs and OFLs of the individual species groups. The Plan Team encourages assessment authors to coordinate efforts for consistency in estimation methods of incidental catch in the halibut fishery.

18a. Squid

Status and catch specifications (t) of squid and projections for 2010 and 2011. Other species are managed under an aggregate OFL and ABC for the category; individual ABCs and OFLs by species are presented to indicate their relative contribution to the total.. Catch data in table are current through 10/07/2009.

Year	Biomass	OFL	ABC	TAC	Catch
2008		NA	NA	NA	84
2009	Unknown	1,527	1,145	NA	336
2010		1,530	1,148		
2011		1,530	1,148		

Changes from previous assessment

Squid were first assessed in 2008 for the purpose of recommending aggregate "other species" harvest levels. Catch information was updated through 2008 and through October 7, 2009 along with the distribution of catch. Biomass information is updated with data from the 2009 NMFS bottom trawl survey. The OFL and ABC for squid contribute to the overall OFL and ABC for the "other species" category.

Spawning biomass and stock status trends

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

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Calculation of standard fishery reference values are particularly problematic because squid are generally highly productive short lived animals with multiple cohorts in one year. The Team discussed different options for making Tier 6 computations. The Team concluded that available biomass estimates are unreliable and therefore recommends that squid be placed in Tier 6. Squid catch has only been estimated since 1990 precluding application of the standard 1978-1995 catch history. Given squid life history aspects and results of ecosystem modeling, the author's Tier 6 (max) calculations seemed unreasonably low.

The stock assessment authors recommended the continued use of a modified Tier 6 (endorsed by the SSC) for establishing OFL and ABC levels for the squid complex based on the highest estimated squid catch during the 1997 to 2007 baseline period. The Team adopted this approach such that the OFL = maximum historical catch and ABC = 0.75*OFL. This results **in a recommended OFL of 1,530 mt and an ABC of 1,148 mt**. Team thought that this would represent an interim approach and encourages further development of alternative management for squid as an ecosystem component with the understanding that the current groundfish Tier system may be inappropriate for managing cephalopods.

Status determination

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

Ecosystem Considerations summary

Fishery management should attempt to prevent negative impacts on squid populations primarily because of their role as forage in marine ecosystems. Information on squid predation by seabirds is presented.

Squid are important components in the diets of many seabirds, fish, and marine mammals. Investigating the interactions between incidental fishery removals of squid and foraging by sensitive species (such as toothed whales and albatrosses) should be a high priority research topic.

With the implementation of annual catch limits required by the Magnuson-Stevens Act in 2011 it is anticipated that species within the "other species" category will be managed as separate species complexes. Squid may be managed as a separate complex within the fishery with an OFL, ABC, and TAC; or within an ecosystem component subject to different management measures.

Area apportionment

The ABC recommendations for squid within the other species category are gulf-wide.

18b. Sharks

Status and catch specifications (t) of sharks and projections for 2010 and 2011. Other species are managed under an aggregate OFL and ABC for the category; individual ABCs and OFLs by species are presented to indicate their relative contribution to the total. Reliable biomass estimates for sharks are unavailable and management under a modified Tier 6 is recommended. Catch data for 2009 are current through 10/07/2009.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Sharks	2008	Unknown	NA	NA		619
	2009		1,036	777		365
	2010		1,276	957		
	2011		1,276	957		

Changes from previous assessment

Biomass estimates from the 2009 GOA bottom trawl survey are presented. The total catch for GOA sharks from 2003-2008 has been updated due to changes to Catch Accounting System (Appendix B). Total catch has been updated to include 2009 (as of Oct 7, 2009). Biomass estimates from the 2009 GOA bottom trawl survey are incorporated, and preliminary estimates of bycatch in unobserved IFQ Halibut fisheries are examined (Appendix A), however, these catches are not included in the ABC calculations.

Spawning biomass and stock status trends

Stock status and trends are difficult to determine for sharks. NMFS AFSC bottom trawl survey biomass estimates are available for shark species in the GOA (1984-2009), but are considered highly uncertain as sharks may be poorly sampled by bottom trawl gear. The efficiency of bottom trawl gear also varies by species, and trends in these biomass estimates should be considered, at best, a relative index of abundance for shark species. The 1984-2009 GOA bottom trawl survey biomass estimates are highly variable, and recent surveys show a decline in relative biomass. Catch data for non-target species, including sharks, were recalculated based on changes in the Catch Accounting System. This resulted in substantial changes in yearly catches by species and an overall increase of 23% in average catch for sharks. The spiny dogfish index is highly variable in the longline survey and shows peaks in 1993 and 1998, otherwise the index was relatively low. Salmon sharks are poorly represented in bottom trawl catches as they are not frequently caught by that gear type.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Plan Team recommends that sharks be specified under Tier 6 for the interim while the other species specifications are set as an aggregate. The Plan Team recommends the use of the modified Tier 6 criteria with an average catch from 1997-2007. This results in a 2009 ABC of 957 t and an OFL of 1,276 for sharks. This level is unlikely to constrain other fisheries given the aggregate specifications for "other species". However, if sharks are broken out in the future, Tier 6 management may constrain a number of

fisheries. The Plan Team recommends further assessment of modified or alternative Tier 6 criteria and the potential for application of Tier 5 criteria to either individual species (e.g., spiny dogfish) or the shark complex as a whole.

Status determination

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

Additional Plan Team recommendations

The Plan Team recommends work on shark population structure. The new ACL amendment will require sharks to have individual specifications and there are concerns about the potential for constraining fisheries in which they are caught. It is important to investigate methods by which sharks could be moved out of Tier 6. Bycatch in halibut fisheries were not included in official catch estimates. While information was presented on the bycatch of sharks in the halibut fishery (per the request of the GOA Plan Team last year), they were not included in official catch estimates. The Plan Team recommends that this endeavor continue to be pursued in attempts to account for all shark removals. The Plan Team encourages assessment authors to coordinate efforts for consistency in estimation methods of incidental catch in the halibut fishery.

Ecosystem Considerations summary

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

Area apportionments

The ABC recommendations for sharks within the other species category are Gulf-wide.

18c. Octopus

Status and catch specifications (t) of octopus and projections for 2010 and 2011. Other species are managed under an aggregate OFL and ABC for the category; individual ABCs and OFLs by species are presented to indicate their relative contribution to the total. Reliable biomass estimates for octopus are not available and management under Tier 6 is recommended. Catch data are current through 10/07/09.

Species	Year	Biomass	OFL	ABC	TAC	Catch
	2008		NA	NA	NA	325
	2009	Unknown	298	224	NA	238
	2010		298	224		
	2011					

Changes from previous assessment

The last full assessment was presented in 2006. Since the 2006 assessment, survey data have been updated. The 2007 GOA survey caught octopus in 8.7% of the trawl tows, with a total biomass estimate of 2,296 tons. The 2009 survey caught octopus in 20.9% of tows, with a total biomass estimate of 3,791 t; this biomass estimate is the highest ever observed. The average of the most recent 10 years of survey biomass estimates is 2,395 tons. The assessment authors conducted a preliminary analysis to evaluate the feasibility of incorporating discard mortality into future catch accounting for octopus in both the BSAI and GOA. This was accomplished with data collected by an observer program special project in 2006 and 2007 which included a visual evaluation of the condition of the octopus by the observer. These observations provide preliminary data on the nature of discard mortality for octopus. Based on these

limited observations, the observed mortality rate for octopus caught in pot gear was less than one percent. Since 2003, over 85% of the annual incidental catches of GOA octopus has come from pot gear. These preliminary data suggest that a gear-specific discard mortality factor could be estimated for octopus, similar to the one now used for Pacific halibut. If a discard mortality factor were included in catch accounting for octopus, only a fraction of discarded octopus would be counted as mortality due to fishing. An observer special project was also initiated to collect individual weight and sex data on octopuses in the GOA and Bering Sea. Data from the 2006-2009 fisheries have been collected. The North Pacific Research Board has funded a field study in support of stock assessment for octopus beginning in fall 2009. The main focus of the study is to increase the knowledge of reproductive biology of the Giant Pacific octopus (*Enteroctopus dofleini*), in particular to document the seasonality of mating, denning, and egg incubation in Alaskan waters.

Spawning biomass and stock status trends

Stock status and trends are difficult to determine for octopus. NMFS AFSC bottom trawl survey biomass estimates are available for octopus species in the GOA (1984-2009), but are considered highly uncertain as octopuses are not be well sampled by bottom trawl surveys.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Plan Team determined that reliable estimates of biomass and life history information (specifically *M*) are unavailable for octopus, therefore Tier 6 management is recommended. There is no directed fishery for octopus, but a low level of octopus bycatch is retained and sold. Catch history is based on incidental catches thus ABC estimates based on Tier 6 criteria are particularly low. Last year the Plan Team and SSC utilized an alternative Tier 6 criteria based on the maximum (rather than average) catch for octopus. The Plan Team discussed whether to include the 2008 catch (which was the maximum in the time series). The catch time series from 1997 to 2007 was used for sharks and squid, and the Plan Team decided to use this time frame for octopus for consistency. This results in a 2010 OFL of 298 t and 75% of that value for a 2010 ABC is 224 t (equivalent to the 2009 values). As with squid, the Team thought that this would represent an interim approach and encourages further development of alternative management for octopus with the understanding that the current Tier system for groundfish may be inappropriate for cephalopod species.

Status determination

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

Additional Plan Team recommendations

The Plan Team discussed the problems of applying the current tier system criteria to octopus.

The Plan Team recommended that octopus not be taken out of the FMP and may be a candidate for an Ecosystem Component (EC). However, one of the criteria for EC is that there should be only minimal amounts for sale. Octopus probably don't satisfy this criteria, which presents a conflict for classification.

Ecosystem Considerations summary

Very little is known about the role of octopus in North Pacific ecosystems. The food-web model indicates that octopus in the GOA are preyed upon primarily by grenadiers, Pacific cod, halibut, and sablefish. Unlike in the Bering Sea, Steller sea lions and other marine mammals are not thought to be significant predators of octopus in the GOA.

Area apportionment

The ABC recommendations for octopus within the other species category are gulf-wide.

18d. Sculpins

Status and catch specifications (t) of sculpins and projections for 2010 and 2011. Other species are managed under an aggregate OFL and ABC for the category; individual ABCs and OFLs by species are presented to indicate their relative contribution to the total. Catch data are current through 10/07/2009.

Species	Year	Biomass	OFL	ABC	TAC	Catch
	2008		NA	NA	NA	1,943
Sculpins	2009	30,836	5,859	4,394		1,146
	2010	33,307	6,328	4,746		
	2011		6,328	4,746		

Changes from previous assessment

Sculpin catch was updated with complete 2008 and partial 2009 data as of October 7, 2009. In addition, catch data from 2003-2007 have been updated due to changes in the Catch Accounting System. Biomass estimates from the 2009 GOA bottom trawl survey were included in the assessment.

Spawning biomass and stock status trends

The estimate of aggregate sculpin biomass from the 2009 GOA survey was 40,727. This represents an increase from the 2007 biomass estimate (32,368 t). Most of this increase was due to estimates for yellow Irish lord which make up 62% of the 2009 sculpin biomass estimate. Trends in biomass were available for only selected sculpin species for the period 1984-2000 due to difficulties with species identification and survey priorities. Species specific biomass estimates are available for the 2001-2009 surveys. Almost 95% of the sculpin biomass is dominated by the larger sculpin species in the GOA. Yellow Irish lord is the most abundant, followed by great sculpin, bigmouth sculpin, and plain sculpin.

Biomass trends show that the bigmouth sculpin declined between 1984 and 2001, but has remained relatively stable since then. Yellow Irish lord biomass has increased over the last three surveys. The CVs for the 2009 survey biomass estimates for 7 out of 11 sculpin species are less than or equal to 0.3, and the CV for total sculpin biomass is 0.11, suggesting that the GOA survey is doing an adequate job assessing the biomass of the more abundant species.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Team determined that reliable estimates of biomass are available from the trawl survey and recommended that sculpins be managed under Tier 5. The Team agreed with the assessment authors on the use of a conservative estimate of M (0.19) applied to the average of the last 4 survey biomass estimates for sculpins (33,307 t) and recommend a 2009 ABC of 4,746 t (F_{ABC} = 0.1425) and OFL of 6,328 t (F_{OFL}=0.19).

Status determination

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

Additional Plan Team recommendations

The Team encouraged using updated species-specific values of *M* applied to species-specific estimates of biomass for future assessments. This would provide better aggregate ABC and OFL recommendations based on species-specific information.

Ecosystem Considerations summary

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

on shrimp and benthic crustaceans. Other sculpins are mainly preyed upon by Pacific cod and is the main source of mortality

Area apportionment

The ABC recommendations for sculpins within the other species category are gulf-wide.

Overview of Appendices

Appendix 1: Grenadiers

An executive summary assessment of the grenadier assemblage is provided in Appendix 1. This is an update of a full assessment that was provided in the 2006 SAFE report. The grenadier assessment covers both the BSAI and GOA management areas. Seven species of grenadiers are known to occur in Alaska. The giant grenadier is the most abundant and has the shallowest depth distribution on the continental slope. The assessment focused on the giant grenadier as it is the most common grenadier caught in both the commercial fishery and longline and trawl trawl surveys. Pacific and popeye grenadiers are occasionally caught. Grenadier species are currently considered "non-specified" under both BSAI and GOA Groundfish FMPs; however, the Teams recommend that the grenadier assemblage, which would include giant grenadier as the indicator species, along with popeye grenadier and Pacific grenadier be moved into a managed category so that annual catch limits can be established. The remaining four grenadier species would remain non-specified.

No management measures have been implemented for grenadiers and no official catch statistics exist because reporting for this assemblage is not required. However, catches have been estimated based on observer data or the NMFS Alaska Region Catch Accounting System from 2003 through October 7, 2009. Average annual catches over this time period have been 2,877 t in the EBS, 2,371 t in the Aleutian Islands (AI), and 10,544 t in the GOA. Most of the catch occurs in longline and pot fisheries.

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

Appendix 2: Pacific Halibut Discard Mortality Rates

Halibut discard mortality rates (DMRs) are set by the Council on a 3-year cycle based on recommendations by International Pacific Halibut Commission staff. Current rates will expire at the end of 2009; new rates are needed for 2010 -2012. The recommended rates are based on an average of annual DMRs from the previous 10 years. The GOA Plan Team endorsed IPHC staff recommendations for DMRs for the GOA groundfish fisheries for 2010 - 2012. The Council is expected to adopt these rates during its December 2009 meeting. This procedure will be repeated in 2012 for 2013-2015.

Recommended Pacific halibut discard mortality rates (DMR) for 2010-2012 GOA groundfish fisheries.

Gear	Target	Recommendation
Trawl	Bottom pollock	59
	Pacific cod	62
	Deepwater flatfish	48
	Shallow water flatfish	71
	Rockfish	67
	Flathead sole	65
	Mid water pollock	76
	Sablefish	65
	Arrowtooth flounder	72

	Rex sole	64
Pot	Pacific cod	17
Longline	Pacific cod	12
	Rockfish	9

Appendix 3: Vulnerability

To aid in the classification of stocks within an FMP and provide advice for the structuring of stock complexes, a national working group from NOAA fisheries developed a vulnerability analysis tool with broad application to U.S. fisheries. Staff from the Alaska Fisheries Science Center used this methodology to produce a preliminary analysis of vulnerability for selected species (all non-targets and some targets) in the BSAI and GOA. The tool compares productivity attributes of a stock (mostly life history information) to attributes of the stock's susceptibility to fishing activity. The results are displayed graphically and by generating a vulnerability score that is the Euclidean distance from the origin, which corresponds the lowest vulnerability score. There is also an assessment of the quality of the data used in the analysis of each stock. The appendix contains the results of these analyses.

Main preliminary results include:

1) Productivity varies considerably among stocks in both regions; susceptibility is less variable.
2) The main target stocks (e.g. pollock and Pacific cod) in each region have the highest susceptibility scores.
3) There are no clear divisions among stocks in the PSA, i.e. there appears to be a continuum of vulnerability rather than distinct levels of vulnerability.
4) Squids and forage fishes have the lowest vulnerability.
5) The vulnerability scores for sculpins and grenadiers are in the range of the included target stocks.
6) Skates and sharks have high vulnerability scores.

The appendix includes a discussion of the implications of these results for compliance with the revised National Standard guidelines.

Appendix 4: Forage fish

An assessment for forage fish in the Gulf of Alaska is provided in **Appendix 4**. The forage fish category in the Gulf of Alaska FMP contains over fifty species with diverse characteristics. These species have been identified as having ecological importance as prey, and directed fishing is prohibited for the group. Retention of forage fishes in commercial catches is limited to 2% of the target species weight, and other limitations are placed on the bycatch, sale, barter, trade, or processing of any species in this group by amendment 39 to the GOA Groundfish FMP. Thus harvest specifications for these species are not established. Forage fish were first included as an assessment in 2003 with the intention to review current information on these species and identify future assessment needs. The Plan Team continues to recommend maintaining the forage fish chapter as a SAFE appendix to be updated similar to groundfish stock assessments as new information becomes available in the off year, or in the interim as new information and issues arise, noting that forage fish are essential ecosystem components, important to seabirds, marine mammals and commercially important groundfish. An expanded assessment of forage fish was produced for the 2008 SAFE report. The format of the forage fish report has been fundamentally changed, with new information added for each taxonomic group. The forage fish assessment focuses upon two main species of importance in the forage fish category: capelin and eulachon. The section on eulachon was greatly expanded and now includes spatial analyses of eulachon distribution and catch. The small-mesh survey data for capelin and eulachon were expanded to include all sampled areas. The Team noted that the small-mesh survey is useful for indexing forage fish population trends and supports its continuation on an annual basis. This year the forage fish report consists of only an executive summary with updated catch and survey data.

Two developments have implications for GOA forage fishes. The reauthorization of the Magnuson-Stevens Act and the resulting changes in NMFS guidelines require a reorganization of FMP species into "in the fishery" or "ecosystem components" (EC). Forage fishes are a likely candidate for the EC category, and the NPFMC is conducting analyses of this issue. A decision is scheduled for 2010. Management of forage fishes will likely not change substantially but may be modified, particularly if other stocks are added to the EC group. A second development is that the North Pacific Research Board will begin funding integrated ecosystem research (GOA IERP) in the GOA in 2010. Forage species are a central focus of this research plan and it is expected that the IERP will provide information to enhance the monitoring and assessment of forage fishes in the GOA.

Appendix 5. Economic summary

According to data taken from the 2009 Economics SAFE report, first-wholesale revenues from the processing and production of Alaska groundfish rose from $2.1 billion in 2007 to $2.3 billion in 2008, a difference of $186.5 million. During that same time-period, the total quantity of groundfish products decreased from 758.4 thousand metric tons to 688.4, a difference of 70.0 thousand metric tons. thousand metric tons. In general, a decrease in production can be accompanied by an increase in revenues if (i) prices increase, for example, as a demand-side response to the decrease in production, or (ii) the pattern of production changes to favor higher-valued species or products. This brief report (Appendix 5) analyzes the change in groundfish revenues in 2007-08, across species and products, to identify where the largest changes, both positive and negative, occurred.

Tables

Table 1. Gulf of Alaska groundfish 2009 - 2011 OFLs and ABCs, 2009 TACs, and 2009 catches (reported through November 7th, 2009).

Stock/ Assemblage	Area	2009 OFL	2009 ABC	2009 TAC	2009 Catch	2010 OFL	2010 ABC	2011 OFL	2011 ABC
Pollock	W (61)		15,249	15,249	14,935		26,256		34,728
	C (62)		14,098	14,098	14,006		28,095		37,159
	C (63)		11,058	11,058	12,135		19,118		25,287
	WYAK		1,215	1,215	1,221		2,031		2,686
	Subtotal	58,590	41,620	41,620	42,297	103,210	75,500	135,010	99,860
	EYAK/SEO	11,040	8,280	8,280		12,326	9,245	12,326	9,245
	Total	69,630	49,900	49,900	42,297	115,536	84,745	147,336	109,105
Pacific Cod	W		21,567	16,175	14,243		27,685		34,265
	C		31,521	23,641	23,380		49,042		60,698
	E		2,212	1,991	778		2,373		2,937
	Total	66,600	55,300	41,807	38,401	94,100	79,100	116,700	97,900
Sablefish	W		1,640	1,640	1,341		1,660		1,488
	C		4,990	4,990	4,780		4,510		4,042
	WYAK		1,784	1,784	1,774		1,620		1,450
	SEO		2,746	2,746	2,803		2,580		2,320
	Total	13,190	11,160	11,160	10,698	12,270	10,370	11,008	9,300
Shallow-water flatfish	W		26,360	4,500	96		23,681		23,681
	C		29,873	13,000	8,195		29,999		29,999
	WYAK		3,333	3333	1		1,228		1,228
	EYAK/SEO		1,423	1,423			1,334		1,334
	Total	74,364	60,989	22,256	8,292	67,768	56,242	67,768	56,242
Deep-water Flatfish	W		706	706	8		521		530
	C		6,927	6,927	428		2,865		2,928
	WYAK		997	997	4		2,044		2,089
	EYAK/SEO		538	538	2		760		778
	Total	11,578	9,168	9,168	442	7,680	6,190	7,847	6,325
Rex sole	W		1,007	1,007	342		1,543		1,521
	C		6,630	6,630	4,162		6,403		6,312
	WYAK		513	513	1		883		871
	EYAK/SEO		846	846			900		888
	Total	11,756	8,996	8,996	4,505	12,714	9,729	12,534	9,592
Arrowtooth Flounder	W		30,148	8,000	1,517		34,773		34,263
	C		164,251	30,000	22,813		146,407		144,262
	WYAK		14,908	2,500	56		22,835		22,501
	EYAK/SEO		12,205	2,500	52		11,867		11,693
	Total	261,022	221,512	43,000	24,438	254,271	215,882	250,559	212,719
Flathead Sole	W		13,010	2,000	303		16,857		17,520
	C		29,273	5,000	3,115		27,124		28,190
	WYAK		3,531	3,531			1,990		2,068
	EYAK/SEO		650	650			1,451		1,508
	Total	57,911	46,464	11,181	3,418	59,295	47,422	61,601	49,286

Table 1. continued.

Stock/ Assemblage	Area	2009 OFL	2009 ABC	2009 TAC	2009 Catch	2010 OFL	2010 ABC	2011 OFL	2011 ABC
Pacific ocean perch	W	4,409	3,713	3,713	3,805	3,332	2,895	3,220	2,797
	C	9,790	8,246	8,246	8,027	12,361	10,737	11,944	10,377
	WYAK		1,108	1,108	1,147		2,004		1,937
	SEO		2,044	2,044	1		1,948		1,882
	E(subtotal)	3,741	3,152	3,152	1,148	4,550		4,396	
	Total	17,940	15,111	15,111	12,980	20,243	17,584	19,560	16,993
Northern rockfish[3]	W		2,054	2,054	1,946		2,703		2,549
	C		2,308	2,308	1,942		2,395		2,259
	E								
	Total	5,204	4,362	4,362	3,888	6,070	5,098	5,730	4,808
Rougheye	W		125	125	80		80		81
	C		833	833	100		862		869
	E		326	326	100		360		363
	Total	1,545	1,284	1,284	280	1,568	1,302	1,581	1,313
Shortraker	W		120	120	151		134		134
	C		315	315	192		325		325
	E		463	463	207		455		455
	Total	1,197	898	898	550	1,219	914	1,219	914
Other slope[3]	W		357	357	401		212		212
	C		569	569	385		507		507
	WYAK		604	604	82		273		273
	EYAK/SEO		2,767	200	11		2,757		2,757
	Total	5,624	4,297	1,730	879	4,881	3,749	4,881	3,749
Pelagic Shelf rockfish	W		819	819	716		650		607
	C		3,404	3,404	2,143		3,249		3,035
	WYAK		234	234	177		434		405
	EYAK/SEO		324	324	1		726		680
	Total	5,803	4,781	4,781	3,037	6,142	5,059	5,739	4,727
Demersal rockfish	Total	580	362	362	137	472	295	472	295
Thornyhead Rockfish	W		267	267	230		425		425
	C		860	860	275		637		637
	E		783	783	152		708		708
	Total	2,540	1,910	1,910	657	2,360	1,770	2,360	1,770
Atka mackerel	Total	6,200	4,700	2,000	2,221	6,200	4,700	6,200	4,700
Big Skate	W		632	632	68		598		598
	C		2,065	2,065	1,656		2,049		2,049
	E		633	633	87		681		681
	Total	4,439	3,330	3,330	1,811	4,438	3,328	4,438	3,328
Longnose Skate	W		78	78	62		81		81
	C		2,041	2,041	880		2,009		2,009
	E		768	768	175		762		762
	Total	3,849	2,887	2,887	1117	3,803	2,852	3,803	2,852
Other skates	Total	2,806	2,104	2,104	1,007	2,791	2,093	2,791	2,093
Other Species	Total	8720	6,540	4,500	2,327	9,432	7,075	9,432	7,075
Total		**632,498**	**516,055**	**242,727**	**163,382**	**693,253**	**565,499**	**743,559**	**605,086**

Table 2. Gulf of Alaska 2010 ABCs, biomass, and overfishing levels (t) for Western, Central, Eastern, Gulfwide, West Yakutat, and Southeast Outside regulatory areas.

		2010		
Species/Assemblage	Area	ABC	Biomass	OFL
Pollock	W (61)	26,256		
	C (62)	28,095		
	C (63)	19,118		
	WYAK	2,031		
	Subtotal	75,500	756,550	103,210
	EYAK/SEO	9,245	41,088	12,326
	Total	84,745	797,638	115,536
Pacific Cod	W	27,685		
	C	49,042		
	E	2,373		
	Total	79,100	701,200	94,100
Sablefish	W	1,660		
	C	4,510		
	WYAK	1,620		
	EY/SEO	2,580		
	Total	10,370	140,000	12,270
Deep water flatfish	W	521		
	C	2,865		
	WYAK	2044		
	EYAK/SEO	760		
	Total	6,190	89,682 [4]	7,680
Shallow water flatfish	W	23,681		
	C	29,999		
	WYAK	1,228		
	EYAK/SEO	1,334		
	Total	56,242	398,961 [5]	67,768
Rex sole	W	1,543		
	C	6,403		
	WYAK	883		
	EYAK/SEO	900		
	Total	9,729	88,221 [5]	12,714
Arrowtooth flounder	W	34,773		
	C	146,407		
	WYAK	22,835		
	EYAK/SEO	11,867		
	Total	215,882	2,139,000 [5]	254,271
Flathead sole	W	16,857		
	C	27,124		
	WYAK	1,990		
	EYAK/SEO	1451		
	Total	47,422	328,862 [5]	59,295

Table 2. continued.

Species/Assemblage	Area	2010 ABC	Biomass	OFL
Pacific ocean perch	W	2,895		3,332
	C	10,737		12,361
	WYAK	2,004		0
	EY/SEO	1,948		0
	EGOA	0		4,550
	Total	17,584	334,797	20,243
Northern rockfish	W	2,703		
	C	2,395		
	E	2 [1]		
	Total	5,100	103,300	6,070
Rougheye	W	80		
	C	862		
	E	360		
	Total	1,302	45,751	1,568
Shortraker	W	134		0
	C	325		0
	E	455		0
	Total	914	40,626	1,219
Other Slope rockfish	W	212		
	C	507		
	WYAK	273 [1]		
	EYAK/SEO	2,757		
	Total	3,749	76,867 [5]	4,881
Pelagic shelf rockfish	W	650		
	C	3,249		
	WYAK	434		
	EY/SEO	726		
	Total	5,059	66,603	6,142
Demersal shelf rockfish	Total	295	14,321	472
Thornyhead rockfish	Western	425		
	Central	637		
	Eastern	708		
	Total	1,770	78,795 [5]	2,360
Atka mackerel	Total	4,700	Unknown	6,200
Big skates	W	598	7,979	
	C	2,049	27,325	
	E	681	9,077	
	Total	3,328	**44,381**	4,438
Longnose skates	W	81	1,086	
	C	2,009	26,790	
	E	762	10,155	
	Total	2,852	**38,031**	3,803
Other skates	Total	2,093	**28,908**	2,791
Other species		7,075		9432
All species	Total	565,501	5,220,757	693,253

1/ The EGOA ABC of 2 t for northern rockfish has been included in the WYAK ABC for other slope rockfish.
2/ Abundance relative to target stock size as specified in SAFE documents.
3/ Historically lightly exploited therefore expected to be above the specified reference point.
4/ Biomass of Dover sole; biomass of Greenland turbot and deep-sea sole is unknown.

Table 3. Summary of fishing mortality rates and overfishing levels for the Gulf of Alaska, 2009.

Species	Tier	F_{ABC} [1]	Strategy	F_{OFL} [2]	Strategy
Pollock	3b	0.14	F_{ABC}	0.19	$F_{35\%\ adjusted}$
Pacific cod	3a	0.49	$F_{40\%}$ adjusted	0.60	$F_{35\%adjusted}$
Sablefish	3b	0.084	$F_{40\%\ adjusted}$ [3]	0.10	$F_{35\%adjusted}$ [4]
Deepwater flatfish	3a,6[3]	0.119	$F_{40\%}$, F_{ABC} [3]	0.149	$F_{35\%}$, F_{OFL} [4]
Rex sole	5	0.128	F=.75M	0.17	F=M
Flathead sole	3a	0.38	$F_{40\%}$	0.494	$F_{35\%}$
Shallow water flatfish	4,5[5]	0.150, 0.162, 0.204	$F_{40\%}$, F=.75M [5]	0.192, 0.20, 245	$F_{35\%,}$ F=M [6]
Arrowtooth	3a	0.183	$F_{40\%}$	0.219	$F_{35\%}$
Pacific ocean perch	3a	0.123	$F_{40\%}$	0.142	$F_{35\%}$
Rougheye and blackspotted rockfish	3a	0.040	$F_{40\%}$	0.048	$F_{35\%}$
Shortraker rockfish	5	0.0225	F=.75M	0.03	F=M
Other slope rockfish	4, 5[7]	0.053, 0.038-0.075	$F_{40\%,}$ F=.75M [7]	0.064, 0.05, 0.10	$F_{35\%,}$ F=M [8]
Northern rockfish	3a	0.059	$F_{40\%}$	0.071	$F_{35\%}$
Pelagic Shelf Rockfish	3a,5[9]	0.087, 0.0525	$F_{40\%}$, F=.75M [9]	0.106, 0.07	$F_{35\%,}$ F=M [10]
Demersal Shelf rockfish	4	0.02	F=M	0.032	$F_{35\%}$
Thornyhead rockfish	5	0.0225	F=.75M	0.03	F=M
Atka mackerel	6	NA	F_{ABC} [11]	NA	F_{OFL} [12]
Skates	5	0.075	F=.75M	0.10	F=M
Sculpins	5	0.1425	F=.75M	0.19	F=M
Squid	6	NA	F_{ABC} [13]	NA	F_{OFL} [14]
Octopus	6	NA	F_{ABC} [15]	NA	F_{OFL} [16]
Sharks	6	NA	F_{ABC} [17]	NA	F_{OFL} [18]

1/ Fishing mortality rate corresponding to acceptable biological catch.
2/ Maximum fishing mortality rate allowable under overfishing definition.
3/ $F_{40\%}$= for Dover sole (Tier 3a), ABC=.75 x average catch (1978-1995) for other deepwater flatfish (Tier 6).
4/ $F_{35\%}$ for Dover sole (Tier 3a), average catch (1978-1995) for other deepwater flatfish (Tier 6).
5/ $F_{40\%}$ for northern and southern rocksole (Tier 4), F=.75M for remaining shallow water flatfish (Tier 5).
6/ $F_{35\%}$ for northern and southern rocksole (Tier 4), F=M for remaining shallow water flatfish (Tier 5).
7/ $F_{40\%}$ for sharpchin rockfish (Tier 4), F=.75M for other species (Tier 5).
8/ $F_{35\%}$ for sharpchin (Tier 4), F=M for other species (Tier 5).
9/ $F_{40\%}$ for dusky rockfish (Tier 3a), F=.75M for dark,,widow, and yellowtail rockfish (Tier 5).
10/ $F_{35\%}$ for dusky rockfish (Tier 3a), F=M for dark, widow and yellowtail rockfish (Tier 5).
11/ ABC for Atka mackerel is equal to 0.75 x average catch from 1978 to 1995. This maximum permissible ABC is intended for bycatch in other target fisheries and to minimize targeting.
12/ OFL for Atka mackerel is equal to average catch from 1978 to 1995.
13/ ABC for squid is equal to 0.75 x the maximum catch of squid from 1997-2008. This is a modified Tier 6 recommendation.
14/ OFL for squid is equal to the maximum catch of squid from 1997-2008. This is a modified Tier 6 recommendation.
15/ ABC for octopus is equal to 0.75 x the maximum catch of octopus from 1997-2008. This is a modified Tier 6 recommendation.
16 OFL for octopus is equal to the maximum catch of octopus from 1997-2008. This is a modified Tier 6 recommendation.
17/ ABC for sharks is equal to 0.75 x the catch from 1997-2008 (which differs from the standard Tier 6 time frame of 1978-1995).
18/ OFL for sharks is equal to the average catch from 1997-2008 (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 2010 recommended fishing mortality rates and ABCs, for those species whose recommendations were below the maximum. Relative to last year, there are no changes to this table.

Species	Tier	2010 *Max* F_{ABC}	*Max* ABC	F_{ABC}	2010 ABC
Pollock[1]	3b	0.17	89,800	0.14	75,500
Demersal shelf rockfish	4	0.026	384	0.02	295

1/ The Plan Team recommended 2010 W/C pollock ABC of 75,500 mt is reduced by 1,650 mt to accommodate the Prince William Sound GHL. For comparisons in this table, the maximum permissible ABC of 89,800 mt should be compared with the full ABC 77,150 mt.

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

Year	Pollock	Pacific Cod	Sable Fish	Flat Fish	Arrowtooth Flounder	Slope Rock Fish[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[I]	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[J]	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[H]	42,297	38,401	10,364	16,657	24,438	18,577

a/ Catch defined as follows: (1) 1961-78, Pacific ocean perch (*S. alutus*) only; (2) 1979-1987, the 5 species of the Pacific ocean perch complex; 1988-90, the 18 species of the slope rock assemblage; 1991-1995, the 20 species of the slope rockfish assemblage.
b/ Catch from Southeast Outside District.
c/ Thornyheads were included in the other species category, and are foreign catches only.
d/ After numerous changes, the other species category was stabilized in 1981 to include sharks, skates, sculpins, eulachon, capelin (and other smelts in the family Osmeridae and octopus. Atka mackerel and squid were added in 1989. Catch of Atka Mackerel is reported separately for 1990-1992; thereafter Atka mackerel was assigned a separate target species.

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

Year	Pelagic Shelf Rockfish	Demersal Shelf Rockfish[b]	Thorny Heads[c]	Atka Mackerel[e]	Skates[k]	Other Species[d]	Total All Species
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[H]	3,037	137	657	2,221	3,935	2,085	163,382

e/ Atka mackerel was added to the Other Species category in 1988 and separated out in 1994
f/ PSR includes light dusky, yellowtail, widow, dark, dusky, black, and blue rockfish; black and blue excluded in 1998, dark in 2008.
g/ Does not include at-sea discards.
h/ Catch data reported through November 7th, 2009.
i/ Includes all species except arrowtooth.
j/ Does not include state fisheries
k/ Includes all managed skates species

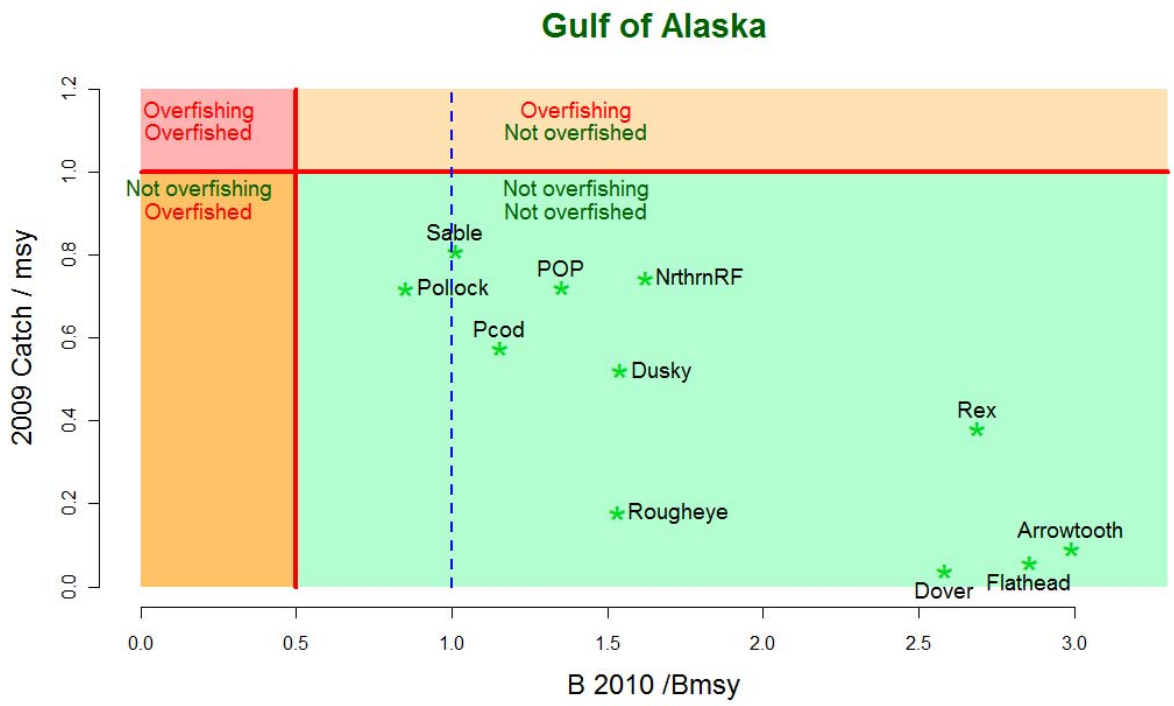


Figure 1. Summary status of age-structured GOA species relative to 2009 catch levels (vertical axis) and projected 2010 spawning biomass relative to B_{msy} levels. Note that the 2009 MSY level is defined as the 2009 catch at F_{OFL}.

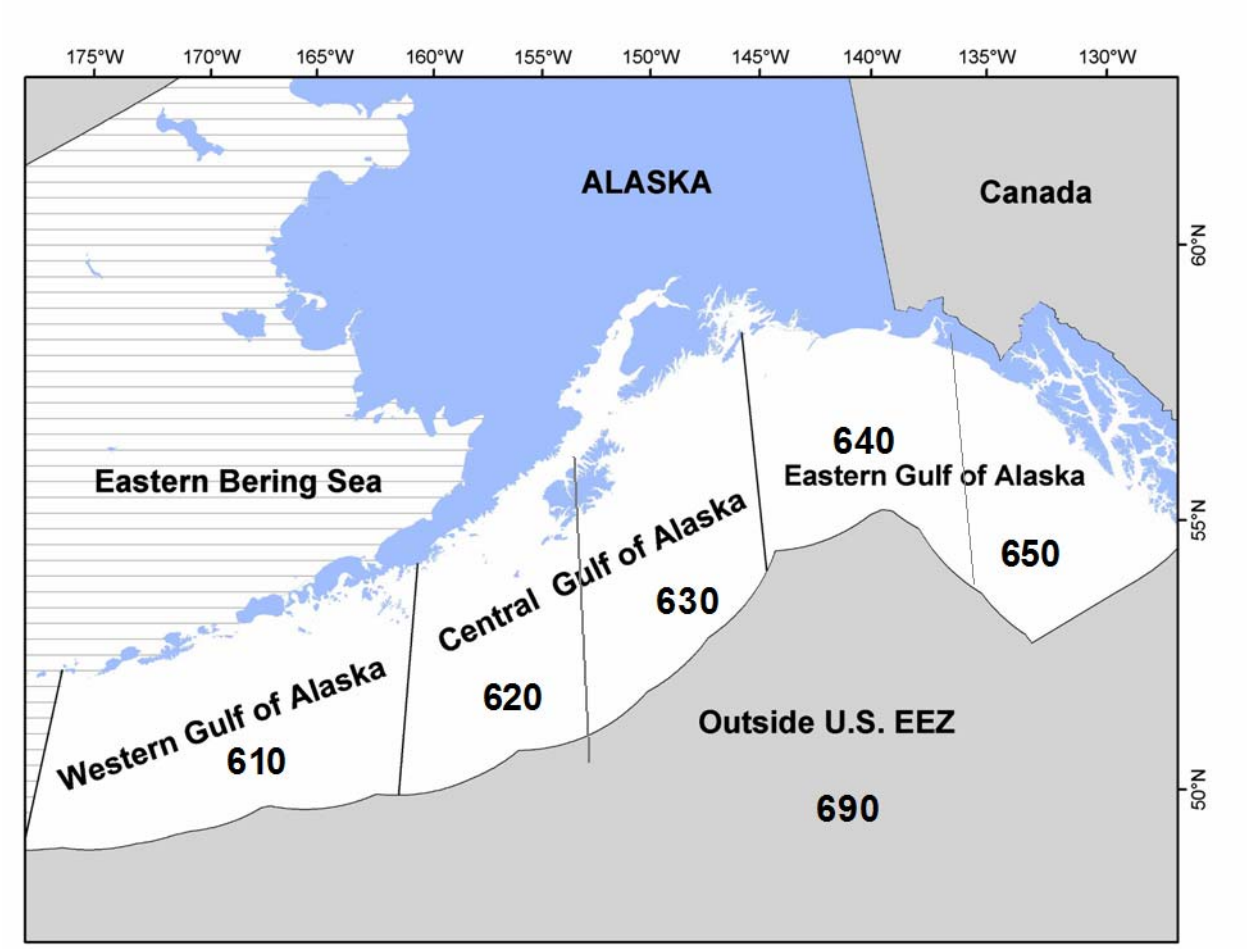


Figure 2. Gulf of Alaska statistical and reporting areas.

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