APPENDIX B

STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

FOR THE GROUNDFISH RESOURCES OF THE GULF OF ALASKA

Compiled by

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

with contributions by

K. Aydin, S. Barbeaux, J. Boldt, C. Brylinsky, D. Carlile, H. Cheung, D. Clausen, E. Connors, D. Courtney, M. Dalton, M. Dorn, N. Friday, J. Fujioka, S. Gaichas, K. Goldman, M. Guttormsen, D. Hanselman, J. Heifetz, J. Ianelli, M. Jaenicke, E. Jorgensen, R. Lauth, S. Lowe, C. Lunsford, B. Matta, B. Megrey, D, O. Ormseth, T. Pearson, R. Reuter, C. Rodgveller, N. Sagalkin, K. Shotwell, L. Slater, K. Spalinger, P. Spencer, J. Stahl, W. Stockhausen, D. Stram, T. Tenbrink, G. Thompson, C. Tribuzio, B. Turnock, J. Vollenweider, T. Wilderbuer, and M. Wilkins.

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North Pacific Fishery Management Council
605 W 4th Avenue, Suite 306
Anchorage, AK 99501

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

Table of Contents

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 17-21st, 2008 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), Sandra Lowe, Jeff Fujioka, Jon Heifetz, Cleo Brylinsky, Tom Pearson, Nick Sagalkin, Mike Dalton, Nancy Friday, Leslie Slater, Henry Cheung 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, rougheye 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, 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 2009 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 2008 was issued (NPFMC 2007), the following new information has been incorporated in the stock assessments:

1) Pollock: (a) Total fishery catch from the 2007 fishery and preliminary catch estimates for the 2008 fishery, (b) age composition from the 2007 fishery; (c) biomass from the 2008 Shelikof Strait echo integration trawl (EIT) survey; (d) age compositions from the 2007 and 2008 Shelikof Strait EIT surveys (e) age composition from the 2007 NMFS bottom trawl survey, and f) 2008 biomass and length composition from the ADF&G crab/groundfish trawl survey.
2) Pacific cod: (a) Commercial fishery size composition data for the years prior to 1990 were recompiled, resulting in several new records; (b) size composition data from the 2007 and preliminary estimates for the 2008 fisheries; (c) age composition and mean length-at-age data from the 1987, 1990, and 1993 GOA bottom trawl surveys were incorporated; (d) the ageing error matrix was updated; (e) seasonal catch per unit effort (CPUE) data for the trawl, longline, and pot fisheries from 2007 were updated, and preliminary catch rates for the longline and pot fisheries from 2008 were incorporated; (f) the time series of weight-at-length data was recompiled; and (g) each trawl survey abundance estimate and each survey size composition vector was split into two portions: the portion consisting of fish smaller than 27 cm (referred to as the "sub-27" survey), and the portion consisting of fish 27 cm and larger (referred to as the "27-plus" survey).
3) Sablefish: (a) Relative abundance and length data from the 2008 longline survey, (b) relative abundance and length data from the 2007 longline and trawl fisheries, (c) age data from the 2007 longline survey and longline fishery, (d) use of simpler selectivity functions.
4) Flatfish: Flatfish have been moved to a biennial stock assessment schedule to coincide with new survey data. Executive summaries only are presented in this SAFE Report with last year's key assessment parameters and projections for 2009 and 2010..
5) Shallow-water flatfish: Shallow-water flatfish have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2009 and 2010. The only new information that is updated in the projections is the 2007 catch and the best estimate of 2008 catch.
6) Deepwater flatfish: Deep-water flatfish have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and model-based projections for Dover sole for 2009 and 2010. The only new information that is updated in the projections is the 2007 catch and the best estimate of 2008 catch.
7) Rex sole: Rex sole have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and model-based projections for 2009 and 2010. The only new information that is updated in the projections is the 2007 catch and the best estimate of 2008 catch.
8) Arrowtooth flounder: Arrowtooth flounder have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and model-based projections for 2009 and 2010. The only new information that is updated in the projections is the 2007 catch and the best estimate of 2008 catch.
9) Flathead sole: Flathead sole have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and model-based projections for 2009 and 2010. The only new information that is updated in the projections is the 2007 catch and the best estimate of 2008 catch

10) Rockfish: Rockfish have been moved to a biennial stock assessment schedule to coincide with new survey data. Executive summaries only are presented in this SAFE Report with last year's key assessment parameters and projections for 2009 and 2010.
11) Pacific ocean perch: Pacific ocean perch have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and model-based projections for 2009 and 2010. The only new information that is updated in the projections is the 2007 catch and the best estimate of 2008 catch. (a) a comparison of the effects of weighting biomass or proportions when apportioning biomass for rockfish is appended to the Pacific ocean perch summary; (b) historical maps of observed Pacific ocean perch catches for all gear types are provided from 1993-2007.
12) Northern rockfish: Northern rockfish have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and model-based projections for 2009 and 2010. The only new information that is updated in the projections is the 2007 catch and the best estimate of 2008 catch. (a) historical maps of observed northern rockfish catches for all gear types are provided from 1993-2007.
13) Rougheye rockfish: Rougheye rockfish have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and model-based projections for 2009 and 2010. The only new information that is updated in the projections is the 2007 catch and the best estimate of 2008 catch. (a) Orr and Hawkins (2008) formally verified the presence of two species, rougheye rockfish (*Sebastes aleutianus*) and blackspotted rockfish (*S. melanostictus*), in what was once considered a single variable species with light and dark color morphs. The assessment now refers to these two species together as the rougheye rockfish complex. (b) historical maps of observed rougheye rockfish catches for all gear types are provided from 1993-2007.
14) Shortraker and other slope rockfish: Shortraker and other slope rockfish have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters. The only new information that is updated in the projections is the 2007 catch and the best estimate of 2008 catch. There is no new survey information for shortraker and other slope rockfish, therefore the 2007 estimates are rolled over for 2009 and 2010. (a) historical maps of observed shortraker catches for all gear types are provided from 1993-2007.
15) Pelagic shelf rockfish: Pelagic shelf rockfish have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters. The only new information that is updated in the projections is the 2007 catch and the best estimate of 2008 catch. There is no new survey information for dark, widow, and yellowtail rockfish, therefore the 2007 estimates are rolled over for 2009 and 2010. For dusky rockfish, new information for this year's projection model is updated 2007 catch and the best estimate of the 2008 catch. (a) historical maps of observed dusky and dark catches for all gear types are provided from 1993-2007.
16) Demersal shelf rockfish: Demersal shelf rockfish have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters. The only new information available is updated catch information for SEO and average weights for the East Yakutat (EYKT) and Southern Southeast Outside (SSEO) Management Areas where directed commercial fisheries occurred in 2008. The average weight data was derived from the directed fishery and incidental catch in the halibut fishery. No new surveys were conducted in 2008. However, the changes to average weights changed the biomass estimates in EYKT and SSEO

17) Thornyheads: Thornyhead rockfish have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters. The only new information that is updated in the projections is the 2007 catch and the best estimate of 2008 catch. There is no new trawl survey information for thornyhead rockfish, therefore the 2007 estimates are rolled over for 2009 and 2010. The summary noted an unusually large number of shortspine thornyheads observed in the 2008 GOA longline survey.
18) Atka mackerel: Atka mackerel has been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters. The only new information for the projection is the 2007 catch and the best estimate of 2008 catch. Gulf of Alaska Atka mackerel are managed under Tier 6 as a bycatch only fishery, therefore the 2007 estimates are rolled over for 2009 and 2010. The summary noted significant catches of Atka mackerel were taken in area 610 and to some extent from area 620 by rockfish fisheries resulting in going over the 2008 TAC. Age data from the 2007 survey continue to show the 1999 year class dominates the age distribution.
19) Skates: Skates have been moved to a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key parameters. The only new information for the projection is the 2007 catch and the best estimate of 2008 catch. There is no new trawl survey information for skates, therefore the 2007 estimates are rolled over for 2009 and 2010. (a) updated life history information from recent research results; (b) the Alaska Department of Fish & Game is preparing to open a limited fishery for skates in the state waters of Prince William Sound.
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) Information on total sculpin catch by target fishery and gear type is available for 2007; (b) 2008 is first year that sculpin species are identified to species in the fishery observer data; (c) biomass estimates from the GOA are presented for selected sculpin species from triennial and biennial AFSC bottom trawl surveys; (d) length frequencies of the four most abundant sculpin species are presented from AFSC survey data of the GOA.
22) Squid: (a) Total catch for GOA squids is estimated for 1990 though 2008; (b) biomass information is presented for squids from the 1984-2007 GOA bottom trawl surveys.
23) Octopus: (a) 2007 bottom trawl survey biomass estimates; (b) preliminary discard mortality data for pot gear.
24) Sharks: (a) Biomass estimates from the 2007 GOA bottom trawl survey are presented; (b) updated life history and population demographic information based on recent research results; (c) the 2006 assessment authors recommended a "Modified Tier 6 Approach"which used the maximum (rather than average) catch from 1997-2005 to set OFL. The current assessment authors recommend the standard Tier 6 criteria of average catch over an expanded timeline (1997-2007) be used to set the OFL and ABC for the shark complex.
25) Groundfish, generally: Updated catch data from the NMFS Observer Program and Regional Office for 2007 and through November 8th, 2008.

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.

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
   $ABC \le 0.75 \times OFL$

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=$F_{40\%}$.

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 2009 and 2010, 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 2021 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 Dover sole, flathead sole, arrowtooth flounder, Pacific ocean perch, rougheye rockfish, northern rockfish, and dusky rockfish are above target stock size. The abundances of pollock, Pacific cod, 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 2008, and recommendations for ABCs and overfishing levels (OFLs) for 2009 and 2010. 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 2009, 2010 ABCs for target species are 516,055 t (2009), 562,762 t (2010) which are within the FMP-approved optimum yield (OY) of 116,000 - 800,000 t for the Gulf of Alaska. The sum of 2009 and 2010 OFLs are 632,498 t and 722,134 t, respectively. The Team notes that because of halibut bycatch mortality considerations in the high-biomass flatfish fisheries, an overall OY for 2009 will be considerably under this upper limit. For perspective, the sum of the 2008 TACs was 262,826 t, and the sum of the ABCs was 536,201 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 2007 and 2008 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 2009 and 2010 correspond to the Plan Team recommendations.
4. The exploitable biomass for 2007 and 2008 that are reported in the following summaries were estimated by the assessments in those years. Comparisons of the projected 2009 biomass with previous years' levels should be made with biomass levels from the revised hindcast reported in each assessment.
5. The values used for 2009 and 2010 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 2009 and 2010 (Table 1). In the case of stocks managed under Tier 3, 2009 and 2010 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 the case of stocks managed under Tiers 4-6, 2009 and 2010 projections are set equal to the Plan Team's recommended values for 2008.

The 2010 ABC and OFL values recommended in next year's SAFE report are likely to differ from this year's projections for 2010, for the same reasons that the 2009 projections in this SAFE report differ from the projected values from last year's SAFE report.

Effects of Cancelled Surveys

Except under Tier 1, current harvest rules do not account for assessment uncertainty. Assessment uncertainty is increasing in Alaska groundfish assessments because some recent surveys have been cancelled due to decreased funding. Lacking an uncertainty adjustment, ABC recommendations may risk long-term fishery sustainability. The Plan Teams make three recommendations: (1) increase funding so that surveys are not cancelled; (2) modify harvest rules so that more Tiers (especially 3 and 5) account for assessment uncertainty; (3) request that assessment authors present a measure of assessment uncertainty (the probability that female spawning biomass will fall below 20% of the unfished value in the next three to five years).

Ecosystem Considerations for the Gulf of Alaska stock assessments

The ecosystem considerations chapter (bound separately) consists of three sections: ecosystem assessment, ecosystem status indicators, and ecosystem-based management indices and information. A summary of GOA specific trends and incorporation of ecosystem assessment data in specific stock assessment chapters is included in this section in survey years where full assessments are provided for all species.

Stock status summaries

1. Walleye Pollock

Status and catch specifications (t) of pollock and projections for 2009 and 2010. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2009 and 2010 are those recommended by the Plan Team. Catch data are current through November 8, 2008. Note that the projections for 2010 are subject to change in 2009. The 2009 and 2010 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	2007	861,072	95,429	68,307	68,307	51,842
	2008	741,819	83,150	60,180	60,180	51,721
	2009	675,749	69,630	49,900		
	2010		101,960	74,330		
W/C/WYK	2007	833,710	87,220	62,150	62,150	51,842
	2008	705,020	72,110	51,940	51,940	51,721
	2009	638,950	58,590	41,620		
	2010		90,920	66,050		
EYK/SEO	2007	27,362	8,209	6,157	6,157	0
	2008	36,799	11,040	8,240	8,240	0
	2009	36,799	11,040	8,280		
	2010		11,040	8,280		

Changes from previous assessment

The age-structured model developed using AD Model Builder and used for GOA W/C/WYK pollock assessments in 1999-2007 is fundamentally unchanged. This year's pollock chapter features the following new data: (1) 2007 total catch and catch at age from the fishery, (2) 2008 biomass and 2007 and 2008 age composition from the Shelikof Strait EIT survey, (3) 2007 age composition from the NMFS bottom trawl survey, and (4) 2008 biomass and length composition from the ADF&G crab/groundfish trawl survey. A vessel comparison (VC) experiment between *R/V Miller Freeman* and *R/V Oscar Dyson* was conducted in March 2007 during the Shelikof Strait acoustic-trawl survey. Results indicate that the ratio of 38 kHz pollock backscatter from the *R/V Oscar Dyson* relative to the *R/V Miller Freeman* was significantly greater than one (1.13), as would be expected if the quieter *R/V Oscar Dyson* reduced the avoidance response of the fish. Methods to incorporate this result in the assessment model were explored. The method applied was to treat the *R/V Miller Freeman* and the *R/V Oscar Dyson* time series as independent survey time series, and include the vessel comparison results directly in the log likelihood of the assessment model. In 2007, the largest discrepancy between fishery data and the model prediction was a lower than expected abundance of the 2004 year class (age-3 fish), suggesting that this year class is less abundant than previously estimated. The abundance of this year class was also less than expected in the 2008 Shelikof Strait EIT survey. General trends in survey time series are fit reasonably well, but since each survey time series shows a different pattern of decline, the model is unable to fit all surveys simultaneously. The ADF&G survey matches the model trend better than any other survey, despite receiving less weight in model fitting. The 2007 NMFS trawl survey is nearly exactly equal to the model prediction. Since this survey is the most comprehensive survey, the consistency between the NMFS survey and the assessment lends support to assessment results.

Spawning biomass and stock status trends

The 2008 Shelikof Strait EIT trawl survey was the first conducted using the *R/V Oscar Dyson*. The 2008 biomass estimate for Shelikof Strait was 15% higher than the 2007 estimate. In winter of 2007, a vessel comparison experiment was conducted between the *R/V Miller Freeman* (MF) and the *R/V Oscar Dyson* (OD), which obtained a OD/MF ratio of 1.132. These results suggest that biomass was relatively constant from 2007 to 2008. Biomass estimates of Shelikof Strait fish ≥43 cm (a proxy for spawning biomass) decreased by 52% from the 2007 estimate, apparently due to below average recruitment to the spawning population. The 2008 ADF&G crab/groundfish survey biomass estimate increased 9% from 2007.

The Plan Team concurred with the author's choice to use the same model as last year with the addition of the vessel comparison to provide assessment advice. This model fixed the NMFS bottom trawl survey catchability (q) at 1.0 and estimated other survey catchabilities. Although the likelihood is higher for models with q closer to 0.74, the change in likelihood is small (less than 1.5) between models with q fixed at 1.0 or estimated. Fixing q at 1.0 results in a more precautionary estimate of spawning biomass.

Despite the significant difference in the ratio of pollock backscatter between the *R/V Miller Freeman* and the *R/V Oscar Dyson*, the impact on assessment results and recommended ABCs was minor regardless of the modeling approach. The 2009 spawning biomass and ABCs varied 5-7% across different model configurations, while population biomass varied by about 3%. Models that included a likelihood component for the vessel comparison experiment were considered to be a better approach from a technical perspective.

The model results produced an estimated 2009 spawning biomass of 132,810 t, or 22.4% of unfished spawning biomass. The $B_{40\%}$ estimate is 237,000 t. Estimates of 2009 stock status indicate that spawning biomass remains low.

Status determination

Pollock are not overfished nor are they approaching an overfished condition.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Because model estimated 2009 female spawning biomass is below $B_{40\%}$, the W/C/WYK Gulf of Alaska pollock are in Tier 3b. Similar to last year, the Plan Team accepted the author's recommendation to reduce F_{ABC} from the maximum permissible using the "constant buffer" approach (first accepted in the 2001 GOA pollock assessment). The projected 2009 age-3+ biomass estimate is 638,950 t. Markov Chain Monte Carlo analysis indicated the probability of the stock being below $B_{20\%}$ to be highest in 2009, with a probability of 12%, but drops to less than 1% in subsequent years. **Therefore, the ABC for 2009 based on this precautionary model configuration and adjusted harvest control rule is 43,270 t (F_{ABC} = 0.11) for GOA waters west of 140°W longitude (Note that this ABC recommendation is not reduced by 1,650 t to account for the Prince William Sound GHL, thus the final ABC is 41,620 for 2009). The 2009 OFL under Tier 3b is 58,590 t (F_{OFL}= 0.15).**

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 2007 survey. The 2007 NMFS bottom trawl survey increased 37% since 2005. This results in a **2009 ABC of 8,280 t**, and a **2009 OFL of 11,040 t**.

In recent years, the two year projections of ABCs show increases that have not been realized. This could be due to a number of factors including the use of average recruitment in the current projection while below average recruitment is occurring, and juvenile natural mortality may be higher than assumed.

Ecosystem Considerations

There were no major 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. The Plan Team thinks that this provides additional support for continued precautionary management of GOA pollock.

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 managed pollock fishery in Prince William Sound, are tabulated below:

Area apportionments (reduced by 1,650 t) for 2009 and 2010 pollock ABCs for the Gulf of Alaska (t).

Year	610	620	630	640	650	
	W	Central	Central	W. Yakutat	E.Yak/SE	Total
2009	15,249	14,098	11,058	1,215	8,280	49,900
2010	24,199	22,374	17,548	1,929	8,280	74,330

2. Pacific cod

Status and catch specifications (t) of Pacific cod and projections for 2009 and 2010. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch includes the federally reported catch (parallel and catch outside 3 miles; excludes state fishery inside 3-miles) and is current through November 8th 2008.

Area	Year	Biomass	OFL	ABC	TAC	Catch
GOA	2007	375,000	97,600	68,859	52,264	39,473
	2008	*233,310**	88,660	66,493	50,269	42,424
	2009	520,000	66,600	55,300		
	2010		126,000	79,500		

*the 2008 biomass is the trawl survey biomass from 2007

Changes from previous assessment

Extensive work on the GOA Pacific cod model has occurred since the November 2007 Plan Team meeting. Changes to the input data include updated catch data, recompilation of the pre-1990 fishery size composition data, updating the ageing error matrix, recompilation of the weight-at-length time series, updating the 2007 seasonal catch-per-unit-effort data from the longline, pot, and trawl fisheries, and splitting each trawl survey abundance estimate and size composition into fish smaller than 27 cm (referred to age the "sub-27" survey) and fish 27 cm and larger (referred to as the "27-plus" survey). New data to the model included age composition and length-at-age data from the 1987, 1990, and 1993 GOA shelf bottom trawl surveys, and preliminary catch rates for the 2008 longline and pot fisheries.

Three models were presented in the September 2008 Plan Team meeting which addressed many of the previous comments of the Plan Teams and the SSC. In particular, many aspects of the model were changed, including splitting the survey time series into large and small fish, weighting the age and length composition data, modeling the weight-at-length data, and estimation of catchability and selectivity. One

of the three models is an "exploratory" model which made use of some new features of the Stock Synthesis modeling software.

Two models were presented to the November 2008 Plan Team. Model A is the "reference" model requested by the SSC during its October 2008 meeting and is similar to the exploratory model from September 2008 (appended to the chapter) with the following two changes: 1) estimation of the descending slope of dome-shaped selectivity curves is unconstrained and 2) the distribution of length at age 1 during the summer is estimated externally rather than internally. Model B is the author's preferred model, and differs from Model A in that 1) a stepwise model selection process was used for incorporating time-varying selectivity; 2) a constant catchability was used for 27-plus survey; and 3) the input sample sizes for the age composition were decreased substantially. The Team provisionally accepted the use of the model B, as recommended by the assessment author, and requests that additional work be conducted on the model.

The current GOA Pacific cod models are complex, with fish caught in multiple seasons with multiple fisheries and gear types, and estimation of complex dome-shaped selectivity curves that vary between years, seasons and gear types. A number of issues were noted by the Plan Team and authors regarding fit to survey data and estimation of selectivity. The fit of the preferred model to the 27-plus survey abundance was problematic in that each of the model estimates was an underestimate of the observed survey abundance estimate. The fit to this time series improved as the age and length compositions were downweighted, which indicates some inconsistency in the input data which should be explored in more detail. Some of the fishery and survey selectivity curves show sharp reductions at older ages or larger sizes which seem implausible.

Spawning biomass and stock status trends

Model B results produced an estimated 2009 spawning biomass of 88,000 t, or 34% of unfished spawning biomass. The $B_{40\%}$ estimate was 102,200 t. Spawning biomass was projected to increase dramatically in subsequent years because of the 2006 year class which was estimated to be the highest on record. The extent of the rate of increase depends on the magnitude of this year class which was extremely uncertain being based solely on length frequencies collected in the 2007 trawl survey. This year class has increased the estimate of the recruitment variability during the period 1978-2007 relative to the previous assessments.

Status determination

Pacific cod are not overfished nor are they approaching an overfished condition.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Team discussed whether to base harvest specifications on a model that the Plan Team and author recognize needs more work, or continue to use the Tier 5 harvest specifications. An issue with using the Tier 5 specifications is that reliance on survey estimates from earlier years may poorly reflect current biomass levels. The Team accepted the results from the model as an improvement over Tier 5 and therefore recommends Tier 3 for this stock. The model estimate of 2009 female spawning biomass is below $B_{40\%}$, therefore Gulf of Alaska Pacific cod are in Tier 3b. The Plan Team accepted the author's recommendation to use the maximum permissible F value from Tier 3b. The projected 2009 age-0+ biomass estimate is 520,000 t. The probability of the stock being below $B_{20\%}$ was estimated to be less than 1% in 2009 and subsequent years. **Therefore, the ABC for 2009 is 55,300 t (**F_{ABC} =0.44). **The 2009 OFL under Tier 3b is 66,600 t** (F_{OFL}= 0.54).

The uncertainty regarding the 2006 year class warrants caution for 2010 specifications. The maximum permissible 2010 ABC is 103,700 t. The Team concurred with the author's recommendation that the 2010 ABC be set below the maximum permissible ABC at 79,500 t and 2010 OFL at 126,000 t.

Additional Plan Team recommendations

The Team also requests that the assessment include more information and discussion on the biology and life-history of Pacific cod. This material is requested for background information and to help understand how the behavior and distribution patterns of Pacific cod interact with the fishery and survey processes. If biological information that could improve understanding is unavailable, the Team requests that these be identified as research priorities. The Team strongly reiterates the need for the 2009 GOA trawl survey in order to improve the estimation of the 2006 year class.

Ecosystem Considerations

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

Area apportionment

The Team concurred with the author's recommendation to apportion the 2008 and 2009 ABC according to the average of biomass distribution in the three most recent surveys. For the Team's recommended ABC level, this gives:

	Apportionment	2009	2010
West	39%	21,567	31,005
Central	57%	31,521	45,315
East	4%	2,212	3,180
Total		55,300	79,500

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 2009 and 2010 are those recommended by the Plan Team. Catch data are current through 11/08/2008.

Area	Year	Age 4+ Biomass	OFL	ABC	TAC	Catch
GOA	2007	158,000	16,906	14,310	14,310	12,265
	2008	167,000	15,040	12,730	12,730	12,284
	2009	149,000	13,190	11,160		
	2010		12,231	10,337		

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 2008 longline survey, relative abundance and length data from the 2007 longline and trawl fisheries, and age data from the 2007 longline survey and longline fishery. The move to a sex-specific model in 2007 increased the number of selectivity parameters. These parameters were estimated with high correlation and low precision. Simpler selectivity functions were used this year and some selectivity curves were linked to improve parameter estimation with minimal effect on model fits or trends.

Spawning biomass and stock status trends

The survey abundance index decreased 2% from 2007 to 2008, a change which follows a 14% decrease from 2006 to 2007. The fishery abundance index was up 5% from 2006 to 2007 (2008 data not yet

available). The spawning biomass is projected to be similar from 2008 to 2009, but is expected to decline through 2012. The projected 2009 spawning biomass is 36% of unfished biomass compared with about 29% of unfished biomass estimated during the 1998 to 2001 period. The 1997 year class has been an important contributor to the population but has been reduced and comprises 13% of the 2008 spawning biomass.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Team has determined that this stock qualifies for management under Tier 3. The updated point estimate of $B_{40\%}$ is 115,120 t (**combined across the EBS, AI, and GOA**) . Projected spawning biomass (combined areas) for 2009 is 103,127 t (90% of $B_{40\%}$), placing sablefish in Tier 3b.

The maximum permissible value of F_{ABC} under Tier 3b is 0.085, resulting in a 2009 GOA ABC of 11,160 t. The recommended 2009 ABC is lower than the 2008 ABC of 12,730 t. The OFL fishing mortality rate under Tier 3b is 0.101 resulting in a GOA OFL of 13,190 t.

Status determination

Alaska sablefish are not overfished nor are they approaching an overfished condition.

Additional Plan Team recommendations

During the joint team meeting there was discussion regarding sperm whale depredation on the longline survey. The suggestion to use the survey vessel to directly measure active depredation by sperm whales through the use of sonar or acoustics was supported by the Plan Team. The purpose of these studies will be to quantify sperm whales depredation during the longline survey. The Teams also requested a new stock assessment of sperm whales to update the population estimate and estimate of the potential biological removal (PBR). There is concern over what appears to be an increase in sperm whale interactions and the likelihood that the population of sperm whales has increased.

The Team concurred with the author's list of data gaps and research priorities and looks forward to the results of the upcoming CIE review.

Ecosystem Considerations

The ecosystem considerations section of the assessment was similar to the previous assessment. The section on fishery-specific effects on EFH non-living substrate was updated through 2007.

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 2009 ABC among regions, resulting in the following values: 2,720 t for EBS, 2,200 t for AI, and 11,160 t for GOA. Relative to 2008, apportionments to the EBS, AI and GOA all decreased.

Using the survey/fishery based apportionment scheme described above, the 2009 OFL is apportioned among regions and results in the following values: 3,210 t for EBS, 2,600 t for AI, and 13,190 t for GOA. These values also represent a decrease from 2008 OFL levels for all three regions.

GOA area apportionments of sablefish ABC's for 2009 and 2010 (includes allocation of 5% of combined EGOA ABC to West Yakutat)

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2009	1,640	4,990	1,784	2,746	11,160
2010	1,523	4,625	1,645	2,544	10,337

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

Status and catch specifications (t) of deep water flatfish (*Dover sole and others*) and projections for 2009 and 2010. Biomass for each year corresponds to the estimate given when the ABC was determined. Catch data in this table are current through 11/08/2008

Year	Biomass	OFL	ABC	TAC	Catch
2007	134,196	10,431	8,707	8,707	278
2008	132,625	11,343	8,903	8,903	561
2009	133,025	11,578	9,168		
2010		12,367	9,793		

Changes from previous assessment

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

New data for the deep water flatfish (*excluding Dover sole*) assessment from last year included the updated 2007 catch and estimated 2008 catch. New information available to update the Dover sole projection model consists of the total catch for 2007 (277 t) and the current catch for 2008 (539 t as of Sept. 20, 2008). To run the projection model to predict ABC's for 2009 and 2010, estimates are required for the total catches in 2008 and 2009. Because the current catch of Dover sole (539 t) is the largest in recent years, it was used as a "best" estimate of the total catches taken in 2008 and 2009

Spawning biomass and stock status trends

Dover sole female spawning biomass peaked in 1991 and declined to 2005. Spawning biomass trend is slightly increasing.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Tier 6 calculation (based on average catch from 1978-1995) for the deep water flatfish complex (*excluding Dover sole*) ABC is 183 t and the OFL is 244 t. These values apply for 2009 and 2010 ABC and OFLs.

For the Dover sole Tier 3a assessment the 2009 ABC using $F_{40\%}$=0.137 is 8,985 and 9,610 t for 2010. The 2009 OFL using $F_{35\%}$=0.176 is 11,334 t and 12,123 t for the 2010 OFL..

The GOA Plan Team agrees with the authors' recommended 2009 and 2010 ABC's and OFL's for the deep water flatfish complex which were equivalent to the maximum permissible ABC.

Status determination

Catch levels for this complex remain below the TAC. The complex is not approaching a level where overfishing would be a concern.

Ecosystem Considerations summary

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

Area apportionment

Area apportionments of deep water flatfish (*excluding Dover sole*) are based on proportions of historical catch. Area apportionments of Dover sole (using $F_{40\%}$) are based on the fraction of the 2007 survey

biomass in each area. The recommend percentage apportionments are identical to the 2008 apportionments.

Area apportionments of deep water flatfish (*Dover sole and others*) ABC's for 2009 and 2010 (using $F_{40\%}$) are based on the fraction of the 2007 survey biomass in each area.

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2009	706	6,927	997	538	9,168
2010	747	7,405	1,066	575	9,793

5. Shallow water flatfish

Status and catch specifications (t) of shallow water flatfish and projections for 2009 and 2010. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/08/2008.

Year	Biomass	OFL	ABC	TAC	Catch
2007	365,766	63,840	51,450	19,972	8,788
2008	436,590	74,364	60,989	22,256	8,889
2009	436,590	74,364	60,989		
2010		74,364	60,989		

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, and Alaska plaice. New data for the shallow water flatfish from last years assessment included the 2007 and 2008 catch estimates.

Spawning biomass and stock status trends

Condition of shallow water flatfish stocks is based on the bottom trawl survey from 1984 to 2007. Survey abundance estimates for the shallow-water complex were higher in 2007 compared to 2005 for northern rock sole, southern rock sole, sand sole, starry flounder, butter sole and Alaska plaice. The 2007 survey abundance estimates were lower than 2005 for yellowfin sole and English sole. The overall survey abundance increased by 70,824 t in 2007 over 2005.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Northern and southern rock sole are managed in Tier 4 while other shallow water flatfish are in Tier 5. 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 2009 and 2010 shallow-water flatfish remains the same as the 2008 ABC (60,989 t) and OFL (74,364 t). The GOA Plan Team agrees with authors recommended ABC for the shallow water flatfish complex which was equivalent to maximum permissible ABC.

Status determination

Catch levels for this complex remain below the TAC. The complex is not considered to be approaching a level where overfishing would be a concern.

Ecosystem Considerations summary

No ecosystem consideration section is included in this year's assessment.

Area apportionment

Area apportionments of shallow water flatfish ABC's for 2008 and 2009 are based on the fraction of the 2007 survey biomass in each area.

Area apportionments of shallow water flatfish ABC's for 2009 and 2010 (using $F_{40\%}$) are based on the fraction of the 2005 survey biomass in each area.

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2009	26,360	29,873	3,333	1,423	60,989
2010	26,360	29,873	3,333	1,423	60,989

6. Rex Sole

Status and catch specifications (t) of rex sole and projections for 2009 and 2010. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data are current through 11/08/2008.

Year	Biomass	OFL	ABC	TAC	Catch
2007	82,403	11,900	9,100	9,100	2,852
2008	82,801	11,933	9,132	9,132	2,698
2009	81,572	11,756	8,996		
2010		11,535	8,827		

Changes from previous assessment

Similar to previous years, rex sole are assessed using an age-structured model first presented in 2004. Slope and age at 50% selectivity were estimated as parameters to characterize survey selectivity in the current model, rather than ages at 50% and 95% selectivity as in the previous assessment (Turnock et al., 2005).

New data in the rex sole projections included updated 2007 catch and an assumed 2008 catch set equal to the 2007 level.

Spawning biomass and stock status trends

Survey biomass increased slightly from 101,255 t in 2005 to 103,776 t in 2007. The model estimate of 2008 adult biomass was 82,801 t. Spawning biomass increased in 2008 and is projected to decrease in 2009 and 2010.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

In 2005, the Plan Team adopted a Tier 5 approach (using model estimated adult biomass) for rex sole ABC recommendations due to unreliable estimates of $F_{40\%}$ and $F_{35\%}$. The 2009 ABC was calculated assuming the 2008 catch would be the same as the 2007 catch. Using $F_{ABC} = 0.75M = 0.128$ results in an 2009 ABC of 8,966 t. The 2009 OFL using $F_{OFL} = M = 0.17$ is 11,756 t. The 2010 ABC (8,827 t) and OFL (11,535 t) were projected by assuming the 2009 catch would equal the largest catch over the last 5 years (2006:4,394 t).

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

Status determination

Catch levels for this complex remain below the TAC. The complex is not approaching a level 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.

Area apportionment

Area apportionments of rex sole ABC's for 2009 and 2010 are based on the fraction of the 2007 survey biomass in each area.

Area apportionments of rex sole ABC's for 2009 and 2010 (using $F_{40\%}$) are based on the fraction of the 2007 survey biomass in each area.

	Western	**Central**	**West Yakutat**	**East Yakutat/SE**	**Total**
2009	1,007	6,630	513	846	8,996
2010	988	6,506	503	830	8,827

7. Arrowtooth flounder

Status and catch specifications (t) of arrowtooth flounder and projections for 2009 and 2010. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data in this table are current through 11/08/2008.

Year	Biomass	OFL	ABC	TAC	Catch
2007	2,146,360	214,828	184,008	43,000	25,364
2008	2,244,870	266,914	226,470	43,000	29,163
2009	1,295,050	261,022	221,512		
2010		258,397	219,273		

Changes from previous assessment

The 2007 and 2008 catch data were updated in the model.

Spawning biomass and stock status trends

The estimated age 3+ biomass from the model is projected to decrease slowly from 2008.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Arrowtooth flounder has been determined to qualify for Tier 3a management. The 2009 ABC using $F_{40\%}$=0.186 is 221,512 t. The 2009 OFL using $F_{35\%}$=0.222 is 261,022 t. The 2009 ABC and OFL were projected by setting 2008 catches equal to 27,938 t (catch current as of October 11, 2008). The 2009 catch was assumed to be the average catch of the last three years (26,985 t) for projecting to 2010, resulting in a 2010 ABC of 219,273 t and OFL of 258,397 t.

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

Status determination

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

Ecosystem Considerations summary

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

Area apportionment

Area apportionments of arrowtooth flounder ABC's for 2009 and 2010 are based on the fraction of the 2007 survey biomass in each area.

Area apportionments of arrowtooth flounder ABC's for 2009 and 2010 (using $F_{40\%}$) are based on the fraction of the 2007 survey biomass in each area.

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2009	30,148	164,251	14,908	12,205	221,512
2010	29,843	162,591	14,757	12,082	219,273

8. Flathead sole

Status and catch specifications (t) of flathead sole for recent years and current projections for 2009 and 2010. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch data in this table are current through 11/08/2008.

Year	Biomass	OFL	ABC	TAC	Catch
2007	297,353	48,658	39,110	9,077	3,159
2008	324,197	55,787	44,735	11,054	3,396
2009	323,937	57,911	46,464		
2010		59,349	47,652		

Changes from previous assessment

Flathead sole are assessed with an age-structured model as presented in the 2005 assessment. The fishery catches estimates were updated for the projection to 2009 and 2010. The 2007 catch was used as the best estimate for the 2009 and 2010 catch.

Spawning biomass and stock status trends

Projected female spawning biomass is estimated to increase slightly.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Flathead sole are determined to be in Tier 3a based on the age-structured model. The 2009 ABC using $F_{40\%} = 0.380$ is 46,464 t. The 2009 OFL using $F_{35\%} = 0.494$ is 57,911 t. The 2009 and 2010 ABC and OFL were calculated with 2008 and 2009 catches equivalent to 2007 catches.

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

Status determination

The stock is not overfished nor approaching an overfished condition. Catch levels for this complex remain below the TAC. The complex is not approaching a level 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 ABC's for 2009 and 2010 are based on the fraction of the 2007 survey biomass in each area.

Area apportionments of flathead sole ABC's for 2009 and 2010 (using $F_{40\%}$) are based on the fraction of the 2007 survey biomass in each area.

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2009	13,010	29,273	3,531	650	46,464
2010	13,342	30,021	3,622	667	47,652

Slope rockfish

Status and catch specifications (t) of slope rockfish management category and projections for 2009 and 2010. Projections are made using authors' estimate of 2008 and 2009 catch. Catch data in table below are current through 11/08/2008.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Pacific ocean perch	2007	315,521	17,157	14,636	14,635	12,951
	2008	317,511	17,807	14,999	14,999	12,395
	2009	318,336	17,940	15,111		
	2010		17,925	15,098		
Northern rockfish	2007	94,271	5,890	4,938	4,938	4,184
	2008	93,391	5,430	4,549	4,549	4,011
	2009	90,557	5,204	4,362		
	2010		4,979	4,173		
Shortraker rockfish	2007	37,461	1,124	843	843	599
	2008	39,905	1,197	898	898	592
	2009		1,197	898		
	2010		1,197	898		
Rougheye and blackspotted rockfish	2007	39,506	1,148	988	988	308
	2008	46,121	1,548	1,286	1,286	380
	2009	46,385	1,545	1,284		
	2010		1,562	1,297		
Other slope rockfish	2007	93,552	5,394	4,154	1,482	676
	2008	90,283	5,624	4,297	1,730	806
	2009		5,624	4,297		
	2010		5,624	4,297		

GOA slope rockfish are in a biennial stock assessment schedule to coincide with new survey data. This year's SAFE chapters consist of executive summaries for all slope rockfish. Species with age structured models have updated catch and new projections. Tier 5 species are rolled over. It is critically important to the rockfish assessments that the GOA trawl surveys continue and that they extend to 500 m in order to cover the range of primary habitat for the slope rockfish complex.

Historical maps (1993-2007) of the spatial distribution of fishery catch based on observer data were included in response to an SSC request to include this information. Data are available online from Fisheries Monitoring and Analysis Division (FMA, Observer program) at www.afsc.noaa.gov/FMA/spatial_data.htm. Catches were aggregated by 100 km^2 cell blocks and cells representing less than three vessels for a given gear type and year were not provided due to confidentiality issues. Spatial maps were presented for all GOA rockfish documents.

Area apportionments of ABC for slope rockfish for 2009.

Species	Western	Central	Eastern	West Yakutat	East Yak./SE	Total
Pacific ocean perch	3,713	8,246	--	1,108	2,044	15,111
Northern rockfish	2,054	2,308	--	--	--	4,362
Shortraker rockfish	120	315	463			898
Rougheye and blackspotted rockfish	125	833	326			1,284
Other slope rockfish	357	569		604	2,767	4,297

8. Pacific ocean perch

Status and catch specifications (t) of Pacific ocean perch and projections for 2009 and 2010. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. ABC and OFL for 2009 and 2010 are projected using author's estimate of 2008 and 2009 catch. Catch data are current through 11/08/2008.

Species	Year	Biomass[1]	OFL	ABC	TAC	Catch
Pacific ocean perch	2007	315,521	17,157	14,636	14,635	12,954
	2008	317,511	17,807	14,999	14,999	12,395
	2009	318,336	17,940	15,111		
	2010		17,925	15,098		

[1]Total biomass from the age-structured model

Changes from previous assessment

No new assessment model was run in this off-survey year. Catches were updated for 2007-2008 and new projections made. Total catch in 2007 and 2008 was less than previously estimated.

Spawning biomass and stock status trends

The spawning population is above $B_{40\%}$ (89,195 t).

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 determinations of ABC and OFL by the authors. New projections yielded an ABC of 15,111 t in 2009 which is very similar to the 2008 ABC. The OFL is 17,940 t for 2009.

Status determination

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

Ecosystem Considerations summary

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

Area apportionment

The apportionment percentages are identical to last year as there is no new survey information this year. Area apportionments are 25% for the Western area, 55% for the Central area, and 20% for the Eastern area.

Area apportionment of 2009-2010 ABC and OFL for POP in the Gulf of Alaska:

Year		Western	Central	Eastern	WYAK	SEO	Total
2009	ABC	3,713	8,246	--	1,108	2,044	15,111
2010		3,710	8,239	--	1,107	2,042	15,098
2009	OFL	4,409	9,790	3,741	--	--	17,940
2010		4,405	9,782	3,738	--	--	17,925

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 the same as last year at 0.35. This corresponds to a 2009 ABC of 1,108 t for WYAK. Under this apportionment strategy, very little of the 2,044 t assigned to the remaining Eastern area (East Yakutat/Southeast Outside area) will be harvested.

Additional Plan Team recommendations

An attachment to the SAFE report presents a comparison of the effects of weighting proportion or biomass by survey year for determining area apportionment. Simple scenarios which assumed no survey error and different trends between regions were used to evaluate the potential for bias between the two methods. They also explored varying levels of survey error to evaluate bias in apportioning ABCs. Based on these results, the Team recommended that the current apportionment strategy was appropriate.

9. Northern Rockfish

Status and catch specifications (t) of northern rockfish and projections for 2009 and 2010. Projections are made using author's best estimate of 2008 and 2009 catch. Catch data in table are current through 11/08/2008.

Species	Year	Biomass[1]	OFL	ABC	TAC	Catch
Northern rockfish	2007	94,271	5,890	4,938	4,938	4,187
	2008	93,391	5,430	4,549	4,549	4,011
	2009	90,557	5,204	4,362		
	2010		4,979	4,173		

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

Changes from previous assessment

No new assessment model was run in this off-survey year. Catches were updated for 2007-2008 and new projections made. Total catch in 2007 and 2008 was less than previously estimated.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Northern rockfish are determined to be in Tier 3a. The recommended ABC for 2009 is 4,362 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 22,300 t.

Status determination

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

Ecosystem Considerations summary

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

Area apportionment

Apportioning the 2009 and 2010 ABC is based on the same method used from last year resulting in the following percentage apportionments by area: Western 47.1% and Central 52.9%. Northern rockfish ABC apportionments include the movement of 1 t from the Eastern Gulf with Other Slope Rockfish in West Yakutat.

Northern rockfish ABC apportionments 2009-2010:

	Western	Central	Eastern	West Yakutat	East Yak./SE	Total
2009	2,054	2,308	-	-	-	4,362
2010	1,965	2,208	-	-	-	4,173

10. Rougheye and blackspotted rockfish (Rougheye complex)

Status and catch specifications (t) of rougheye and blackspotted rockfish and projections for 2009 and 2010. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Projections to 2009 and 2010 use author's estimate of 2008 and 2009 catch. Catch data are current through 11/08/2008.

Species	Year	Biomass	OFL	ABC	TAC	Catch
	2007	39,506	1,148	988	988	425
Rougheye and	2008	46,121	1,548	1,286	1,286	380
blackspotted rockfish	2009	46,385	1,545	1,284		
	2010		1,562	1,297		

Changes from previous assessment

No new assessment model was run in this off-survey year. Catches were updated for 2007-2008 and new projections made. Total catch in 2007 and 2008 was less than previously estimated.

Spawning biomass and stock status trends

Female spawning biomass is well above $B_{40\%}$ (9,935 t) with projected biomass stable.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Rougheye rockfish are determined to be in Tier 3a. Reference values for rougheye rockfish are summarized below. The 2009 female spawning biomass is projected to be 14,055 t and the ABC and OFL are 1,284 t and 1,545 t, respectively.

Status determination

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

Ecosystem Considerations summary

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

Area apportionment

Area apportionments (calculated using the same method as for POP) of the 2009 and 2010 ABC for the rougheye rockfish complex in the Gulf of Alaska:

	Western	Central	Eastern	Total
2009	125	833	326	1,284
2010	126	842	329	1,297

Additional Plan Team recommendations

The authors reported preliminary analysis from the 2005-2006 two day experiment on the longline survey near Yakutat concerning rougheye and blackspotted rockfish identification. At-sea scientists identified specimens and an AFSC expert identified specimens from photos. When compared to the genetic analysis of those samples, rougheye rockfish were correctly identified. However, blackspotted rockfish were often misidentified. Upon reexamination of photos, it was determined there were several other features that may be important for correct identification of blackspotted rockfish. The authors recommended a new at-sea field identification pamphlet be prepared and field identification results be validated with genetic samples. The Plan Team supports these recommendations.

11. Shortraker and other slope rockfish

Shortraker rockfish

Status and catch specifications (t) of shortraker rockfish and projections for 2009 and 2010. Catch data are current through 11/08/2008. Biomass estimates are based on 3 most recent trawl surveys (2003, 2005, and 2007).

Species	Year	Biomass	OFL	ABC	TAC	Catch
Shortraker rockfish	2007	37,461	1,124	843	843	650
	2008	39,905	1,197	898	898	592
	2009		1,197	898		
	2010		1,197	898		

Other slope rockfish

Status and catch specifications (t) of the Other Slope rockfish management category and projections for 2009 and 2010. Catch data are current through 11/08/2008. Biomass estimates are based on 3 most recent trawl surveys (2003, 2005, and 2007)..

Species	Year	Biomass	OFL	ABC	TAC	Catch
Other Slope rockfish	2007	93,552	5,394	4,154	1,482	690
	2008	90,283	5,624	4,297	1,730	806
	2009		5,624	4,297		
	2010		5,624	4,297		

Changes from previous assessment

No changes were made in this off-survey year. Catches were updated for 2007-2008.

Spawning biomass and stock status trends

Exploitable biomass is based upon averaging the trawl survey estimates. No additional trawl survey data was available for biomass estimates this year.

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.

Status determination

The catches have been below the TACs in recent years therefore the stock is not approaching a level where overfishing would be a concern.

Ecosystem Considerations summary

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

Area apportionment

Apportionment values for shortraker and "other slope rockfish" are equivalent to last year's. The Eastern area for "other slope rockfish" is also further divided into the West Yakutat area and the East Yakutat/Southeast Outside area.

Area apportionment of 2009 and 2010 ABC for shortraker rockfish in the Gulf of Alaska:

Western	Central	Eastern	Total
120	315	463	898

Area apportionment of 2009 and 2010 ABC for Other Slope rockfish in the Gulf of Alaska:

	Western	Central	WYAK	SEO	Total
ABC	357	569	604	2,767	4,297

15. Pelagic shelf rockfish

Pelagic shelf rockfish

Status and catch specifications (t) of pelagic shelf rockfish with dark rockfish and projections for 2009 and 2010. ABC and OFL are projected using author's estimates of catch for 2008 and 2009 for dusky rockfish. Catch data in this table are current through 11/08/2008. 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	2007	99,829	6,458	5,542	5,542	3,318
	2008	70,823	6,400	5,227	5,227	3,634
	2009	67,841	6,404	5,231		
	2010		6,021	4,915		

[1]Total biomass estimates for pelagic shelf rockfish include trawl survey estimates for dark, widow and yellowtail rockfish and biomass estimates from an age-structured model for dusky rockfish

Status and catch specifications (t) of pelagic shelf rockfish without dark rockfish and projections for 2009 and 2010. ABC and OFL are projected using author's estimates of catch for 2008 and 2009 for dusky rockfish. Catch data in this table are current through 11/08/2008. Biomass levels are based on trawl survey estimates and the age structured model for dusky rockfish.

Area	Year	Biomass[2]	OFL	ABC	TAC	Catch
GOA	2009	66,603	5,803	4,781		
	2010	63,906	5,420	4,465		

[2]Total biomass estimates for pelagic shelf rockfish include 2007 trawl survey estimates for widow and yellowtail rockfish and biomass estimates from an age-structured model for dusky rockfish.

Changes from previous assessment

Catches were updated for 2007-2008 and only projections were made for dusky rockfish. For all other species in the complex (Tier 5 species) the 2008 estimates were the same as in 2007.

In March, 2007, the North Pacific Fishery Management Council took final action to remove dark rockfish from both the GOA FMP (PSR Complex) and BSAI FMP (other rockfish complex). Removing the species from the Federal FMP serves to turn full management authority of the stock over to the State of Alaska in both regions. At this time, the rules to implement these FMP amendments have not yet been finalized. The effective date for Amendments 77/73 will occur sometime after January, 2009. Therefore, ABC's and OFLs are presented in this assessment for 2009 which include dark rockfish in the PSR complex as well as ABC estimates which do not include the contribution to the PSR complex from dark rockfish.

Spawning biomass and stock status trends

Female spawning biomass for dusky rockfish is well above $B_{40\%}$, with projected biomass stable.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Dark, widow, and yellowtail rockfish are managed as Tier 5 species with ABC determined by the average of exploitable biomass from the three most recent trawl surveys. For dusky rockfish, which is managed as a Tier 3a species, we use an age-structured model. For the pelagic shelf rockfish complex, ABC and OFL for dark, widow, and yellowtail rockfish are combined with the ABC and OFL for dusky rockfish yielding a combined ABC of 5,231 for pelagic shelf rockfish and OFL of 6,404.

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

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

Area apportionment

The 2009 recommended ABC for pelagic shelf rockfish is 5,231 t with the following area apportionments with dark rockfish:

Area apportionments of ABC for pelagic shelf rockfish in 2009 and 2010					
	Western	**Central**	**W. Yakutat**	**E. Yakutat/SE**	**Total**
2009	1,004	3,628	251	348	5,231
2010	943	3,410	236	326	4,915

The 2009 recommended ABC for pelagic shelf rockfish is 4,781 t with the following area apportionments without dark rockfish:

Area apportionments of ABC for pelagic shelf rockfish in 2009 and 2010					
	Western	**Central**	**W. Yakutat**	**E. Yakutat/SE**	**Total**
2009	819	3,404	234	324	4,781
2010	765	3,179	219	302	4,465

14. Demersal shelf rockfish

Status and catch specifications (t) of demersal shelf rockfish and projections for 2009 and 2010. Biomass for each year corresponds to the survey biomass estimates given in the SAFE report issued in the preceding year(s). 2008 catch data are current through 10/22/2008 but reflect landed catch only.

Year	**Biomass**	**OFL**	**ABC**	**TAC**	**Catch**
2007	19,558	650	410	410	250
2008	18,329	611	382	382	261
2009	17,390	580	362		
2010		580	362		

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

Changes from previous assessment

Demersal shelf rockfish have been moved to a biennial stock assessment schedule. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2009 and 2010. The only new data are 2008 average weights from directed commercial catch and catch incidental to the halibut fishery. No new surveys were conducted in 2008, and no new age data were available.

Spawning biomass and stock status trends

Density and biomass estimates for this complex are based on yelloweye rockfish only. Yelloweye rockfish biomass for stock status evaluations are based on the most recent estimate by management area. The SSEO was last surveyed in 2005, EYKT was surveyed in 2003, 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 17,390 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 **2009 ABC of 362 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 2009 of 580 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 are current through 11/08/2008.

Year	Biomass	OFL	ABC	TAC	Catch
2007	98,158	2,945	2,209	2,209	701
2008	84,775	2,540	1,910	1,910	737
2009	84,775	2,540	1,910		
2010		2,540	1,910		

Changes from previous assessment

Thornyheads have been moved to a biennial stock assessment schedule to coincide with the timing of survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2009 and 2010. New information includes updated 2007 and 2008 catches by area, information from the 2008 longline survey, and relative population number and weight for GOA thornyheads from the longline 2006-2008 surveys. New 2008 longline survey information indicates a large increase in the relative population numbers and weight of thornyheads caught in the survey. In contrast to the high numbers of thornyheads, the 2008 longline survey found low numbers of sablefish.

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 2007 GOA trawl survey declined 10% in the 2007 GOA trawl survey compared with the 2005 trawl survey. However, most of this decrease was observed in the western GOA. The 2007 trawl survey biomass declined 45% and 11% in the Western and Central Gulf areas, while the Eastern Gulf biomass increased 15%. Previous to this, survey biomass from the 2005 survey declined about 7% relative to the 2003 survey.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Thornyhead rockfish are in Tier 5. No new information is incorporated into the projection, and last year's stock assessment recommendations are rolled over for 2009 and 2010. The 2009 ABC recommendation is 1,910 t and the OFL is 2,540 t.

Status determination

The catches have been below the TACs in recent years and thus are not expected to approach the OFL therefore overfishing is not expected to be occurring on this stock. It is not possible to determine the status of stocks in Tier 5 with respect to overfished status.

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

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 for thornyhead ABC's are identical to last year, because there is no new survey information. Apportionments are based upon the relative distribution of biomass by area from the 2007 GOA bottom trawl survey.

Area apportionment of 2009-2010 ABC for Thornyhead rockfish:

Western	Central	Eastern	Total
267	860	783	1,910

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 2009 and 2010 are those recommended by the Plan Team. Catch data are current through 11/08/2008.

Year	Biomass	OFL	ABC	TAC	Catch
2007		6,200	4,700	1,500	1,453
2008		6,200	4,700	1,500	2,071
2009		6,200	4,700		
2010		6,200			

Changes from previous assessment

Atka mackerel are assessed on a biennial schedule to coincide with the timing of survey data. The last complete assessment was presented in 2007. An executive summary is presented this year with rollover values for 2009 and 2010. New catch information includes updated 2007 catch (1,453 t), and 2008 catch (2,071 t) as of November 8, 2008. The 2008 GOA Atka mackerel catch through October is 38% over the 2008 TAC. Significant catches were taken in area 610 and to some extent from area 620 by rockfish fisheries. 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. Also, in 2008 a

small amount of observer data for the catcher vessels indicated a high discard rate for Atka mackerel in area 610 that was extrapolated to the trawl catcher vessel fleet. Since the 2007 assessment, ages from the 2007 GOA survey have become available. A total of 144 otoliths were collected from 38 hauls throughout the Western and Central Gulf. The data continue to show that the 1999 year class dominates the age distribution

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.

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 2006-2008 ABCs (under Tier 6), were increased to the maximum allowable of 4,700 t and the TACs were set at 1,500 t 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 2009 ABC for GOA Atka mackerel equal to the maximum permissible value of 4,700 t. The 2009 OFL is 6,200 t under Tier 6.**

Status determination

Up until 2008, catches have been below the TAC, however, the 2008 Atka mackerel catch is 38% over TAC but still under the ABC. It is not possible to determine the status of stocks in Tier 6 with respect to overfishing and overfished status.

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 2007 and 2008 TACs for GOA Atka mackerel were 1,500 t which the data suggests is insufficient to meet bycatch needs for 2009. The Plan Team recommends a level of 2,000 t be considered to meet incidental catch needs for other directed fisheries.

Ecosystem Considerations summary

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 2009 and 2010. Average biomass for each group and area, corresponds to the value given in last year's (2007) SAFE report. Catch data are current through 11/08/2008.

Species group	Area	Average Biomass	OFL	ABC	TAC	2008 Catch	2009 and 2010 ABC	2009 and 2010 OFL
Big skate	W	8,422		632	632	130	632	
	C	27,536		2,065	2,065	1,196	2,065	
	E	8,434		633	633	48	633	
	Total	**44,392**	**4,439**	**3,330**	**3,330**	**1,374**	**3,330**	**4,439**
Longnose skate	W	1,043		78	78	31	78	
	C	27,209		2,041	2,041	847	2,041	
	E	10,239		768	768	118	768	
	Total	**38,491**	**3,849**	**2,887**	**2,887**	**996**	**2,887**	**3,849**
Bathyraja skates	GOA wide	**28,057**	**2,806**	**2,104**	**2,104**	**1,178**	**2,104**	**2,806**

Changes from previous assessment

Skates are on a biennial stock assessment schedule to coincide with new survey data. An executive summary is presented in this SAFE Report with last year's key assessment parameters and projections for 2009 and 2010. Research published in fall 2008 explored the reproductive biology of big and longnose skates in the GOA. For big skates, length at 50% maturity was 148.6 cm for females and 119.2 cm for males. For longnose skates, length at 50% maturity was 113.2 cm for females and 102.9 cm for males. These values suggest that big and longnose skates mature at larger sizes than do individuals of the same species in British Columbia and California. No evidence of seasonality in reproductive output was observed for either species.

Other than updated catch data, there is no new information to update the harvest recommendations for skates. Last year's ABC recommendations for skates, set according to Tier 5 using a natural mortality rate of 0.1 for all skates, are rolled over for 2009 and 2010.

Spawning biomass and stock status trends

GOA bottom trawl survey biomass for both big and longnose skates decreased from 2005 to 2007, with longnose skates experiencing the largest decline. GOA "other skate" survey biomass increased slightly over the same period, primarily due to an increase 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 three 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. A wider range of M estimates is now available, and may be used in upcoming assessments. 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.

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 are likely to be taken (or exceeded) incidentally in groundfish and IFQ halibut fisheries. The Plan Team recommends continued inclusion of IPHC survey-based estimates of skate bycatch in IFQ halibut fisheries, recognizing that this likely represents 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 Team notes that The Alaska Department of Fish & Game (ADF&G) is preparing to open a limited fishery for skates in the state waters of Prince William Sound. Scientists at ADF&G are currently preparing harvest guidelines for this fishery and the Plan Team encourages this coordinated effort.

Given the report from the public that interest in targeting and retaining skates is likely to increase, we are concerned that no fishery length data were available to determine if the disproportionate harvest of large female big skates observed in 2003-2005 has continued.

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.

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

Ecosystem considerations based on the early 1990's Gulf of Alaska food web model were presented in the 2007 assessment. The Plan Team encourages updating this information with diet data being collected by Moss Landing Marine Lab researchers as it becomes available.

Area apportionment

The Plan Team concurred with the authors recommended area-specific ABCs based on the average of the three 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 2009 and 2010. Prior to 2009, the other species category was managed with an aggregate TAC; no ABC or OFL specifications were made for other species category. Catch data in the table below are current through 11/08/2008.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Sculpins	2007		NA	NA	NA	871
	2008		NA	NA	NA	1,295
	2009	30,836	5,859	4,394		
	2010		5,859	4,394		
Squid	2007		NA	NA	NA	412
	2008		NA	NA	NA	84
	2009	Unknown	1,527	1,145		
	2010		1,527	1,145		
Octopus	2007		NA	NA	NA	266
	2008		NA	NA	NA	325
	2009	Unknown	298	224		
	2010		298	224		
Sharks	2007		NA	NA	NA	1,379
	2008		NA	NA	NA	412
	2009	Unknown	1,036	777		
	2010		1,036	777		
Other Species Total	2007		NA	NA	4,500	2,928
	2008		NA	NA	4,500	2,116
	2009		8,720	6,540		
	2010		8,720	6,540		

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. Amendment 79 to the GOA FMP 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.

18a. Sculpins

Status and catch specifications (t) of sculpins and projections for 2009 and 2010. Prior to 2009, sculpins were managed within the other species category under an aggregate TAC; no ABC or OFL specifications were made for other species. Catch data are current through 11/08/2008.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Sculpins	2007		NA	NA	NA	2,800
	2008		NA	NA	NA	1,295
	2009	30,836	5,859	4,394		
	2010		5,859	4,394		

Changes from previous assessment

Information on total sculpin catch by target fishery and gear type is available for 2007. Sculpin were identified for the first time to species in the fishery observer data in 2008.

Biomass estimates from the GOA are presented for selected sculpin species from triennial and biennial Alaska Fisheries Science Center bottom trawl surveys. Length frequencies of the four most abundant sculpin species are presented from AFSC survey data of the GOA.

Spawning biomass and stock status trends

Aggregate sculpin biomass in the GOA shows no clear trend, and the assessment recommends that it not be used as an indicator of population status for a complex with so much species diversity. Trends in biomass were available for only selected sculpin species for the period 1984-2005 due to difficulties with species identification and survey priorities. Species specific biomass estimates are available from the 2001, 2003, 2005 and 2007 surveys. Biomass trends show that the bigmouth sculpin declined between 1984 and 2001, but remains stable over the last 2 surveys. The only sculpins that showed an increase since 1984 are the plain sculpins, while yellow Irish lord, spinyhead, great and darkfin sculpins show no real trend in biomass through the years. The coefficients of variation for the survey biomass estimates of 7 out of 12 sculpins species are below 0.3, suggesting that the GOA survey is doing an adequate job assessing the biomass of the more abundant species.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The Plan Team determined that reliable estimates of survey biomass are available for selected sculpin species and that sculpin can be managed under Tier 5 criteria. The Plan Team agreed with the assessment on the use of a single conservative estimate of M applied to survey biomass for sculpins and recommend a 2009 ABC of 4,394 t and 2009 OFL of 5,859 t.

Status determination

Sculpin catches have generally been under a 1,000 t and a small percentage of the other species catch. However, in 2008 sculpin catches increased to over 1,200 t representing approximately 60% of the other species catch. It is not possible to determine the status of stocks in Tier 5 with respect to overfishing and overfished status.

Additional Plan Team recommendations

The Plan Teams encourage the incorporation of updated species-specific values of M to be applied to species-specific estimates of biomass for next year‘s assessment. This would provide for improved 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.

18b. Squid

Status and catch specifications (t) of squid and projections for 2009 and 2010. Prior to 2009, squid were managed within the other species category under an aggregate TAC; no ABC or OFL specifications were made for other species.Catch data in table are current through 11/08/2008.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Squid	2007		NA	NA	NA	412
	2008		NA	NA	NA	84
	2009	Unknown	1,527	1,145		
	2010		1,527	1,145		

Changes from previous assessment

This is the first squid stock assessment that was used to recommend harvest levels. Total catch is estimated for 1990-2008. Biomass information from trawl surveys is presented for 1984-2007.

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. Ecosystem models suggest that biomass of squid in the Gulf of Alaska may be at least an order of magnitude larger than trawl survey estimates.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The stock assessment authors indicated that the bottom trawl survey may provide a minimum biomass estimate and presented two options for calculating appropriate *F* values for Tier 5 management. However, 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 computing *F* and biomass. 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 calculations seemed unreasonably low. The Team recommends that the SSC consider the use of maximum annual catch during 1990 -2007 as the basis for harvest specifications for this stock. This results **in a recommended OFL of 1,527 t and an ABC of 1,145 t**. As with octopus, the Team thought that this would represent an interim approach and encourages further development of alternative management for squid with the understanding that the current groundfish Tier system may be inappropriate for managing cephalopods.

Status determination

Presently it is not possible to determine the status of stocks in Tier 6 with respect to overfishing and overfished status.

Ecosystem Considerations summary

Fishery management should attempt to prevent negative impacts on squid populations primarily because of their role as forage in marine ecosystems. 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 protected species such as toothed whales should be a high priority research topic.

Area apportionment

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

18c. Octopus

Status and catch specifications (t) of octopus and projections for 2009 and 2010. Prior to 2009, octopuses were managed within the other species category under an aggregate TAC; no ABC or OFL specifications were made for other species. Reliable biomass estimates for octopus are not available and management under Tier 6 is recommended. Catch data are current through 11/08/2008.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Octopus	2007		NA	NA	NA	266
	2008		NA	NA	NA	325
	2009	Unknown	298	224		
	2010		298	224		

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. This biomass estimate is the second-highest ever observed. The average of the most recent 10 years of survey biomass estimates is 1,835 tons. The assessment authors are following up on a suggestion to incorporate discard mortality into future catch accounting for octopus in both the BSAI and GOA. This is being 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 catch 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.

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 (1984-2007), 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 not available for octopus, therefore Tier 6 management is recommended. There is no directed fishery

for octopus. Catch history is based on incidental catches thus ABC estimates based on Tier 6 criteria are particularly low. The Team recommends that the SSC consider alternative Tier 6 criteria based on the maximum (rather than average) catch for octopus. This results in a 2009 OFL of 298 t and 75% of that value for a 2009 ABC is 224 t. 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

It is not possible to determine the status of stocks in Tier 6 with respect to overfishing and overfished status.

Additional Plan Team recommendations

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

Although Tier 6 management is problematic, particularly for non-target species, the Plan Team recommended that octopus *not* be considered for inclusion in forage fish category.

Ecosystem Considerations summary

Very little is known about the role of octopus in North Pacific ecosystems. The Ecopath 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. Sharks

Status and catch specifications (t) of sharks and projections for 2009 and 2010. Prior to 2009, sharks were managed within the other species category under an aggregate TAC; no ABC or OFL specifications were made for other species. Reliable biomass estimates for sharks are unavailable and management under a modified Tier 6 is recommended. Catch data are current through 11/08/2008.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Sharks	2007		NA	NA		1,186
	2008		NA	NA		412
	2009	Unknown	1,036	777		
	2010		1,036	777		

Changes from previous assessment

Biomass estimates from the 2007 GOA bottom trawl survey are presented. Life history and population demographic information has been updated with recent research results. Tier 6 criteria require a reliable catch history from 1978-1995, which do not exist for sharks in the GOA prior to 1997. The current assessment authors recommend a modified Tier 6 criteria using average catch over 1997-2007 for OFL and ABC estimates. The Tier 6 approach based on maximum catch as recommended for squid and octopus is not recommended for this group because of the potentially large unobserved or unreported catches in the halibut IFQ and ADF&G managed salmon set net fisheries. For this reason, a more conservative ABC and OFL based on the average catch (as opposed to the maximum) is recommended. This was the authors' recommendation and the Plan Team concurred.

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 (1984-2007), but are considered highly uncertain as sharks may be poorly sampled by bottom trawl surveys. 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. Data from the 1984-2007 GOA bottom trawl surveys indicate an increasing biomass trend for the shark species group apparently due to increased spiny dogfish and sleeper shark abundance between 1990 and 2007. Relative population numbers (RPNs) have been estimated from the GOA longline survey for the years 1982-2003. This index shows the RPN for Pacific sleeper shark increasing from 1994-2001, then declining through the remainder of the time series. The spiny dogfish index is more variable and shows peaks in 1993 and 1998, otherwise the index was relatively low.

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 agrees with the assessment authors to use the modified Tier 6 criteria of average catch from 1997-2007. This results in a **2009 ABC of 777 t and an OFL of 1,036 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 is unlikely to be sufficient and low TAC and OFL levels could 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 spiny dogfish and sleeper sharks.

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 stock structure be conducted. The Plan Team would also like to see information on the estimated level of unreported shark catches (to species) 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 will be critical to determine the affect of fluctuations in shark populations on community structure in the GOA.

Area apportionments

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

Overview of Appendices

Grenadiers

An executive summary assessment of grenadier species is provided in **Appendix 1**. This assessment is an update of a full assessment that was provided in the 2008 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 trawl surveys.

Although grenadier species are currently considered "non-specified" under both BSAI and GOA FMPs, the Team recommends that this complex be moved into a managed category so that separate specifications (such as region-specific ABCs and catches) can be established.

No management measures have been implemented for these species and no official catch statistics exist. However, catches have been estimated for 1997-2008 (through 10/03/2008) based upon data from the North Pacific Groundfish Observer Program. Average annual catches over this time period have been 2,901 t in the EBS, 2,244 t in the Aleutian Islands (AI), and 10,789 t in the GOA. Most of the catch occurs in longline and pot fisheries.

Biomass estimates (sampling to 1,000 m in GOA and to 1,200 m in EBS) were based on deep-water trawl surveys in each area and resulting in an estimated 488,414 t for the GOA and 518,778 t for the EBS. Two survey indices were used to indirectly estimate biomass in the AI (979,256 t). These values were then used to compute the OFLs and ABC values. Catches, particularly in EBS and AI, are much less than the ABCs so that conservation concerns are minimal at this time.

Recent data (collected by observers in 2007) on giant grenadier ages suggest a natural mortality rate of 0.078; the previous estimate was 0.074. This new study yielded an estimated maximum age of 58 years and also provided growth parameters in GOA giant grenadiers (female age- and size-at-50%-maturity were computed at 22.9 years and 26 cm pre-anal fin length, respectively). In 2007 the observers identified giant grenadiers to species and were able to provide data for these studies.

Forage fish

An assessment for forage fish in the Gulf of Alaska is provided in **Appendix 2**. The forage fish category in the Gulf of Alaska FMP contains over 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 requested 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 current assessment focuses upon two main species of importance in the forage fish category: capelin and eulachon. The section on eulachon has been greatly expanded and includes spatial analyses of eulachon distribution and catch. The small-mesh survey data for capelin and eulachon have been 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.

Tables

Table 1. Gulf of Alaska groundfish 2008 - 2010 OFLs and ABCs, 2008 TACs, and 2008 catches reported through November 8, 2008. Dark rockfish are excluded for 2009 due to pending regulatory changes.

Stock/ Assemblage		2008				2009		2010	
	Area	OFL	ABC	TAC	Catch	OFL	ABC	OFL	ABC
Pollock	W (61)		17,602	17,602	17,239		15,249		24,199
	C (62)		19,181	19,181	19,058		14,098		22,374
	C (63)		13,640	13,640	14,263		11,058		17,548
	WYAK		1,517	1,517	1,161		1,215		1,929
	Subtotal	72,110	51,940	51,940	51,721	58,590	41,620	90,920	66,050
	EYAK/SEO	11,040	8,240	8,240	0	11,040	8,280	11,040	8,280
	Total	83,150	60,180	60,180	51,721	69,630	49,900	101,960	74,330
Pacific Cod	W		25,932	19,449	14,696		21,567		31,005
	C		37,901	28,426	27,445		31,521		45,315
	E		2,660	2,394	283		2,212		3,180
	Total	88,660	66,493	50,269	42,424	66,600	55,300	126,000	79,500
Sablefish	W		1,890	1,890	1,663		1,640		1,523
	C		5,500	5,500	5,268		4,990		4,625
	WYAK		2,120	2,120	2,054		1,784		1,645
	SEO		3,220	3,220	3,299		2,746		2,544
	Total	15,040	12,730	12,730	12,284	13,190	11,160	12,321	10,337
Deep-water Flatfish	W		690	690	13		706		747
	C		6,721	6,721	543		6,927		7,405
	WYAK		965	965	1		997		1,066
	EYAK/SEO		527	527	4		538		575
	Total	11,343	8,903	8,903	561	11,578	9,168	12,367	9,793
Shallow-water flatfish	W		26,360	4,500	754		26,360		26,360
	C		29,873	13,000	8,135		29,873		29,873
	WYAK		3,333	3333	0		3,333		3,333
	EYAK/SEO		1,423	1,423	0		1,423		1,423
	Total	74,364	60,989	22,256	8,889	74,364	60,989	74,364	60,989
Rex sole	W		1,022	1,022	181		1,007		988
	C		6,731	6,731	2,517		6,630		6,506
	WYAK		520	520	0		513		503
	EYAK/SEO		859	859	0		846		830
	Total	11,933	9,132	9,132	2,698	11,756	8,996	11,535	8,827
Arrowtooth flounder	W		30,817	8,000	3,113		30,148		29,843
	C		167,936	30,000	25,928		164,251		162,591
	WYAK		15,245	2,500	34		14,908		14,757
	EYAK/SEO		12,472	2,500	88		12,205		12,082
	Total	266,914	226,470	43,000	29,163	261,022	221,512	258,397	219,273
Flathead sole	W		12,507	2,000	286		13,010		13,342
	C		28,174	5,000	3,110		29,273		30,021
	WYAK		3,420	3,420	0		3,531		3,622
	EYAK/SEO		634	634	0		650		667
	Total	55,787	44,735	11,054	3,396	57,911	46,464	59,349	47,652

Table 1. continued.

Stock/ Assemblage	Area	2008 OFL	2008 ABC	2008 TAC	2008 Catch	2009 OFL	2009 ABC	2010 OFL	2010 ABC
Pacific ocean perch	W	4,376	3,686	3,686	3,670	4,409	3,713	4,405	3,710
	C	9,717	8,185	8,185	7,625	9,790	8,246	9,782	8,239
	WYAK		1,100	1,100	1,100		1,108		1,107
	SEO		2,028	2,028	0		2,044		2,042
	E(subtotal)	3,714	3,128	3,128	1,100	3,741	3,152	3,738	3,149
	Total	17,807	14,999	14,999	12,395	17,940	15,111	17,925	15,098
Northern rockfish[3]	W		2,141	2,141	1,885		2,054		1,965
	C		2,408	2,408	2,126		2,308		2,208
	E		0	0	0		0		0
	Total	5,430	4,549	4,549	4,011	5,204	4,362	4,979	4,173
Rougheye	W		125	125	77		125		126
	C		834	834	183		833		842
	E		327	327	120		326		329
	Total	1,548	1,286	1,286	380	1,545	1,284	1,562	1,297
Shortraker	W		120	120	132		120		120
	C		315	315	241		315		315
	E		463	463	219		463		463
	Total	1,197	898	898	592	1,197	898	1,197	898
Other slope[3]	W		357	357	297		357		357
	C		569	569	435		569		569
	WYAK		604	604	50		604		604
	EYAK/SEO		2,767	200	24		2,767		2,767
	Total	5,624	4,297	1,730	806	5,624	4,297	5,624	4,297
Pelagic Shelf rockfish	W		1,003	1,003	572		819		765
	C		3,626	3,626	2,866		3,404		3,179
	WYAK		251	251	195		234		219
	EYAK/SEO		347	347	1		324		302
	Total	6,400	5,227	5,227	3,634	5,803	4,781	5,420	4,465
Demersal rockfish	Total	611	382	382	261	580	362	580	362
Thornyhead Rockfish	W		267	267	274		267		267
	C		860	860	299		860		860
	E		783	783	164		783		783
	Total	2,540	1,910	1,910	737	2,540	1,910	2,540	1,910
Atka mackerel	Total	6,200	4,700	1,500	2,071	6,200	4,700	6,200	4,700
Big Skate	W		632	632	130		632		632
	C		2,065	2,065	1,196		2,065		2,065
	E		633	633	48		633		633
	Total	4,439	3,330	3,330	1,374	4,439	3,330	4,439	3,330
Longnose Skate	W		78	78	31		78		78
	C		2,041	2,041	847		2,041		2,041
	E		768	768	118		768		768
	Total	3,849	2,887	2,887	996	3,849	2,887	3,849	2,887
Other skates	Total	2,806	2,104	2,104	1,178	2,806	2,104	2,806	2,104
Other Species	Total		n.a.	4,500	2,116	8,720	6,540	8,720	6,540
Total		**665,642**	**536,201**	**262,826**	**181,687**	**632,498**	**516,055**	**722,134**	**562,762**

Table 2. Gulf of Alaska 2009 ABCs, biomass, and overfishing levels (t) for Western, Central, Eastern, Gulfwide, West Yakutat, and Southeast Outside regulatory areas. Dark rockfish are excluded for 2009 due to pending regulatory changes.

		2009		
Species/Assemblage	Area	ABC	Biomass	OFL
Pollock	W (61)	15,249		
	C (62)	14,098		
	C (63)	11,058		
	WYAK	1,215		
	Subtotal	41,620	638,950	58,590
	EYAK/SEO	8,280	36,799	11,040
	Total	49,900	675,749	69,630
Pacific Cod	W	21,567		
	C	31,521		
	E	2,212		
	Total	55,300	520,000	66,600
Sablefish	W	1,640		
	C	4,990		
	WYAK	1,784		
	EY/SEO	2,746		
	Total	11,160	149,000	13,190
Deep water flatfish	W	706		
	C	6,927		
	WYAK	997		
	EYAK/SEO	538		
	Total	9,168	133,025 [4]	11,578
Shallow water flatfish	W	26,360		
	C	29,873		
	WYAK	3,333		
	EYAK/SEO	1,423		
	Total	60,989	436,590 [5]	74,364
Rex sole	W	1,007		
	C	6,630		
	WYAK	513		
	EYAK/SEO	846		
	Total	8,996	81,572 [5]	11,756
Arrowtooth flounder	W	30,148		
	C	164,251		
	WYAK	14,908		
	EYAK/SEO	12,205		
	Total	221,512	2,035,710 [5]	261,022
Flathead sole	W	13,010		
	C	29,273		
	WYAK	3,531		
	EYAK/SEO	650		
	Total	46,464	323,937 [5]	57,911

Table 2. continued.

Species/Assemblage	Area	2009 ABC	Biomass	OFL
Pacific ocean perch	W	3,713		4,409
	C	8,246		9,790
	WYAK	1,108		0
	EY/SEO	2,044		0
	EGOA	3,152		3,741
	Total	15,111	318,336	17,940
Northern rockfish	W	2,054		
	C	2,308		
	E	0 [1]		
	Total	4,362	90,557	5,204
Rougheye	W	125		
	C	833		
	E	326		
	Total	1,284	46,385	1,545
Shortraker	W	120		0
	C	315		0
	E	463		0
	Total	898	39,905	1,197
Other Slope rockfish	W	357		
	C	569		
	WYAK	604 [1]		
	EYAK/SEO	2,767		
	Total	4,297	90,283 [5]	5,624
Pelagic shelf rockfish	W	819		
	C	3,404		
	WYAK	234		
	EY/SEO	324		
	Total	4,781	66,603	5,803
Demersal shelf rockfish	Total	362	17,390	580
Thornyhead rockfish	Western	267		
	Central	860		
	Eastern	783		
	Total	1,910	84,775 [5]	2,540
Atka mackerel	Total	4,700	Unknown	6,200
Big skates	W	632	8,422	
	C	2,065	27,536	
	E	633	8,434	
	Total	3,330	44,392	4,439
Longnose skates	W	78	1,043	
	C	2,041	27,209	
	E	768	10,239	
	Total	2,887	38,491	3,849
Other skates	Total	2,104	28,057	2,806
Other species		6,540		8,720
All species	Total	516,055	5,220,757	632,498

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	0.11	F_{ABC}	0.15	$F_{35\%\ adjusted}$
Pacific cod	3b	0.44	$F_{40\%}$ adjusted	0.54	$F_{35\%adjusted}$
Sablefish	3b	0.085	$F_{40\%\ adjusted}$	0.101	$F_{35\%adjusted}$
Deepwater flatfish	3a,6[3]	0.137	$F_{40\%}$, F_{ABC}[3]	0.176	$F_{35\%}$, 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]	0.150-0.204	$F_{40\%}$, F=.75M[5]	0.192-0.245	$F_{35\%}$, F=M[6]
Arrowtooth	3a	0.186	$F_{40\%}$	0.222	$F_{35\%}$
Pacific ocean perch	3a	0.061	$F_{40\%}$	0.073	$F_{35\%}$
Rougheye rockfish	3a	0.039	$F_{40\%}$	0.047	$F_{35\%}$
Shortraker rockfish	5	0.023	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	0.061	$F_{40\%}$	0.073	$F_{35\%}$
Pelagic Shelf Rockfish	3a, 5[9]	0.087, 0.0525	$F_{40\%}$, F=.75M[9]	0.107, 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.
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. This is a modified Tier 6 recommendation.
14/ OFL for squid is equal to the maximum catch of squid. This is a modified Tier 6 recommendation.
15/ ABC for octopus is equal to 0.75 x the maximum catch of octopus. This is a modified Tier 6 recommendation.
16 OFL for octopus is equal to the maximum catch of octopus. This is a modified Tier 6 recommendation.
17/ ABC for sharks is equal to 0.75 x the catch from 1997-2007 (which differs from the standard Tier 6 time frame of 1978-1995).
18/ OFL for sharks is equal to the average catch from 1997-2007 (which differs from the standard Tier 6 time frame of 1978-1995).

Table 4. Plan Team recommendations for ABC that fell below the maximum permissible fishing mortality rates and ABCs as defined in Amendment 56 to the GOA and BSAI Groundfish FMPs.

Species	Tier	2009 *Max* F_{ABC}	*Max* ABC	F_{ABC}	2009 ABC
Pollock[1]	3b	0.13	50,770	0.11	41,620
Demersal shelf rockfish	4	0.026	451	0.02	347

1/ The Plan Team recommended 2009 W/C pollock ABC of 41,620 mt is reduced by 1,650 mt to accommodate the Prince William Sound GHL. For comparisons in this table, the maximum permissible ABC of 50,770 mt should be compared with the full ABC 43,270 mt.

Table 5. Groundfish landings (metric tons) in the Gulf of Alaska, 1956-2008.

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[H]	51,721	42,424	12,284	15,544	29,163	18,184

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, 1956-2008.

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[H]	3,634	261	737	2,071	3,548	2,116	181,687

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; after 1998 black and blue were excluded.
g/ Does not include at-sea discards.
h/ Catch data reported through November 8th, 2008.
i/ Includes all species except arrowtooth.
j/ Does not include state fisheries
k/ Includes all managed skates species

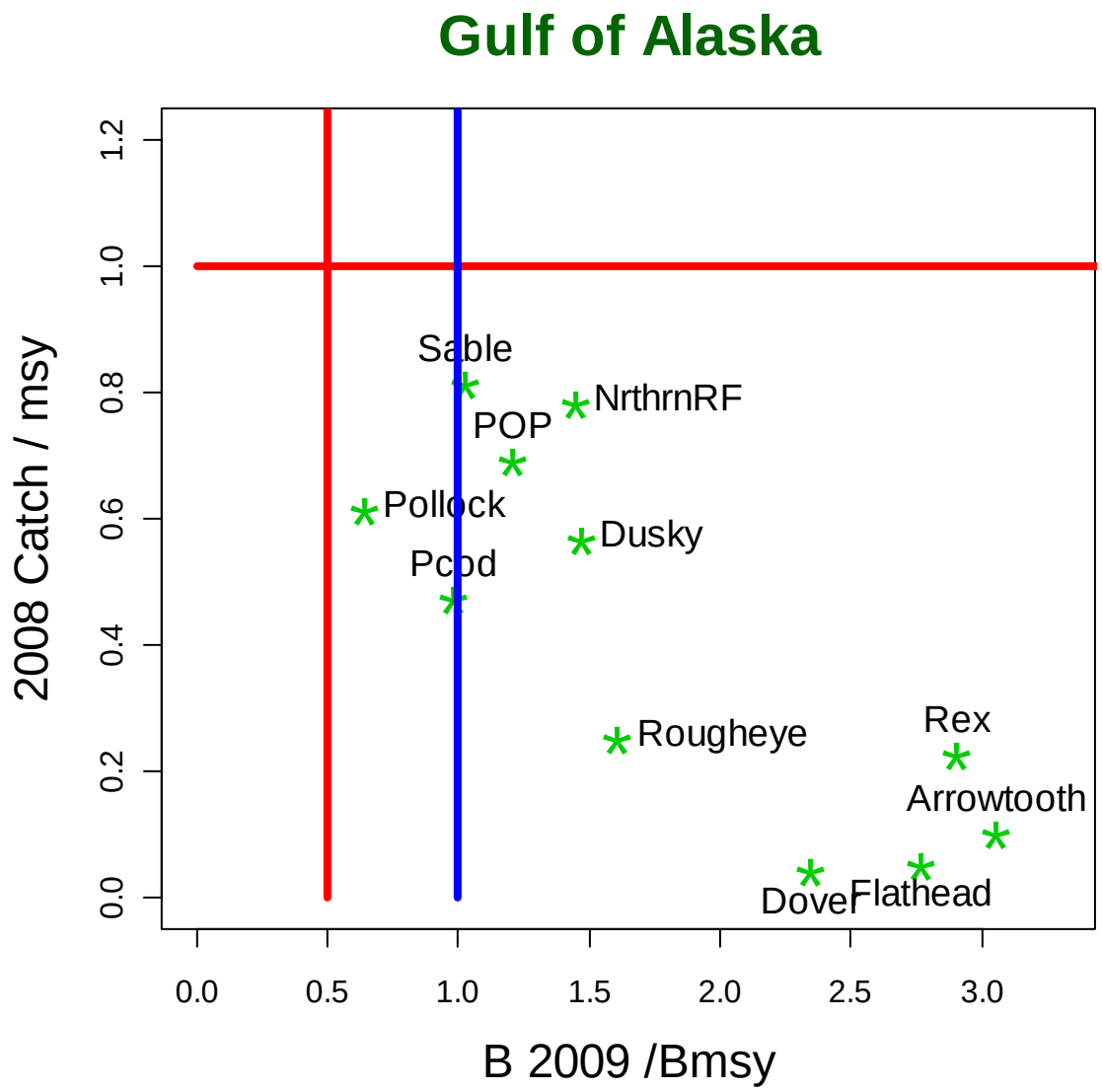

Figure 1. Summary status of age-structured GOA species relative to 2008 catch levels (vertical axis) and projected 2009 spawning biomass relative to B_{msy} levels. Note that the 2008 MSY level is taken as the 2008 OFL (which is defined as the catch at F_{msy}). Also, Pacific cod is based on last year's assessment.

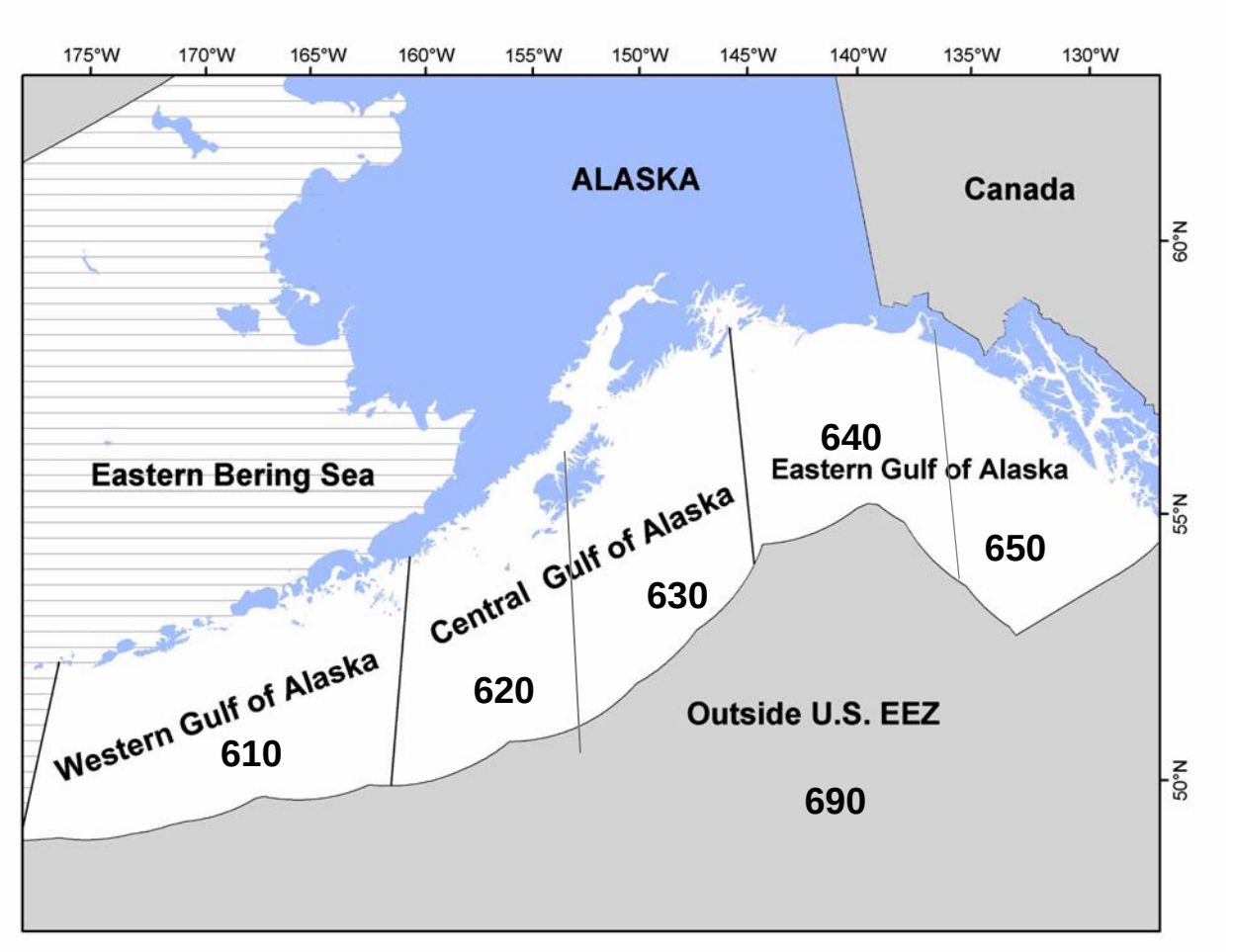

Figure 2. Gulf of Alaska statistical and reporting areas.

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