APPENDIX B

STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

FOR THE GROUNDFISH RESOURCES OF THE GULF OF ALASKA

Compiled by

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

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Summary

by

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

Introduction

The *National Standard Guidelines for Fishery Management Plans* published by the National Marine Fisheries Service (NMFS) require that a stock assessment and fishery evaluation (SAFE) report be prepared and reviewed annually for each fishery management plan (FMP). The SAFE reports are intended to summarize the best available scientific information concerning the past, present, and possible future condition of the stocks and fisheries under federal management. The FMPs for the groundfish fisheries managed by the Council require that drafts of the SAFE reports be produced each year in time for the December North Pacific Fishery Management Council (Council) meetings.

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

The GOA Groundfish Plan Team met in Seattle on November 13-16th, 2007 to review the status of stocks of seventeen 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, Bob Foy, Steven Hare, Sarah Gaichas, Cleo Brylinsky, Tom Pearson, Kathy Kuletz, Nick Sagalkin, and Theresa Tsou.

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 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 2008 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 2007 was issued (NPFMC 2006), the following new information has been incorporated in the stock assessments:

1) Pollock: (a) preliminary catch estimates for the 2007 fishery, (b) age composition from the 2006 fishery; (c) biomass and length composition from the 2007 Shelikof Strait echo integration trawl (EIT) survey; (d) biomass and length composition from the 2007 NMFS bottom trawl survey, and e) 2006 age composition and 2007 biomass and length composition from the ADF&G crab/groundfish trawl survey.
2) Pacific cod: (a) size composition data from the 2006 and preliminary estimates for the 2007 fisheries; (b) age composition and mean length-at-age data from the 1996, 1999, 2001 GOA bottom trawl surveys were incorporated; (c) relative abundance (numeric) from GOA bottom trawl surveys from 1984-2007.
3) Sablefish: (a) relative abundance and length data from the 2007 longline survey, (b) relative abundance and length data from the 2006 longline and trawl fisheries, (c) age data from the 2006 longline survey and longline fisheries, (d) survey abundance and length data from GOA bottom trawl surveys, (e) older growth data (1981-1993) were updated, and (f) new growth data were added (1996-2004) in the form of new age-length conversion matrices.
4) Flatfish: Flatfish have been moved to a biennial stock assessment schedule to coincide with new survey data. Last year only executive summaries were presented in the SAFE Report. This year, in conjunction with the 2007 NMFS bottom trawl survey, full assessments are provided for all flatfish categories.
5) Shallow-water flatfish: (a) biomass and length composition from the 2007 NMFS bottom trawl survey.
6) Deepwater flatfish: (a) 2006 and partial 2007 fishery catch data, (b) biomass and length composition from the 2007 NMFS bottom trawl survey, and (c) age compositions from the 2003 and 2005 NMFS bottom trawl surveys.
7) Rex sole: (a) 2006 and partial 2007 fishery catch data, (b) updated 2005 fishery catch and length compositions, (c) biomass and length composition from the 2007 NMFS bottom trawl survey.
8) Arrowtooth flounder: (a) 2006 and partial 2007 fishery catch data, (b) biomass and length composition from the 2007 NMFS bottom trawl survey, (c) age composition from the 2005 NMFS bottom trawl survey, and (d) the age-length transition matrix was updated with mean length at age data for 1984-2005.
9) Flathead sole: (a) 2006 and partial 2007 fishery catch data, (b) updated 2005 fishery catch and length compositions, and (c) biomass and length composition from the 2007 NMFS bottom trawl survey.
10) Rockfish: Rockfish have been moved to a biennial stock assessment schedule to coincide with new survey data. Last year only executive summaries were presented in the SAFE Report (except for northern rockfish). This year, in conjunction with the 2007 NMFS bottom trawl survey, full assessments are provided for all rockfish categories.
11) Pacific ocean perch: (a) 2006 and estimated 2007 fishery catch data, (b) 2006 fishery age composition, (c) biomass and length composition from the 2007 NMFS bottom trawl survey, d) age composition from the 2005 NMFS bottom trawl survey.
12) Northern rockfish: (a) 2006 and partial 2007 fishery catch data, (b) 2006 fishery age composition, and (c) biomass from the 2007 NMFS bottom trawl survey.

13) Rougheye rockfish: (a) 2006 and partial 2007 fishery catch data, (b) 2002 And 2006 fishery length compositions, (c) biomass from the 2007 NMFS bottom trawl survey, (d) 1984, 1993, 1996, and 2005 trawl survey age compositions, (e) 2006-2007 longline survey relative population weights, and (f) 2006-2007 longline survey size compositions.

14) Shortraker and other slope rockfish: (a) biomass from the 2007 NMFS bottom trawl survey, (b) survey age results in Alaska for shortraker, sharpchin, redstripe, harlequin, and silvergray rockfish, (c) new information on age and growth and natural mortality rates for several other slope rockfish species, including a new natural mortality rate for silvergray rockfish, and (d) changes to the methodology used to calculate exploitable biomass.

15) Pelagic shelf rockfish: (a) 2006 and estimated 2007 fishery catch data, (b) biomass from the 2007 NMFS bottom trawl survey, (c) age composition from the 2005 NMFS bottom trawl survey, and d) previously, dark rockfish and dusky rockfish were considered one species and treated as a Tier 4 species. Dusky rockfish are now assessed with an age-structured model and are managed as a Tier 3 species. Dark rockfish are now considered a Tier 5 species along with widow and yellowtail rockfish.

16) Demersal shelf rockfish: (a) new 2007 ADF&G survey estimates of yelloweye rockfish density for the Central Southeast Outside (CSEO) area, and (b) updated yelloweye rockfish average weight and standard error data from fish captured as bycatch during the 2007 IPHC survey.

17) Thornyheads: (a) updated 2005, 2006 and partial 2007 fishery catch data, (b) 2006 longline fishery length composition, (c) biomass and length composition from the 2007 NMFS bottom trawl survey, (d) 2006-2007 longline survey relative population numbers and weights, and (e) 2006-2007 longline survey size compositions.

18) Atka mackerel: Atka mackerel has been moved to a biennial stock assessment schedule to coincide with new survey data. Last year only an executive summary was presented in the SAFE Report. This year, in conjunction with the 2007 NMFS bottom trawl survey, a full assessment is provided for Atka mackerel including: (a) updated 2005, 2006 and partial 2007 fishery catch data, (b) age data from the 2006 GOA fisheries, (c) biomass and length composition data from the 2007 NMFS bottom trawl survey, (d) age data from the 2005 NMFS bottom trawl survey, and (e) an expanded and detailed Ecosystems Considerations section.

19) Skates: Skates have been moved to a biennial stock assessment schedule to coincide with new survey data. Last year only an executive summary was presented in the SAFE Report. This year, in conjunction with the 2007 NMFS bottom trawl survey, a full assessment is provided for skates including: (a) updated 2005, 2006 and partial 2007 fishery catch data, (b) biomass estimates from the 2007 NMFS bottom trawl survey, and (c) updated life history information from recent research results.

20) Groundfish, generally: Updated catch data from the NMFS Observer Program and Regional Office for 2006 and through November 3rd, 2007.

21) Other species: incidental catch is included for TAC recommendations. Executive summaries are included for a number of species groups for forthcoming break-out Plan Amendment analyses.

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 2007 or 2) above ½ of its MSY level in 2008 and above its MSY level in 2020 under this scenario, then the stock is not overfished.)

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

In 2008 and 2009, 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 2020 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 rex sole, 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 and sablefish are below target stock size (Figure 1). The target biomass levels for other deep-water flatfish, shallow-water flatfish, shortraker rockfish, demersal shelf rockfish, other pelagic shelf rockfish, other slope rockfish, thornyhead rockfish, Atka mackerel, and skates are unknown. The status of Pacific cod is unknown based on the present stock assessment. However, in 2006 it was estimated to be above the $B_{40\%}$ target level.

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 2007, and recommendations for ABCs and overfishing levels (OFLs) for 2008 and 2009. 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, 1956-2007.

The sum of the preliminary 2008, 2009 ABCs for target species are 536,191 t (2008), 556,174 t (2009) which are within the FMP-approved optimum yield (OY) of 116,000 - 800,000 t for the Gulf of Alaska. The sum of 2008 and 2009 OFLs are 665,642 t and 690,888 t, respectively. The Team notes that because of halibut bycatch mortality considerations in the high-biomass flatfish fisheries, an overall OY for 2008 will be considerably under this upper limit. For perspective, the sum of the 2007 TACs was 269,912 t, and the sum of the ABCs was 490,327 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 2006 and 2007 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 2008 and 2009 correspond to the Plan Team recommendations.

(4) The exploitable biomass for 2006 and 2007 that are reported in the following summaries were estimated by the assessments in those years. Comparisons of the projected 2008 biomass with previous years' levels should be made with biomass levels from the revised hindcast reported in each assessment.

(5) The values used for 2008 and 2009 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 since new data during years when no groundfish surveys are conducted are limited. For example, since 2006 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 2008 and 2009 (Table 1). In the case of stocks managed under Tier 3, 2008 and 2009 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 projections are set equal to the Plan Team's recommended values for 2008.

The 2009 ABC and OFL values recommended in next year's SAFE report are likely to differ from this year's projections for 2009, for the same reasons that the 2008 projections in this SAFE report differ from those in September.

Ecosystem Considerations-Gulf of Alaska

This overview has been added to emphasize the increased treatment of ecosystem considerations in annual SAFE reports. A summary of the ecosystem considerations chapter highlighting recent GOA trends is provided below. The explicit incorporation of ecosystem assessment data and modeling results in specific stock assessment chapters is also summarized. Additional information is available in individual stock assessment chapters and the ecosystem considerations chapter.

The ecosystem considerations chapter consists of three sections: ecosystem assessment, ecosystem status indicators, and ecosystem-based management indices and information. The ecosystem assessment section, introduced in 2003, combines information from the stock assessment chapters with the two other sections of this chapter to summarize the climate and fishery effects.

New trends highlighted in the 2007 ecosystem considerations chapter include:

- There were weak-moderate El Nino conditions near the end of 2006. Neutral conditions returned by early spring 2007. A cooling trend resumed in summer 2007 and it now appears probable at least a weak La Nina will form by the fall/winter of 2007-08.
- Anomalous southwesterly winds in the winter of 2006-07 caused relatively shallow mixed layer depths in the central Gulf, and deep mixed layer depths close to the coast. During spring 2007, anomalously low sea level pressure (SLP) was present in the central Gulf of Alaska, which promotes anomalous downwelling in the coastal zone, and a relatively strong Alaska Coastal Current.
- Gulf of Alaska bottom trawl survey temperatures indicate cooling of surface waters and warming of deeper waters, supporting the idea that there was anomalous mixing on the GOA shelf.
- Incidental catch for habitat areas of particular concern (HAPC) biota, forage species, and non-specified species was updated this year. The catch of non-specified species in the GOA has been relatively low in the last few years; whereas, the catch of HAPC biota has been variable. Grenadiers comprise the majority of non-specified catch and they are caught primarily in the sablefish fishery. Sea anemones comprise the majority of HAPC biota catch in the GOA and they are caught primarily in the flatfish fishery. The catch of forage species has undergone large variations, peaking in 2005 and decreasing in 2006 and 2007. The main species of forage fish caught are eulachon and they are primarily caught in the pollock fishery.
- Bottom trawl fishing effort continued to decrease in the GOA in 2006. Hook and line and pot fishing effort increased in the GOA.
- Demersal groundfish species in the GOA had above-average recruitments from the mid- or late 1970s to the late 1980s, followed by below-average recruitments during most of the 1990s. There is an indication for above-average recruitment from 1994-2000 (with the exception of 1996). In the Gulf of Alaska, recruitment has been below average across stocks from 2001-2006.
- The overall human population of GOA fishing communities in 2000 was over 21 times larger than its 1920 population, with the majority of that growth occurring in Anchorage.

Seven stock assessments incorporated information from the GOA ECOPATH model (Aydin et al. in press): walleye pollock, thornyhead rockfish, and skates have since 2005, and this year rex sole, flathead sole, Dover sole, and arrowtooth flounder assessments incorporated model results. All seven assessments

reported diet composition and total consumption on prey species. The sablefish assessment incorporated recent diet data.

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

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

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

Stock status summaries

1. Walleye Pollock

Status and catch specifications (t) of pollock and projections for 2008 and 2009. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2008 and 2009 are those recommended by the Plan Team. Catch data are current through November 3, 2007. Note that the projections for 2009 are subject to change in 2008. The 2008 and 2009 ABCs are reduced by 1,650 t to accommodate the anticipated Prince William Sound GHL.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
GOA	2006	635,732	118,309	86,547	86,547	70,522
	2007	861,072	95,429	68,307	68,307	51,779
	2008	741,819	83,150	60,180		
	2009		106,980	78,170		
W/C/WYK	2006	608,370	110,100	80,390	79,650	70,522
	2007	833,710	87,220	62,150	62,150	51,779
	2008	705,020	72,110	51,940		
	2009		95,940	69,930		
EYK/SEO	2006	27,362	8,209	6,157	6,157	0
	2007	27,362	8,209	6,157	6,157	0
	2008	36,799	11,040	8,280		
	2009		11,040	8,280		

Changes from previous assessment

The age-structured model developed using AD Model Builder and used for GOA pollock assessments in 1999-2006 is fundamentally unchanged. This year's pollock chapter features the following new data: (1) 2006 catch at age estimates, (2) preliminary catch estimates for 2007, (3) age composition from the 2006 fishery; (4) biomass and age composition from the 2007 Shelikof Strait echo integration trawl (EIT) survey; (5) biomass and length composition from the 2007 ADF&G crab/groundfish trawl survey, (6) age composition from the 2006 ADF&G crab/groundfish trawl survey, and (7) biomass estimates and length composition data from the 2007 NMFS bottom trawl survey.

Spawning biomass and stock status trends

The 2007 Shelikof Strait EIT total survey biomass estimate was 38% less than the 2006 estimate and is the lowest biomass estimated in Shelikof Strait. Biomass estimates of Shelikof Strait fish ≥43 cm (a proxy for spawning biomass) decreased by 47% from the 2006 estimate, primarily due to ageing of the relatively strong 1999 and 2000 year classes without significant recruitment of later year classes to the spawning population. The 2007 ADF&G crab/groundfish survey biomass estimate increased 11% from 2006. The 2007 NMFS bottom trawl survey estimate was 20% lower than the 2005 estimate.

The Plan Team concurred with the author's choice to use the same model as last year to provide assessment advice. This model fixed trawl survey catchability (q) at 1.0 and estimated other survey catchabilities. Although the likelihood is higher for models with q closer to 0.75, 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. The model results produced an estimated 2008 spawning biomass of 145,100 t, or 26% of unfished spawning biomass. The $B_{40\%}$ estimate is 221,000 t. Spawning biomass is projected to be at a minimum in 2008 and will increase in subsequent years in part because of the estimated near or above average 2004 - 2006 classes. The extent of the rate of increase depends on the magnitude of these year classes that are highly uncertain.

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 2007 female spawning biomass is below $B_{40\%}$, Gulf of Alaska pollock are in Tier 3b. Identical 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 2008 age-3+ biomass estimate is 705,020 t. Markov Chain Monte Carlo analysis indicated the probability of the stock being below $B_{20\%}$ to be less than 1% in 2008 and subsequent years. **Therefore, the ABC for 2008 based on this precautionary model configuration and adjusted harvest control rule is 53,590 t (**F_{ABC} =0.13) **for GOA waters west of 140 degrees W. longitude** (Note that this ABC recommendation is not reduced by 1,650 t to account for the Prince William Sound GHL). The 2008 OFL under Tier 3b is 72,110 t (F_{OFL}= 0.17).

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 **2008 ABC of 8,280 t**, and a **2008 OFL of 11,040 t.**

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 felt 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 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 for 2008 and 2009 pollock ABCs for the Gulf of Alaska (t).

Year	610	620	630	640	650	
	W	Central	Central	W. Yakutat	E.Yak/SE	Total
2008	17,602	19,181	13,640	1,517	8,240	61,870
2009	23,700	25,821	18,367	2,042	8,240	79,860

2. Pacific cod

Status and catch specifications (t) of Pacific cod and projections for 2008 and 2009. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year, *except that 2008 biomass is the trawl survey biomass from 2007. ABC and OFL for 2009 are set to the 2008 levels. Catch includes the federally reported catch (parallel and catch outside 3 miles; excludes state fishery inside 3-miles) and is current through 11/03/2007.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
GOA	2006	453,000	95,500	68,859	52,264	37,792
	2007	375,000	97,600	68,859	52,264	36,696
	2008	*233,310**	88,660	66,493		
	2009		88,660	66,493		

Extensive BSAI cod modeling efforts precluded work on the GOA cod assessment model again this year. The impact on the GOA assessment was more extreme this year than last year, and resulted in the delivery

of a partial assessment on the evening prior to Plan Team adjournment. The Plan Team appreciates the lead author's efforts, especially considering the additional requests for the BSAI assessment model developments in 2007. However, the GOA cod assessment is extremely important to sustainable management of one of the most economically valuable resources in this FMP area. Last year, the Team requested that the author be given adequate time to incorporate longline survey data and explore alternative model parameterizations in future assessments. The GOA Plan Team now makes a more specific request that the AFSC give priority to improving the GOA Pacific cod assessment in 2008, as the GOA assessment has been negatively impacted by BSAI issues for the past two years.

Changes from previous assessment
A single model was presented this year.

There were several changes in the input data:

1) Catch data for 2006 were updated, and preliminary catch data for 2007 were incorporated.
2) Size composition data from the 2006 commercial fisheries were updated, and preliminary size composition data from the 2007 commercial fisheries were incorporated.
3) Relative abundance in numbers from the GOA bottom trawl surveys from 1984-2007 was incorporated. In the past, relative abundance in biomass was used in the model.
4) Age composition data from the 1996, 1999, and 2001 GOA bottom trawl survey were incorporated. Now five years of age data, including 2003 and 2005.

The model was implemented in new software, Stock Synthesis 2.0c. There were many changes in model assumptions, which are detailed in the BSAI cod assessment under Model 1. The model used in the GOA was similar, except that

1) *M* was fixed at 0.38 (based on age at maturity; former GOA value was 0.37),
2) *Q* was fixed at 0.98 (based on archival tag data, former GOA value was 1.00),
3) trawl survey selectivity is length-based and constrained to be asymptotic (same as previous years for GOA),
4) fishery selectivities are unconstrained (same as previous years for GOA),
5) mean length-at-age data are included (same as previous years for GOA),
6) fishery selectivities applied to the entire time series, rather than in "eras" as in previous assessments,
7) survey selectivity now has time varying selectivity for ascending limb parameters,
8) fisheries defined for each of three gears for each of three seasons (for a total of 9 fisheries instead of the previous 4), and
9) the model starts in 1977 (rather than 1976).

Spawning biomass and stock status trends
The numeric abundance estimate from the 2007 survey was up 37% from the 2005 estimate. However, the biomass estimate from the 2007 survey was 233,310 t, down 24% from the 2005 estimate. The reason for the difference in trend between the two measures of abundance was the occurrence of large numbers of very small fish in the 2007 survey. Hence, the model is estimating above average recruitment for the 2006 year class, but this estimate is uncertain as it has been observed only from the survey. Based on the model, the projected 2008 female spawning biomass for the GOA stock is 108,000 mt, down about 15% from last year's estimate for 2007 and below the $B_{40\%}$ value of 121,000 mt. The projected 2008 age 3+ biomass is 295,000 t, down about 21% from last year's projection for 2007. Compared to the 2006 assessment, this model predicted higher historic biomass levels and lower current biomass levels.

Tier determination/Plan Team discussion and resulting ABCs and OFLs
The Plan Team determined that the model presented was significantly different from past models, and therefore required a full stock assessment and more extensive review than was possible given the timing. As such, the Team felt that it was unprepared for specifying harvest recommendations at this time, especially since its results could not be compared with a previously accepted model structure. The

decrease in GOA trawl survey biomass from 2005 to 2007 was considered important to reflect in harvest recommendations. After much discussion of Tier options, which focused on the uncertainty in the stock's status relative to $B_{40\%}$, the Plan Team settled on a Tier 5 calculation based on 2007 survey biomass of 233,310 t and the updated *M* of 0.38 (which was estimated outside the model based on published estimated age at maturity for GOA Pacific cod). Therefore, F_{ABC} is equal to 75% of *M*, or 0.38 * 0.75 = 0.285, and F_{OFL} is equal to *M* (0.38). The resulting ABC for 2008 and 2009 is 66,493 t, and the OFL for 2008 and 2009 is 88,658, rounded to 88,660 t.

Status determination
Based on the recommended specifications and catch in recent years, catch is unlikely to exceed OFL so the stock is not subject to overfishing. It is not possible to determine the status of Tier 5 stocks with respect to overfished conditions.

Additional Plan Team recommendations
The Team recommends that the current model be treated as any new model and be reviewed at next September's Plan Team meeting, alongside previously accepted models for comparison.

Ecosystem Considerations
There was no 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	2008	2009
West	39%	25,932	25,932
Central	57%	37,901	37,901
East	4%	2,660	2,660
Total		66,493	66,493

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 2008 and 2009 are those recommended by the Plan Team. Catch data are current through 11/03/07

Area	Year	Age 4+ Biomass	OFL	ABC	TAC	Catch
GOA	2006	152,000	17,880	14,840	14,840	13,367
	2007	158,000	16,906	14,310	14,310	12,539
	2008	167,000	15,040	12,720		
	2009		12,924	11,624		

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 only major model changes were the inclusion of informative priors on catchability for all abundance indices. 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 into the model: relative abundance and length data from the 2007 longline survey, relative abundance and length data from the 2006 longline fishery, length data from the 2006 trawl fishery, and age data from the 2006 longline survey and longline fishery. In addition, relative abundance and length data from the 2007 Gulf of

Alaska trawl survey were included with the expectation of improving estimates of recruitment. New growth data were added (1996-2004) in the form of revised age-length transition matrices, and older growth data (1981-1993) were updated. Fishery CPUE data from observer data and logbooks were used in the catch rate analysis.

Spawning biomass and stock status trends
The survey abundance index decreased 14% between 2006 and 2007, a change which follows the 13% increase between 2005 and 2006. The fishery abundance index was down 8% from 2005 to 2006 (2007 data not yet available).

The Plan Team concurred with the assessment authors recommended model (Model 3). The preferred model differed from the two others in that it incorporated the updated growth data and age-length conversion matrices as well as the informative priors on catchability coefficients. The spawning biomass is projected to be similar from 2007 to 2008, but is expected to decline through 2012. The projected 2008 female spawning biomass is 37% of unfished biomass compared with about 29% of unfished biomass estimated during the 1998 to 2001 period. The 2000 year class now appears to be larger than the 1997 year class and is expected to comprise 18% of the spawning biomass in 2008.

Tier determination/Plan Team discussion and resulting ABCs and OFLs
This stock qualifies for management under Tier 3. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from this assessment are 122,250 t (**combined across the EBS, AI, and GOA**), 0.093, and 0.111, respectively. Projected spawning biomass (combined areas) for 2008 is 111,607 t (91% of $B_{40\%}$), placing sablefish in sub-tier "b" of Tier 3. The maximum permissible value of F_{ABC} under Tier 3b is 0.084, which translates into a 2008 catch (combined areas) of 18,030 t and is the Plan Team's recommended combined 2008 ABC. The recommended 2008 ABC is approximately 10% lower than the 2007 ABC of 21,000 t. The OFL fishing mortality rate under Tier 3b is 0.101. This fishing mortality rate translates into a 2008 OFL (combined areas) of 21,310 t.

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

Additional Plan Team recommendations
The combined ABC has been apportioned to regions using a weighted moving average method since 1993. Since 2000, both survey and fishery data have been used to apportion ABC. The current method is to compute a 5-year exponential weighting for each index which are then combined, with the survey data weighted twice as heavily as the fishery data. The original rationale for this was that the variance for the fishery data was twice that of the survey data. Recent improvements to the sample size of observer and logbook collections have reduced the variance on the fishery source and led to industry requests to weight the two data sets equally. The Plan Team has no preference for one weighting scheme over the other and for this year has simply continued the recent method of double weighting the survey data, which is reflected in the recommended area apportionments below. The Plan Team notes that the increase in fishery data has largely occurred due to voluntary submission of logbooks as well as the availability of soft money funds to hire the IPHC to collect and process the fishery data. If equal weighting of the two data sets is to be considered for future apportionments, it is paramount that a more stable or permanent source of funding be found to ensure continued collection of logbooks. The Plan Team notes that for 2007 the difference in apportionment between the two methods is relatively minor.

Ecosystem Considerations
The ecosystem considerations section of the assessment was not significantly changed from the previous assessment, however 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 2008 ABC among regions, resulting in the following values: 2,860 t for EBS, 2,440 t for AI, and 12,720 t for GOA. Relative to 2006, apportionments to the EBS, AI and GOA all decreased.

Using the survey/fishery based apportionment scheme described above, 2008 OFL also may be apportioned among regions and results in the following values: 3,380 t for EBS, 2,890 t for AI, and 15,040 t for GOA. These values also represent a decrease from 2007 OFL levels for all three regions.

GOA area apportionments of sablefish ABC's for 2008 and 2009

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2008	1,880	5,500	1,950	3,390	12,720
2009	1,718	5,026	1,782	3,098	11,624

4. Deep water flatfish (Dover sole and others)

Status and catch specifications (t) of the deep water flatfish complex 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 2008 and 2009 are those recommended by the Plan Team. Catch data are current through 11/3/07.

Area	Year	Age 3+ Biomass	OFL	ABC	TAC	Catch
GOA	2006	132,460	11,008	8,665	8,665	405
	2007	134,196	10,431	8,707	8,707	267
	2008	132,625	11,343	8,903		
	2009		11,583	9,172		

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.

No changes were made to the model structure for Dover sole this year. New data for deep water flatfish (*excluding Dover sole*) and the Dover sole age-structured model included the 2006 catch and 2007 catch. In addition, the survey biomass and length composition data for Dover sole from the 2007 GOA groundfish trawl survey were added to the model. Survey age compositions for Dover sole from 2003 and 2005 were also added to the model.

Spawning biomass and stock status trends
Dover sole female spawning biomass peaked in 1991 and declined to 2005. The 2008 projection of spawning biomass is 43,284 t which is slightly higher than in the last 3 years.

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 2008 and 2009 ABC and OFLs.

For the Dover sole Tier 3a assessment the 2008 ABC using $F_{40\%}$=0.137 is 8,720 which is 196 t greater than the 2007 ABC. The 2008 OFL using $F_{35\%}$=0.176 is 10,999 t.

The GOA Plan Team agrees with the authors' recommended ABC for the deep water flatfish complex which was 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
Model results for Dover sole were added to the ecosystem considerations section of the assessment. 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.

Area apportionments of deep water flatfish (*Dover sole and others*)ABC's for 2008 and 2009					
Year	**Western**	**Central**	**West Yakutat**	**East Yakutat/SE**	**Total**
2008	690	6,721	965	527	8,903
2009	707	6,927	995	543	9,172

5. Shallow water flatfish

Status and catch specifications (t) of shallow water flatfish in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2008 and 2009 are those recommended by the Plan Team. Catch data are current through 11/3/07.

Area	Year	Survey Biomass	OFL	ABC	TAC	Catch
GOA	2006	365,766	62,418	51,450	19,972	7,641
	2007	365,766	62,418	51,450	19,972	8,042
	2008	436,590	74,364	60,989		
	2009		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 projections from last years assessment model included the 2007 bottom trawl survey biomass, 2006 and 2007 catches.

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 the 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 2008 ABC for shallow-water flatfish increased due to increases in survey biomass from 51,450 t in 2005 to 60,989 t in 2007.

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 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 2008 and 2009					
Year	**Western**	**Central**	**West Yakutat**	**East Yakutat/SE**	**Total**
2008	26,360	29,873	3,333	1,423	60,989
2009	26,360	29,873	3,333	1,423	60,989

6. Rex Sole

Status and catch specifications (t) of rex sole in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2008 and 2009 are those recommended by the Plan Team. Catch data are current through 11/3/07.

Area	Year	Adult Biomass	OFL	ABC	TAC	Catch
GOA	2006	83,475	12,000	9,200	9,200	3,294
	2007	82,403	11,900	9,100	9,100	2,846
	2008	82,801	11,933	9,132		
	2009		11,065	8,468		

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 2006 catch and 2007 catch. The 2007 GOA groundfish survey biomass estimate and length composition data were added to the model and the 2005 fishery catch and length compositions were updated.

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 is 82,801 t. Spawning biomass increased in 2008 and is projected to decrease in 2009.

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 2008 ABC using $F_{ABC} = 0.75M = 0.128$ is **9,132 t** which is 32 t greater than the 2007 ABC. The 2008 OFL using $F_{OFL} = M = 0.17$ is **11,933** t. The 2009 ABC and OFL were projected by setting 2008 catches equivalent to 2007 catches.

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
An ecosystem consideration section was added to the assessment with updated model results and PSC bycatch information through 2006. 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 2008 and 2009 are based on the fraction of the 2007 survey biomass in each area.

Area apportionments of rex sole ABC's for 2008 and 2009

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2008	1,022	6,731	520	859	9,132
2009	948	6,241	483	796	8,468

7. Arrowtooth flounder

Status and catch specifications (t) of arrowtooth flounder in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2008 and 2009 are those recommended by the Plan Team. Catch data are current through 11/3/07.

Area	Year	Age 3+ Biomass	OFL	ABC	TAC	Catch
GOA	2006	2,138,660	207,678	177,844	38,000	27,653
	2007	2,146,360	214,828	184,008	43,000	25,073
	2008	2,244,870	266,914	226,470		
	2009		269,237	228,405		

Changes from previous assessment
The 2007 survey biomass and length data were added to the model. Catch and fishery length data for 2006 and 2007 were added to the model. Age data from the 2005 survey were added. The age-length transition matrix was updated with mean length at age data for 1984 to 2005.

Spawning biomass and stock status trends
The estimated age 3+ biomass from the model decreased from 2,258,230 t in 2006 to 2,256,030 t in 2007. Female spawning biomass in 2007 was estimated at 1,208,120 t, a 4% decline from the projected 2007 biomass of 1,254,030 t from the 2005 assessment.

Tier determination/Plan Team discussion and resulting ABCs and OFLs
Arrowtooth flounder has been determined to fall under Tier 3a. The 2008 ABC using $F_{40\%}$=0.186 is 226,470 t, which is 42,462 t greater than the 2007 ABC. The 2008 OFL using $F_{35\%}$=0.222 is 266,914 t. The 2009 ABC and OFL were projected by setting 2008 catches equivalent to 2007 catches. The increase in ABC is partially due to a change in age-length transition matrix (revised growth) resulting in a higher $F_{40\%}$, as well as an increase in biomass from 2006 to 2008.

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 to include an expanded appendix of trends and model-based information on the role of arrowtooth flounder in the GOA ecosystem. Arrowtooth flounder play an important role in the Gulf of Alaska ecosystem as a predator.

Area apportionment
Area apportionments of arrowtooth flounder ABC's for 2008 and 2009 are based on the fraction of the 2007 survey biomass in each area.

Area apportionments of arrowtooth flounder ABC's for 2008 and 2009

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2008	30,817	167,936	15,245	12,472	226,470
2009	31,080	169,371	15,375	12,579	228,405

8. Flathead Sole

Status and catch specifications (t) of flathead sole in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2008 and 2009 are those recommended by the Plan Team. Catch data are current through 11/3/07.

Area	Year	Age 3+ Biomass	OFL	ABC	TAC	Catch
GOA	2006	295,676	47,003	37,820	9,077	3,134
	2007	297,353	48,658	39,110	9,148	3,105
	2008	324,197	55,787	44,735		
	2009		57,962	46,505		

Changes from previous assessment
Flathead sole are assessed with an age-structured model as presented in the 2005 assessment. The fishery catch and length compositions for 2006 and 2007 were incorporated in the model. The 2005 fishery catch and length compositions were updated. The 2007 GOA groundfish survey biomass estimate and length composition data were added to the model. Survey biomass estimates and length compositions were recalculated for all survey years.

Spawning biomass and stock status trends
Survey biomass increased from 213,221 t in 2005 to 280,990 t in 2007. Projected female spawning biomass is estimated at 106,566 t for 2008.

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 2008 ABC using $F_{40\%}$ = 0.380 is 44,735 t which is 5,625 mt higher than the 2007 ABC. The 2008 OFL using $F_{35\%}$ = 0.494 is 55,787 t. The 2009 ABC and OFL were calculated with 2008 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 model results were added this year. They 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 2008 and 2009 are based on the fraction of the 2007 survey biomass in each area.

Area apportionments of flathead sole ABC's for 2008 and 2009

Year	Western	Central	West Yakutat	East Yakutat/SE	Total
2008	12,507	28,174	3,420	634	44,735
2009	13,001	29,289	3,556	659	46,505

Slope rockfish

Status and catch specifications (t) of slope rockfish management category and projections for 2008 and 2009. Projections are made using authors' estimate of 2006 and 2007 catch. Catch data in table below are current through 11/03/2007.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Pacific ocean perch	2006	312,968	16,927	14,261	14,261	13,590
	2007	315,507	17,157	14,636	14,635	12,795
	2008	317,511	17,807	14,999		
	2009		17,893	15,072		
Northern rockfish	2006	83,485	7,673	5,091	5,091	4,956
	2007	94,271	5,890	4,938	4,938	4,089
	2008	93,391	5,430	4,550		
	2009		5,120	4,350		
Shortraker rockfish	2006	37,461	1,124	843	843	664
	2007	37,461	1,124	843	843	592
	2008	39,905	1,197	898		
	2009		1,197	898		
Rougheye rockfish	2006	37,449	1,180	983	983	351
	2007	39,506	1,148	988	988	399
	2008	46,121	1,548	1,286		
	2009		1,540	1,279		
Other slope rockfish	2006	93,552	5,394	4,154	1,480	931
	2007	93,552	5,394	4,154	1,482	665
	2008	90,283	5,624	4,297		
	2009		5,624	4,297		

Area apportionments of ABC for slope rockfish for 2008.

Species	Western	Central	Eastern	West Yakutat	East Yak./SE	Total
Pacific ocean perch	3,686	8,185		1,100	2,028	14,999
Northern rockfish[1]	**2,141**	**2,408**				**4,549**
Shortraker rockfish	120	315	463	-	-	898
Rougheye rockfish	125	834	327	-	-	1286
Other slope rockfish[1]	357	569	-	604	2,767	4,297

[1] Other slope rockfish in West Yakutat includes 1 t of northern rockfish from the Eastern Gulf of Alaska.

GOA slope rockfish are on a biennial stock assessment schedule to coincide with new survey data. This year's SAFE chapters consist of updated stock assessments

Previously, exploitable biomass for shortraker rockfish and "other slope rockfish" was estimated by excluding the biomass in the 1-100 m depth stratum. The exclusion of the 1-100 m stratum from the estimate was a holdover from when the assessment included Pacific ocean perch; the rationale was that small-sized Pacific ocean perch predominated in this stratum, and these fish should be considered unexploitable. However, information presented in the current assessment shows that the northern rockfish in this strata are adult sized and should be included in the exploitable biomass. Biomass of shortraker rockfish and "other slope rockfish" in this stratum is negligible; hence, the exclusion of the 1-100 m stratum from the exploitable biomass computations for these groups appears unnecessary. Effects of this change are negligible except in the case of area apportioning of northern rockfish ABC.

Area apportionments for rockfish ABC are a weighted average of previous years' percent exploitable biomass distributions. The Plan Team discussed the merit of exploring the difference that weighting the

apportionments by biomass rather than percentages could have on the resultant apportionments. Assessment authors agreed to compare the approaches under different scenarios of biomass distribution.

Industry expressed the need for a method to assess the effect of rockfish in the water column on the accuracy of the stock assessments. It was noted the need for more accurate assessments as the industry becomes more capable of taking specific target species TACs and avoiding bycatch constraints under the Rockfish Pilot Program. The use of hydroacoustics or other methods was discussed as a method to evaluate the effect of midwater fish concentrations, as well as trawlable and untrawlable survey habitat on survey accuracy.

9. Pacific ocean perch

Status and catch specifications (t) of Pacific ocean perch and projections for 2008 and 2009. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. ABC and OFL for 2008 and 2009 are projected using author's estimate of 2007 and 2008 catch. Catch data are current through 11/03/2007.

Species	Year	Biomass[1]	OFL	ABC	TAC	Catch
Pacific ocean perch	2006	312,968	16,927	14,261	14,261	13,590
	2007	315,507	17,158	14,636	14,635	12,795
	2008	317,511	17,807	14,999		
	2009		17,893	15,072		

[1]Total biomass from the age-structured model

Changes from previous assessment
The generic rockfish model continues to be the primary assessment tool for this species and is developed with AD model builder software. New data in the model include the 2005 survey age composition, 2006 fishery age composition, 2006 and estimated 2007 fishery catch and 2007 survey biomass estimates.

Spawning biomass and stock status trends
The 2005 and 2007 survey biomass estimates are relatively large and have greater precision than the estimates in the early 1990s, and have begun to influence the model estimates upward.

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. The projected ABC for 2008 is 14,999 t which is 3% higher than last year's ABC of 14,636 t. The OFL is 17,807 t for 2008.

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

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

Area apportionment
The Plan Team concurred with the method of apportionment of ABC and OFL by the authors. This results in weighting of 4:6:9 for the regional distribution biomass in the 2003, 2005, and 2007 surveys, respectively, and area apportionments of 25% for the Western area, 55% for the Central area, and 20% for the Eastern area.

Area apportionment of 2008 and 2009 ABC and OFL for POP in the Gulf of Alaska:

Year		Western	Central	Eastern	WYAK	SEO	Total
2008	ABC	3,686	8,185		1,100	2,028	14,999
2009		3,704	8,225		1,105	2,038	15,072
2008	OFL	4,376	9,717	3,714			17,807
2009		4,397	9,764	3,732			17,893

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 between 140° and 147° W longitude, that remains open to trawling. Thus, as was done last three years, the Team recommends that a separate ABC be set for Pacific ocean perch in WYAK. This weighted average is based on of the upper 95% confidence interval of the proportion of EG exploitable biomass that occurs in WYAK (0.41). The interval is computed using the weighted average from the 2003, 2005 and 2007 surveys. Using the upper 95% confidence interval is an effort to balance uncertainty with associated costs to industry. This corresponds to an ABC of 1,100 t for WYAK. Under this apportionment strategy, very little of the 2,028 t assigned to the remaining Eastern area (East Yakutat/Southeast Outside area) will be harvested.

10. Northern Rockfish

Status and catch specifications (t) of northern rockfish and projections for 2008 and 2009. Projections are made using author's best estimate of 2007 and 2008 catch. Catch data in table are current through 11/03/2007. 2006 and 2007 biomass estimates are for age 6+, for 2008 total biomass is presented.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Northern rockfish	2006	83,485	7,673	5,091	5,091	4,956
	2007	94,271	5,890	4,938	4,938	4,089
	2008	93,391	5,430	4,549		
	2009		5,120	4,349		

Changes from previous assessment

Unlike other GOA rockfish a complete assessment was performed last year for northern rockfish. The reference age-structured model from last year (Model 1) is used this year with updated data. The data was updated to include the 2007 trawl survey biomass estimate, updated catch for 2006, preliminary catch for 2007, and fishery age compositions from 2006. The only major change to the model configuration relative to last year was that the CV for the prior on survey catchability *q* was changed from 15% to 45 % which is identical to that used in the GOA Pacific ocean perch, and dusky rockfish assessments. The outcome from this change did not substantially change stock assessment results relative to last year.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

Northern rockfish are determined to be in Tier 3a. The recommended ABC for 2008 is 4,550 t. The corresponding reference values for northern rockfish recommended for this year and projected one additional year are summarized below:

Summary	2008	2009
Total Biomass (t)	93,391	90,672
$B_{40\%}$ (t)	22,300	22,300
Female spawning biomass (t)	29,170	28,180
F_{ABC} (=$F_{40\%}$)	0.061	0.061
F_{OFL} (=$F_{35\%}$)	0.073	0.073
ABC	**4,549**	**4,349**
OFL	5,430	5,120

The recommended Tier 3 ABC is similar to results from earlier assessments but down 8% from 2006.

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

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

Area apportionment
Apportioning the 2008 and 2009 ABC is based on the same method used for Pacific ocean perch where the biomass in the 1-100 m strata is included this year. Northern rockfish ABC apportionments (with 1 t from the Eastern Gulf included in Other Slope Rockfish in West Yakutat):

	Western	Central	Eastern	West Yakutat	East Yak./SE	Total
2008	**2,141**	**2,408**				**4,549**
2009	2,047	2,302				4,349

11. Rougheye rockfish

Status and catch specifications (t) of rougheye rockfish and projections for 2007 and 2008. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Projections to 2007 and 2008 use author's estimate of 2006 and 2007 catch. Catch data are current through 11/03/2007.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Rougheye rockfish	2006	37,449	1,180	983	983	351
	2007	39,506	1,148	988	988	399
	2008	46,121	1,548	1,286		
	2009		1,540	1,279		

Changes from previous assessment
The assessment methodology is the same as the author recommended model in 2005.

New data added to this model were the updated estimates of 2006 and 2007 fishery catch, 2002 and 2006 fishery length compositions, 2007 trawl survey biomass estimate, 1984, 1993, 1996, and 2005 trawl survey age compositions, 2006-2007 longline survey relative population weights, and 2006-2007 longline survey size compositions. Since the longline survey does not sample in proportion to area, the authors used the newly available area weighted longline survey size compositions instead of raw size compositions. The assessment provided results from the 2005 model and the updated 2007 model.

Spawning biomass and stock status trends
The trawl survey estimate increased by 25% from 2005, while the longline survey relative population weight increased by 15% in 2006 and another 50% in 2007. Female spawning biomass is projected to be 13,882 t in 2008.

Tier determination/Plan Team discussion and resulting ABCs and OFLs
Rougheye rockfish are determined to be in Tier 3a. The projected ABC derived from the recommended model for 2008 is 1,286 t which is about 30% higher than last year's ABC of 988 t. Reference values for rougheye rockfish are summarized below. Female spawning biomass is well above $B_{40\%}$, with projected biomass stable.

	2008	2009*
$B_{40\%}$ (t) (female spawning biomass)	9,935	-
Female Spawning Biomass (t)	13,882	13,980
$F_{40\%}$	0.039	0.039
F_{ABC} (maximum permissible)	0.039	0.039
ABC (mt; maximum permissible)	1,286	1,279
F_{OFL}	0.047	0.047
OFL (t)	1,548	1,540

*Projected ABCs and OFLs for 2009 are derived using an expected catch value of 517 t for 2008 based on recent ratios of catch to *ABC*. This calculation is in response to management requests to obtain a more accurate one-year projection. Results of this method are listed under the Author's F alternative in Table 11-10 in the rougheye rockfish assessment.

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

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

Area apportionment
Area apportionments (calculated using the same method as for POP) of the 2008 and 2009 ABC for rougheye rockfish in the Gulf of Alaska:

	Western	Central	Eastern	Total
2008	125	834	327	1,286
2009	124	830	325	1,279

Additional Plan Team recommendations
An attachment to the SAFE report presents sensitivity of stock assessment results to trawl and longline surveys. The sensitivity analysis found that artificially increasing the precision of the longline survey results in lower biomass whereas reduced precision in the longline survey results in minimal change to biomass estimates.

The Plan Team recommended that research on the potential for disproportionate harvests between the two species that are currently managed within this group (*S. aleutianus and S. melanostictus*). The authors reported that work is underway to update the maturity schedule for rougheye and will be ready for inclusion in the next assessment.

12. Shortraker and other slope rockfish

Shortraker rockfish

Status and catch specifications (t) of shortraker slope rockfish and projections for 2008 and 2009. Catch data are current through 11/03/2007. Biomass based on 3 most recent trawl surveys.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Shortraker rockfish	2006	37,461	1,124	843	843	664
	2007	37,461	1,124	843	843	592
	2008	39,905	1,197	898		
	2009		1,197	898		

Other slope rockfish

Status and catch specifications (t) of the Other Slope rockfish management category and projections for 2008 and 2009. Catch data are current through 11/03/2007. Biomass based on 3 most recent trawl surveys.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Other Slope rockfish	2006	93,552	5,394	4,154	1,480	931
	2007	93,552	5,394	4,154	1,482	665
	2008	90,283	5,624	4,297		
	2009		5,624	4,297		

Changes from previous assessment
Major new information in this assessment includes biomass estimates from the 2007 trawl survey, and survey age results in Alaska for shortraker, sharpchin, redstripe, harlequin, and silvergray rockfish, and new information on age-and-growth and natural mortality rates for several "other slope rockfish" species. Assessment methodology in this report is generally similar to that used in past assessments for shortraker rockfish and "other slope rockfish", but changes were made to the way that exploitable biomass is calculated and to the natural mortality rate used for silvergray rockfish.

Spawning biomass and stock status trends
Averaging the biomass from the last three Gulf of Alaska trawl surveys (2003, 2005, and 2007), and including the shallow stratum (0-100 m discussed above),results in an exploitable biomass of 39,905 t for shortraker rockfish and 90,283 t for "other slope rockfish".

Tier determination/Plan Team discussion and resulting ABCs and OFLs
The ABC computations for silvergray rockfish include an updated estimate of natural mortality *M*. Previously, an *M* of 0.04 was used for silvergray rockfish based on the midpoint of the range of instantaneous mortality *Z* (0.01-0.07) for British Columbia stocks. For the present assessment, two new estimates are available that are direct measures of *M* for silvergray rockfish: a range of *M* values for the Gulf of Alaska of 0.041-0.057, and an *M* of 0.06 for British Columbia. Thus, both new values indicate that *M* is likely higher than 0.04. Consequently, an *M* of 0.05, which is the approximate midpoint of the 0.041-0.057 range, was used as a new value of *M* for the ABC computations of silvergray rockfish in this assessment.

Shortraker rockfish and the various "other slope rockfish" species have always been classified into Tier 5 in the NPFMC's ABC and OFL definitions, except for sharpchin rockfish which have been in Tier 4 for several years. Now that age results are available for shortraker, redstripe, harlequin, and silvergray rockfish, these species could also potentially be moved into Tier 4. However, for the present assessment the authors recommended keeping these species in Tier 5 until better verification of the new ages is available, along with additional age results. The Plan Team discussed this and agreed that a priority

should be placed on doing additional research to facilitate the move from Tier 5 to Tier 4 or 3. The Tier 5 definitions state that the maximum permissible $F_{ABC} \leq 0.75M$. Applying this definition to the exploitable biomass of shortraker rockfish results in a recommended maximum permissible 2008 ABC of 898 t (F_{ABC} = 0.0225). For "other slope rockfish", applying an $F_{ABC} = F_{40\%}$=0.53 rate to the exploitable biomass of sharpchin rockfish (Tier 4) and an F_{ABC}= 0..75M rate to the other species (Tier 5) results in ABC's of 836 t and 3,461 t, respectively, or a combined recommended ABC of 4,297 t for the "other slope rockfish" management group in 2008.

Overfishing for Tier 5 species such as shortraker rockfish is defined to occur at a harvest rate of F=M. Therefore, applying the estimate of M for shortraker rockfish (0.03) to the estimate of current exploitable biomass (39,905 t) yields an overfishing level of 1,197 t for 2008. Overfishing is defined to occur at the $F_{35\%}$ (in terms of exploitable biomass per recruit) value of 0.064 for sharpchin rockfish, a Tier 4 species. For the remaining species of "other slope rockfish", all of which are in Tier 5, overfishing is defined to occur at the F=M rate. Applying these F's results in an overfishing level of 5,624 t for the "other slope rockfish" group in 2008.

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 occurring on this stock.

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

Area apportionment
Geographic apportionment of the ABCs amongst management areas of the Gulf of Alaska is based on a weighted average of the percent exploitable biomass distribution for each area from the three most recent trawl surveys (2003, 2005, and 2007). In these computations, each successive survey is given a progressively heavier weighting using factors of 4, 6, and 9, respectively.

The new apportionment values for shortraker rockfish are: Western area, 13.37%; Central area, 35.07%; and Eastern area, 51.56%. Applying these percentages to the recommended ABC of 898 t yields the following apportionments for the Gulf in 2008:

Area apportionment of 2008 and 2009 ABC for shortraker rockfish in the Gulf of Alaska:

Western	Central	Eastern	Total
120	315	463	898

Apportionment values for "other slope rockfish" are: Western area, 8.31%; Central area, 13.24%; and Eastern area, 78.46%. The Eastern area for "other slope rockfish" is further divided into the West Yakutat area and the East Yakutat/Southeast Outside area. Based on a procedure identical to the other apportionment calculations (a 4:6:9 weighted average percent biomass of the three most recent trawl surveys), the Eastern area apportionment is subdivided as follows: West Yakutat, 17.93%; and East Yakutat/Southeast Outside, 82.07%. Applying these percentages to the recommended ABC of 4,297 t yields the following apportionments for the Gulf in 2008

Area apportionment of 2008 and 2009 ABC for Other Slope rockfish in the Gulf of Alaska:

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

These significant drops in the apportionments to the western area has to do with the drop in the weighting to the 2003 trawl survey which was a particularly high year for the western area. It was pointed out that last year 191 t of shortraker rockfish was landed in that area and that for 2008, 120 t may result in

shortraker rockfish being placed on PSC status. Discussion continued on the merit of revisiting the rationale for this weighting scheme, however for this year the Plan Team used the currently accepted weighting scheme.

13. Pelagic shelf rockfish

Status and catch specifications (t) of pelagic shelf rockfish and projections for 2008 and 2009. ABC and OFL are projected using author's estimates of catch for 2007 and 2008 for dusky rockfish. Catch data in this table are current through 11/03/2007. Biomass based on trawl survey estimates and the age structured model for dusky rockfish.

Area	Year	Biomass	OFL	ABC	TAC	Catch
GOA	2006	97,386	6,662	5,436	5,436	2,446
	2007	99,829	6,458	5,542	5,542	3,329
	2008	70,823	6,400	5,227		
	2009		6,294	5,140		

Changes from previous assessment
New data for 2007 includes updated 2006 fishery catch, estimated 2007 fishery catch, 2005 survey ages, and 2007 survey biomass estimates.

Previously, dark rockfish and dusky rockfish were considered one species and treated as a Tier 4 species because of the information available for dusky rockfish. Since dusky rockfish now have an age-structured model and are managed as a Tier 3 species, we now consider dark rockfish a Tier 5 species along with widow and yellowtail rockfish.

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. Thus it is unlikely the effective date for Amendments 77/73 will occur before January, 2009. Therefore, it would not be until 2009 that dark rockfish would be removed from Federal management (including the associated contribution to OFLs and ABCs under the respective complexes in both regions) and full management authority would be turned over to the State. The 2008 ABC's and OFLs presented in this assessment are for the PSR complex including dark rockfish but point estimates for individual species are included for comparative purposes.

For dusky rockfish, the model used is the same as last year's author recommended 2005 model with updated fishery and survey data. This model incorporates a variety of changes from previous recommended models, such as: using an updated size-age matrix, removing fishery size compositions from 1990 (experimental year for Observer program), full estimation of the recruitment standard deviation and survey catchability, and modifying the natural mortality to be more in line with other similarly aged rockfish.

Spawning biomass and stock status trends
The authors continue to recommend using the average of exploitable biomass from the three most recent trawl surveys to determine the ABC's for dark, widow, and yellowtail rockfishes. For the three species, the average exploitable biomass from the 2003, 2005, and 2007 surveys was 9,682 t (8,576 t for dark rockfish, 132 t for widow rockfish, and 974 t for yellowtail rockfish).

The exploitable biomass was substantially higher from 2005-2007 for dark rockfish because of an unusually high biomass estimate from the 2005 trawl survey. Conversely, yellowtail biomass estimates were much lower in 2005 and again in 2007 because the 1999 and 2001 survey estimates were exceptionally high and have been left out of the exploitable biomass calculations.

For dusky rockfish, the projected 2008 age 4+ biomass from the model is 68,253 t and projected 2008 female spawning biomass is 23,486 t.

Tier determination/Plan Team discussion and resulting ABCs and OFLs
The 2008 recommended ABC for dark, widow, and yellowtail rockfish combined is 508 t based on Tier 5 calculations (F_{ABC}=0.75M=0.0525). The 2008 OFL (F=M=0.07 applied to average biomass) for dark, widow, and yellowtail rockfish is 678 t.

The Plan Team concurs with the use of the model for determining dusky rockfish ABC because it uses a more realistic estimate of natural mortality and has a better fit to available data including a reasonable fit to survey biomass estimates. The maximum allowable ABC for 2008 is 4,719 t based on Tier 3a and derived from the recommended model. This ABC is 5% less than last year's ABC of 4,991 t. The decrease in ABC is likely due to a 2.5 fold increase in survey biomass from 2003 to 2005 which inflated the 2006 and 2007 ABC's, followed by a decrease in survey biomass in 2007. The biomass for 2007 was similar to the 2003 survey biomass. The 2008 OFL for dusky rockfish is 5,722 t

Status determination
The Dusky rockfish stock is not overfished, nor is it approaching an overfished condition. The catch of remaining stocks in the complex are below the complex level OFL thus overfishing is not occurring on this complex.

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

Area apportionment
Recommended area apportionments of ABC for dark, widow, and yellowtail rockfish are 98 t for the Western area, 353 t for the Central area, 24 t for the West Yakutat area, and 34 t for the Southeast/Outside area.

Recommended area apportionments of ABC for dusky rockfish are 905 t for the Western area, 3,274 t for the Central area, 227 t for the West Yakutat area, and 313 t for the Southeast/Outside area. For the combined pelagic shelf rockfish assemblage, ABC and OFL for dusky rockfish are combined with ABC and OFL for dark, widow, and yellowtail rockfish. The 2008 OFL for pelagic shelf rockfish is 6,400 t and the 2009 OFL is 6,294 t.

The 2008 recommended ABC for pelagic shelf rockfish is 5,227 t with the following area apportionments:

Area apportionments of ABC for pelagic shelf rockfish in 2008 and 2009					
	Western	**Central**	**W. Yakutat**	**E. Yakutat/SE**	**Total**
2008	1,003	3,626	251	347	5,227
2009	986	3,566	247	341	5,140

Additional Plan Team recommendations
The Team agrees with the authors that should the opportunity arise to obtain age and maturity samples from port sampling (possibly in Kodiak in conjunction with the Rockfish Pilot Project) some level of priority should be given to this undertaking. As with other species in this section, attention needs to be given to the impact that untrawlable areas have on the biomass estimates and noted the difficulty in assessing dusky rockfish in particular with trawl gear.

14. Demersal shelf rockfish

Status and catch specifications (t) of demersal shelf rockfish and projections for 2007 and 2008. Biomass for each year corresponds to the survey biomass estimates given in the SAFE report issued in the preceding year(s). 2007 catch data are current through 11/03/2007 but reflect landed catch only.

Area	Year	Biomass	OFL	ABC	TAC	Catch
GOA	2006	19,558	650	410	410	199
	2007	19,558	650	410	410	178
	2008	18,329	611	382		
	2009		611	382		

Changes from previous assessment
This year's demersal shelf rockfish (DSR) assessment features new data from the 2007 line transect survey of yelloweye rockfish for the Central Southeast Outside area (CSEO) management area and new average weight data from SEO using fish sampled during the 2007 IPHC survey. 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 1,420 to 3,557 adult yelloweye per km^2 . The density estimate for CSEO in 2007 was 1,068 adult yelloweye/km^2 (*CV*=17%). This is lower than the previous estimate obtained in 2003 of 1,865 adult yelloweye/km^2 (*CV*=11%). 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 18,329 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 **2008 ABC of 382 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 2008 of 611 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. The OFL and ABC for 2008 and 2009 are those recommended by the Plan Team. Catch data are current through 11/3/07.

Area	Year	Biomass	OFL	ABC	TAC	Catch
GOA	2006	98,158	2,945	2,209	2,209	779
	2007	98,158	2,945	2,209	2,209	769
	2008	84,774	2,540	1,910		
	2009		2,540	1,910		

Changes from previous assessment

Thornyheads are assessed on a biennial schedule to coincide with the timing of survey data. The last complete assessment was presented in 2005. An executive summary was presented in 2006 with projections for 2007 and 2008. This year, a full assessment is presented which includes the 2007 GOA trawl survey information. Other new data include updated total catch weight for 2005, 2006, and partial 2007 data, and relative population numbers and weights for GOA thornyheads from ABL longline surveys for 2006 and 2007.

In the past, the average of the 2 most recent complete surveys was used to compute biomass for Tier 5 calculations. This was done to accommodate the lack of survey coverage in certain depth and area strata in past years. However, the 2005 and 2007 surveys covered all depths and areas, so this is not an issue at this time. A point of concern for the 2007 survey is that while there was a 10% decrease Gulfwide, the majority of this decrease was observed in the western GOA. Because thornyheads have very low *CV*s associated with the trawl surveys (4 and 5% in 2005 and 2007, respectively), and to appropriately account for the area specific decrease, the authors recommend using the most recent survey (2007) to compute biomass and for the ABC apportionment.

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

Thornyheads are assessed using the Tier 5 approach given the lack of age and growth information to support age or length-based modeling. The updated method described above with 2007 survey data is used to calculate ABC and OFL under Tier 5. The most recent (and complete) 2007 GOA trawl survey biomass estimate of 84,774 t, was multiplied by the maximum permissible $F_{ABC} = 0.75M = 0.0225$, for an **ABC recommendation of 1,910 t** and $F_{OFL} = M = 0.03$ for an **OFL recommendation of 2,540 t**. This compares with values estimated in the 2005 assessment (for 2006 and 2007) based on the 2003 and 2005 survey estimates, which gave an average biomass of 98,158 t, an ABC of 2,209 t, and an OFL of 2,945 t. The 2008 ABC recommendation represents a 13% decrease from the Council's 2007 ABC. This is due to a 10% decrease in biomass and the use of only the most recent survey estimate.

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 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 Plan Team supports and encourages the age and growth research being conducted cooperatively with AFSC and Oregon State University.

The Plan Team reiterates their recommendation that the Gulf trawl surveys continue to sample the deeper depths and for full area coverage.

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
Based on the 2007 survey biomass distribution, the authors computed the following apportionment of shortspine thornyheads ABC broken out by management areas. The Plan Team supports the authors' recommendation to use the most recent survey biomass for the apportionment for three reasons: first, the GOA Plan Team and NPFMC SSC have approved of using the most recent survey biomass estimate for ABC apportionment since the 2003 assessment; second, this would appropriately account for the decrease in trawl survey biomass in the western Gulf; and third, this seems the most reasonable survey distribution to use considering the apportionment will be applied in both 2008 and 2009.

GOA Area (NPFMC Area)	2007 Biomass	Percent of Total Biomass	2008 and 2009 ABC Apportionment
Western (610)	12,152	14%	267
Central (620 and 630)	37,607	45%	860
Eastern (640 and 650)	35,016	41%	783
Gulfwide Total	84,775	100%	1,910

16. Atka mackerel

Status and catch specifications (t) of Atka mackerel in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2008 and 2009 are those recommended by the Plan Team. Catch data are current through 11/3/07.

Area	Year	Biomass	OFL	ABC	TAC	Catch
GOA	2006		6,200	4,700	1,500	876
	2007		6,200	4,700	1,500	1,441
	2008		6,200	4,700		
	2009		6,200	4,700		

Changes from previous assessment
Atka mackerel are assessed on a biennial schedule to coincide with the timing of survey data. The last complete assessment was presented in 2005. An executive summary was presented in 2006 with rollover values for 2007 and 2008. This year, a full assessment is presented which includes the 2007 GOA trawl survey information. Other new data include updated total catch weight for 2005, 2006, and partial 2007 data, length data from the 2005, 2006 and preliminary 2007 GOA fisheries, age data from the 2006 GOA

fisheries, age data from the 2005 GOA bottom trawl survey, and an expanded and detailed Ecosystems Considerations section has been provided.

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 2005 assessment, Tier 5 calculations of ABC and OFL (based on 2005 survey biomass estimates) were presented for consideration. The Plan Team, SSC, and Council agreed with the authors that there is no reliable estimate of Atka mackerel biomass and recommended continuing management under Tier 6. This year, Tier 5 calculations of ABC and OFL (based on 2007 survey biomass estimates) are again presented for consideration but were not recommended.

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 and 2007 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 2008 ABC for GOA Atka mackerel equal to the maximum permissible value of 4,700 t. The 2008 OFL is 6,200 t under Tier 6.**

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 occurring on this stock. It is not possible to determine the status of stocks in Tier 6 with respect to overfished status.

Additional Plan Team recommendations
The maximum permissible ABC (18,120 t) and the OFL (24,160 t) under Tier 5 are presented for consideration, but are not recommended because they are based on highly variable survey biomass estimates (Gulfwide *CV* of 46%), and catches of GOA Atka mackerel have been mainly comprised of a single cohort (1999 year class) which appears to be declining. Prudent management of GOA Atka mackerel is still warranted and the rationale as given in the past for a TAC to provide for anticipated bycatch needs of other fisheries, principally for Pacific cod, rockfish and pollock, and to only allow for minimal targeting should still be considered. The 2006 and 2007 TACs for GOA Atka mackerel were 1,500 t which the Plan Team feels would be sufficient to meet bycatch needs for 2008.

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 predator control due to the large and increasing size of their 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, this has not been examined quantitatively. 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 2008 and 2009. Average biomass for each group and area, corresponds to the value given in this year's (2007) SAFE report. Catch data are current through 11/03/2007.

Species group	Area	Average Biomass	OFL	ABC	TAC	2007 Catch	2008 and 2009 ABC	2008 and 2009 OFL
Big skate	W	8,422		695	695	68	632	
	C	27,536		2,250	2,250	1,218	2,065	
	E	8,434		599	599	8	633	
	Total	**44,392**	**4,726**	**3,544**	**3,544**	**1,294**	**3,330**	**4,439**
Longnose skate	W	1,043		65	65	46	78	
	C	27,209		1,969	1,969	814	2,041	
	E	10,239		861	861	240	768	
	Total	**38,491**	**3,860**	**2,895**	**2,895**	**1,100**	**3,849**	**3,849**
Bathyraja skates	GOA wide	28,057	2,156	1,617	1,617	1,104	2,104	2,806

Changes from previous assessment
Skates are on a biennial stock assessment schedule to coincide with new survey data. This year, a full assessment is presented with key assessment parameters and projections for 2008 and 2009.

Changes from previous assessment
Biomass and length data from the 2007 GOA trawl survey were incorporated. Catch data for 2006 and 2007 were updated. This year's stock assessment ABC recommendations are based on the average of 2003, 2005, and 2007 bottom trawl surveys. Length data from fisheries have not been collected since 2005.

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 F_{ABC} =0.075, 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 overfishing is not occurring on this stock. 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 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. 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.

Ecosystem Considerations summary
Ecosystem considerations based on the early 1990's Gulf of Alaska food web model were presented. 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).

Other Species

The other species complex in the GOA contains the following species: squids, sculpins, sharks and octopus. Assessments for these species in the GOA are done irregularly since ABCs and OFLs are not specified. Updated executive summaries of assessments for other species in the GOA are provided as appendices to this SAFE report (**Appendix 1**). These assessments together with the full assessments from 2006 will be used for the forthcoming FMP amendment analysis to evaluate the impact of establishing separate harvest specifications for the complex by species or in aggregate. The assessments were reviewed by the Plan Team and any associated OFLs and ABCs were recommended for analytical purposes only. No specifications will be established based on these assessments until the FMP amendment is finalized.

As an interim measure, the Council took final action in June 2005 to implement a calculation change to the TAC calculation for other species (previously TAC=5% of the sum of target TACs). The 5% TAC calculation was modified 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. The Council's intent was to establish a TAC level which would meet incidental catch needs in other directed fisheries with the potential to establish this TAC at a higher level which could allow for directed fishing on the complex but be placed low enough to prevent excessive harvest of a single targeted species or on the complex as a whole. This interim measure is intended to provide additional flexibility in responding to potential conservation concerns as they arise until more comprehensive management changes can be made to the other species complex (i.e., analysis of individual species level assessments).

In order to provide the Council information to establish a TAC for the other species complex, the Plan Team discussed the incidental catch needs for directed fisheries.

Other species catch in 2007 as of November 3 was 2,695 t. The catch is comprised of sculpins (905 t), sharks (1,161 t), octopus (216 t) and squid (413 t). Sculpin catch occurred by both trawl and pot gear fisheries, octopus was primarily taken by pot gear while catch of sharks and squid occurred primarily in trawl fisheries. The Team reiterates previous comments regarding continued problems with estimating incidental catch of other species from the halibut fishery, which may constitute a significant portion of the total catch of other species in the GOA.

The Plan Team continues to be concerned about the ability for directed fishing on a single species within the other species complex up to the complex-level TAC. Similar to 2006, the Plan Team strongly encourages a TAC be established which would meet incidental catch needs (so as not to constrain directed fisheries) while providing in-season management the ability to control rapid development of directed fishing on a single member of the complex. After reviewing incidental catch needs in directed fisheries together with discussion of the potential for developing fisheries on members of the other species complex, the Plan Team believes that 4,000 t for the complex would meet incidental catch needs and allow for exploratory fishing under the existing MRAs. Any amount set above this level would allow for additional directed fishing on the complex, and the Plan Team reiterates their concerns about the unknown impact this may impose on single species within the larger complex.

Overview of Appendices

Other Species Assessments

Five preliminary stock assessments were reviewed by the Plan Team in conjunction with the forthcoming amendment analysis to establish separate harvest specifications for individual members of the other species complex by species or in aggregate. The Plan Team requested updated executive summaries of the full assessments that were provided to the Team in 2006. Recommended harvest specifications as noted below are provided for analytical purposes only. The Team did not deliberate on specifications but rather received updated information as applicable on their recommendations from the previous year. No separate specifications will be established for these species until the amendment is finalized.

See the Council website for more information on the status of the GOA other species amendment: http://www.fakr.noaa.gov/npfmc/current_issues/non_target/non_target.htm

Sculpins

An executive summary of an assessment of sculpin species in the Gulf of Alaska (GOA) is provided in **Appendix 1a**. There is no directed fishery for sculpins in the GOA at this time; however, they are caught incidentally in a wide variety of fisheries, comprising approximately 16-36% of "other" species catch (2005-2007). Total sculpin catch in 2007 was the third highest on record, and the highest percent of the "other" species catch since skates were removed from the complex (2005). The purpose of this assessment was to compile the available data for sculpins in the GOA and to assess future assessment needs. No specific surveys are conducted for sampling sculpins species, and severe data gaps exist in sculpin life history characteristics, spatial distribution, and abundance. There are 46 listed species, and they are broadly distributed throughout all benthic habitats from shallow to deep, over all substrate types in the GOA.

Natural mortality was estimated from the literature (M=0.19). Unlike other taxa in the "Other" species complex, there are reliable biomass estimates for the sculpin complex Average biomass for the sculpin complex was estimated at 30,836 t using the six most recent surveys.

The Plan Team encourages the authors to continue collaborative work with ADF&G to collect age structures and other pertinent life history data.

The Plan Team concurs with the authors recommendation of using a Tier 5 approach applied to the sculpin complex as long as the catch remains incidental and no target fishery develops. This results in a 2008 ABC of 4,394 t, and a 2008 OFL of 5,859 t for purposes of the forthcoming analysis.

Squid

An executive summary of an assessment of squid species in the Gulf of Alaska (GOA) is provided in **Appendix 1b**. There is no directed fishery for squid in the GOA at this time. No specific surveys are conducted for sampling squid species, and there is limited information available for GOA squid life history characteristics, spatial distribution, and abundance.

Incidental catch of squid increased dramatically in 2006 but returned to lower levels in 2007. Squid catch in 2006 increased from 625mt in 2005 to 1,527 t in 2006. Squid catch in 2006 comprised 42% of the total other species catch, an increase from 27% of the catch in 2005. This occurred primarily in a localized area (Shelikof Strait) over a discrete time period in the pollock fishery. The survey biomass estimate in 2007 increased dramatically from the 2005 estimate. The biomass estimates included in the assessment represent raw survey biomass estimates and as such should be considered a minimum biomass estimates. Multiple options are presented for establishing ABCs and OFLs under Tier 5 and Tier 6 formulations. The Plan Team discussed the inherent problems with each formulation for this species and noted that as an option to breaking them out for separate specifications in the other species category, squid should also be considered for incorporation in the forage fish category.

Octopus

An assessment of octopus species in the Gulf of Alaska (GOA) is provided in **Appendix 1c**. The purpose of this assessment was to compile the available data for octopuses in the GOA and to assess future assessment needs. Directed fishing for octopuses has been limited. They are caught incidentally throughout the GOA in both state and federally-managed bottom trawl, longline, and pot fisheries. While some species composition, and size data are available from the NMFS bottom trawl, biomass estimates are unreliable. It is likely that the most common commercially caught species is *Enteroctopus dofleini*. Life history data for all species are lacking, and at least one species is currently being described.

The Plan Team concurs with the authors regarding the difficulty of placing octopus within the existing tier system for setting regulatory catch limits. For purposes of the forthcoming analysis the authors included a range of ABC and OFL recommendations based upon Tier 5 and two Tier 6 modified options. The authors note problems with each approach and that specifically an OFL based upon the average catch under Tier 6 would have led to fishery closures in 2007. The Plan Team notes that additional information is necessary for adequately managing this fishery and concurs with the authors recommendation for an experimental fishery to allow for greater data collection.

Sharks

An executive summary of an assessment of shark species in the Gulf of Alaska (GOA) is provided in **Appendix 1d**. The shark species complex in Alaska consists of 10 species; however, spiny dogfish (*Squalus acanthias*), Pacific sleeper shark (*Somniosus pacificus*) and salmon sharks (*Lamna ditropis*) are by far the three most common species in the GOA. There is no directed fishery for sharks in the GOA at this time. However spiny dogfish and Pacific sleeper sharks are taken in bottom trawl and longline fisheries, but most incidentally captured sharks are not retained.

The authors presented three alternative assessments: Tier 5, Tier 6 using the standard average catch calculation, and a modified Tier 6 approach (option 1 as described in the "Modified Tier 6 Approach" previously). There have always been problems with applying Tier 5 and Tier 6 options to sharks in the GOA. Tier 5 criteria for establishing ABC and OFL require reliable point estimates for biomass, which do not exist for sharks in the GOA, as the efficiency of bottom trawl gear is questionable for assessing these

species. Tier 5 also requires estimates of natural mortality. For the two most abundant species in the author's data sets; spiny dogfish in GOA waters have been lacking estimates of M and are currently being addressed, and estimates of M for Pacific sleeper sharks do not exist. Tier 6 criteria require a reliable catch history from 1978-1995, which does not exist for sharks in the GOA. The modified Tier 6 approach presented is based on the premise that estimated incidental catch can be considered a known safe level of fishing. Based on this premise the maximum incidental catch can be used to set OFL for the shark complex, and the ABC would represent 75% of the OFL.

The Plan Team concurs with the author's general recommendation that using the modified Tier 6 approach (option 1, using the maximum incidental catch for the OFL) may be the most appropriate way to proceed at this point, as long as a directed fishery does not develop. While sharks are known to be long lived and low fecund, maximum catch is recommended because directed fishing has not occurred, and using average catch would limit other fisheries in some years. This would set the ABC for GOA sharks at 1,792 t, and the OFL at 2,390 t. The Plan Team recommends that dogfish be considered a candidate for separate analysis from the complex. These values are suggested for analytical purposes only.

Forage fish

An updated summary for Forage Fish is included as **Appendix 2**. Forage fish are included as a separate category under the GOA FMP, however a directed fishery for forage fish is prohibited 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 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. No specific surveys are conducted for sampling forage fish species, thus data collection is notably problematic for these species. However, available surveys and catch data do provide some information for assessing the status of these species.

This assessment update focuses upon two main species of importance in the forage fish category: capelin and eulachon. New information for these species includes recent biomass estimates from the GOA trawl survey in 2007, incidental catch through 2007 from NMFS catch accounting for both species, and eulachon harvest in state waters of Alaska. The Plan Team discussed the recent increase in eulachon catches in conjunction with both the pollock survey and pollock fishery and requested additional exploration of this in a subsequent assessment understanding that some additional stock identification information on eulachon may be available for inclusion at that time. The Plan Team continues to recommend maintaining the Forage Fish chapter as an intermittent SAFE appendix to be updated as new information becomes available, noting that forage fish are essential ecosystem components, important to marine mammals and commercially important groundfish. An expanded assessment of Forage Fish is requested for the 2008 SAFE report.

Grenadier

An executive summary assessment of grenadier species is provided in **Appendix 3**. This assessment is an update of a full assessment that was provided in the 2006 SAFE report. The grenadier assessment covers both the BSAI and GOA management areas. Seven species of grenadiers are known to occur in Alaska. The giant grenadier is the most abundant and has the shallowest depth distribution on the continental slope. The assessment focused on the giant grenadier as it is the most common grenadier caught in both the commercial fishery and trawl surveys.

Grenadier species are considered "non-specified" under both BSAI and GOA FMPs. As such there are no management measures implemented for this species and no official catch statistics exist. However, catches have been estimated for 1997-2007 based upon data from the North Pacific Groundfish Observer Program. Average catches in the EBS have been 2,924 t, in the AI 2,275 t and in the GOA 10,791 t. A

new biomass estimate was included for the GOA (487,987 t) which was very similar to the previous estimate of 488,627 t used to compute the OFLs and ABC values.

Only one age and growth study is available for giant grenadiers in the GOA and estimated a maximum age of 56 years, however the assessment author recommended that a proxy natural mortality rate be estimated based on information for Pacific grenadier instead. A subset of trawl survey biomass estimates and longline survey biomass estimates were utilized in the assessment. The Plan Team concurred with the assessment author's recommended Tier 5 approach for this species utilizing the proxy natural mortality rate (M = 0.057). This results in a suggested GOA ABC of 20,889 t and an OFL of 27,852 t for purposes of the forthcoming analysis.

Tables

Table 1. Gulf of Alaska groundfish 2007 - 2009 OFLs and ABCs, 2007 TACs, and 2007 catches reported through November 3, 2007.

Stock/ Assemblage	Area	2007 OFL	2007 ABC	2007 TAC	2007 Catch	2008 OFL	2008 ABC	2009 OFL	2009 ABC
Pollock	W (61)		25,012	25,012	18,012		17,602		23,700
	C (62)		20,890	20,890	19,366		19,181		25,821
	C (63)		14,850	14,850	14,315		13,640		18,367
	WYAK		1,398	1,398	86		1,517		2,042
	Subtotal	87,220	62,150	62,150	51,779	72,110	51,940	95,940	69,930
	EYAK/SEO	8,209	6,157	6,157	0	11,040	8,240	11,040	8,240
	Total	95,429	68,307	68,307	51,779	83,150	60,180	106,980	78,170
Pacific Cod	W		26,855	20,141	13,227		25,932		25,932
	C		37,873	28,405	23,404		37,901		37,901
	E		4,131	3,718	65		2,660		2,660
	Total	97,600	68,859	52,264	36,696	88,660	66,493	88,660	66,493
Sablefish	W		2,470	2,470	1,996		1,880		1,718
	C		6,190	6,190	5,536		5,500		5,026
	WYAK		2,280	2,280	1,769		1,950		1,782
	SEO		3,370	3,370	3,238		3,390		3,098
	Total	16,906	14,310	14,310	12,539	15,040	12,720	12,924	11,624
Deep-water Flatfish	W		420	420	8		690		707
	C		4,163	4,163	247		6,721		6,927
	WYAK		2,677	2,677	2		965		995
	EYAK/SEO		1,447	1,447	10		527		543
	Total	10,431	8,707	8,707	267	11,343	8,903	11,583	9,172
Shallow-water flatfish	W		24,720	4,500	281		26,360		26,360
	C		24,258	13,000	7,761		29,873		29,873
	WYAK		628	628	0		3,333		3,333
	EYAK/SEO		1,844	1,844	0		1,423		1,423
	Total	62,418	51,450	19,972	8,042	74,364	60,989	74,364	60,989
Rex sole	W		1,147	1,147	413		1,022		948
	C		5,446	5,446	2,432		6,731		6,241
	WYAK		1,037	1,037	1		520		483
	EYAK/SEO		1,470	1,470	0		859		796
	Total	11,900	9,100	9,100	2,846	11,933	9,132	11,065	8,468
Arrowtooth flounder	W		20,852	8,000	3,134		30,817		31,080
	C		139,582	30,000	21,808		167,936		169,371
	WYAK		16,507	2,500	63		15,245		15,375
	EYAK/SEO		7,067	2,500	68		12,472		12,579
	Total	214,828	184,008	43,000	25,073	266,914	226,470	269,237	228,405
Flathead sole	W		10,908	2,000	696		12,507		13,001
	C		26,054	5,000	2,407		28,174		29,289
	WYAK		2,091	2,091	2		3,420		3,556
	EYAK/SEO		57	57	0		634		659
	Total	48,658	39,110	9,148	3,105	55,787	44,735	57,962	46,505

Table 1. continued…

Stock/ Assemblage	Area	2007 OFL	2007 ABC	2007 TAC	2007 Catch	2008 OFL	2008 ABC	2009 OFL	2009 ABC
Pacific ocean perch	W	4,976	4,244	4,244	4,428	4,376	3,686	4,397	3,704
	C	8,922	7,612	7,612	7,125	9,717	8,185	9,764	8,225
	WYAK		1,140	1,140	1,242		1,100		1,105
	SEO	3,260	1,640	1,640	0		2,028		2,038
	E(subtotal)	3,260	2,780	2,780	1,242	3714		3732	
	Total	17,158	14,636	14,636	12,795	17,807	14,999	17,893	15,072
Northern rockfish[3]	W		1,439	1,439	1107		2,141		2,047
	C		3,499	3,499	2,982		2,408		2,302
	E		0	0	0		0		0
	Total	5,890	4,938	4,938	4,089	5,430	4,549	5,120	4,349
Rougheye	W		136	136	71		125		124
	C		611	611	175		834		830
	E		241	241	153		327		325
	Total	1,148	988	988	399	1,548	1,286	1,540	1,279
Shortraker	W		153	153	193		120		120
	C		353	353	155		315		315
	E		337	337	244		463		463
	Total	1,124	843	843	592	1,197	898	1,197	898
Other slope[3]	W		577	577	252		357		357
	C		386	386	319		569		569
	WYAK		319	319	49		604		604
	EYAK/SEO		2,872	200	45		2,767		2,767
	Total	5,394	4,154	1,482	665	5,624	4,297	5,624	4,297
Pelagic shelf rockfish	W		1,466	1,466	595		1,003		986
	C		3,325	3,325	2,440		3,626		3,566
	WYAK		307	307	293		251		247
	EYAK/SEO		444	444	1		347		341
	Total	6,458	5,542	5,542	3,329	6,400	5,227	6,294	5,140
Demersal rockfish	Total	650	410	410	178	611	382	611	382
Thornyhead rockfish	W		513	513	338		267		267
	C		989	989	247		860		860
	E		707	707	184		783		783
	Total	2,945	2,209	2,209	769	2,540	1,910	2,540	1,910
Atka mackerel	Total	6,200	4,700	1,500	1,441	6,200	4,700	6,200	4,700
Big skate	W		695	695	68		632		632
	C		2,250	2,250	1,218		2,065		2,065
	E		599	599	8		633		633
	Total	4,726	3,544	3,544	1,294	4,439	3,330	4,439	3,330
Longnose skate	W		65	65	46		78		78
	C		1,969	1,969	814		2,041		2,041
	E		861	861	240		768		768
	Total	3,860	2,895	2,895	1,100	3,849	2,887	3,849	2,887
Other skates	Total	2,156	1,617	1,617	1,104	2,806	2,104	2,806	2,104
Other Species	Total	NA	NA	4,500	2,695				
Total		611,153	490,327	269,912	170,797	665,642	536,191	690,888	556,174

Table 2. Gulf of Alaska 2007 ABCs, biomass, and overfishing levels (t) for Western, Central, Eastern, Gulfwide, West Yakutat, and Southeast Outside regulatory areas.

		2008		
Species/Assemblage	Area	ABC	Biomass	OFL
	W (61)	17,602		
	C (62)	19,181		
	C (63)	13,640		
	WYAK	1,517		
	Subtotal	51,940	705,020	72,110
	EYAK/SEO	8,240	36,799	11,040
Pollock	Total	60,180	741,819	83,150
	W	25,932		
	C	37,901		
	E	2,660		
Pacific Cod	Total	66,493	*233,310**	88,660
	W	1,880		
	C	5,500		
	WYAK	1,950		
	EY/SEO	3,390		
Sablefish	Total	12,720	167,000	15,040
	W	690		
	C	6,721		
	WYAK	965		
	EYAK/SEO	527		
Deep water flatfish	Total	8,903	132,625 [4]	11,343
	W	26,360		
	C	29,873		
	WYAK	3,333		
Shallow water flatfish	EYAK/SEO	1,423		
	Total	60,989	436,590 [5]	74,364
	W	1,022		
	C	6,731		
	WYAK	520		
	EYAK/SEO	859		
Rex sole	Total	9,132	82,801 5	11,933
	W	30,817		
	C	167,936		
Arrowtooth flounder	WYAK	15,245		
	EYAK/SEO	12,472		
	Total	226,470	2,244,870 5	266,914
	W	12,507		
	C	28,174		
	WYAK	3,420		
	EYAK/SEO	634		
Flathead sole	Total	44,735	324,197 5	55,787

Table 2. continued.

Species/Assemblage	Area	2008 ABC	2008 Biomass	2008 OFL
	W	3,686		4,376
	C	8,185		9,717
	WYAK	1,100		0
	EY/SEO	2,028		0
	EGOA	0		3,714
Pacific ocean perch	Total	14,999	317,511	17,807
	W	2,141		
	C	2,408		
	E	0 1		
Northern rockfish	Total	4,549	93,391	5,430
	W	125		
	C	834		
	E	327		
Rougheye	Total	1,286	46,121	1,548
	W	120		0
	C	315		0
	E	463		0
Shortraker	Total	898	39,905	1,197
	W	357		
	C	569		
	WYAK	604 1		
	EYAK/SEO	2,767		
Other Slope rockfish	Total	4,297	90,283 [5]	5,624
	W	1,003		
	C	3,626		
	WYAK	251		
	EY/SEO	347		
Pelagic shelf rockfish	Total	5,227	70,823	6,400
Demersal shelf rockfish	Total	382	18,329	611
	Western	267		
	Central	860		
	Eastern	783		
Thornyhead rockfish	Total	1,910	84,774 [5]	2,540
Atka mackerel	Total	4,700	Unknown	6,200
	W	632	8,422	
	C	2,065	27,536	
	E	633	8,434	
Big skates	Total	3,330	44,392	4,439
	W	78	1,043	
	C	2,041	27,209	
	E	768	10,239	
Longnose skates	Total	2,887	38,491	3,849
Other skates	Total	2,104	28,057	2,806
Other species		0		
All species	Total	536,191		665,642

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.
NOTE: Overfishing is defined Gulf-wide, except for pollock and POP.

Table 3. Summary of fishing mortality rates and overfishing levels for the Gulf of Alaska, 2008.

Species	Tier	F_{ABC}[1]	Strategy	F_{OFL}[2]	Strategy
Pollock	3b	0.13	F_{ABC}	0.17	$F_{35\%\ adjusted}$
Pacific cod	5	0.285	F=.75M	0.38	F=M
Sablefish	3b	0.084	$F_{40\%\ adjusted}$	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

1/ Fishing mortality rate corresponding to acceptable biological catch.
2/ Maximum fishing mortality rate allowable under overfishing definition.
3/ $F_{40\%}$= for Dover sole (Tier 3a), ABC=.75 x average catch (1978-1995) for other deepwater flatfish (Tier 6).
4/ $F_{35\%}$ for Dover sole (Tier 3a), average catch (1978-1995) for other deepwater flatfish (Tier 6).
5/ $F_{40\%}$ for northern and southern rocksole (Tier 4), F=.75M for remaining shallow water flatfish (Tier 5).
6/ $F_{35\%}$ for northern and southern rocksole (Tier 4), F=M for remaining shallow water flatfish (Tier 5).
7/ $F_{40\%}$ for sharpchin rockfish (Tier 4), F=.75M for other species (Tier 5).
8/ $F_{35\%}$ for sharpchin (Tier 4), F=M for other species (Tier 5).
9/ $F_{40\%}$ for dusky rockfish (Tier 3a), F=.75M for dark,, widow and yellowtail rockfish (Tier 5).
10/ $F_{35\%}$ for dusky rockfish (Tier 3a), F=M for dark, widow and yellowtail rockfish (Tier 5).
11/ ABC for Atka mackerel is equal to 0.75 x average catch from 1978 to 1995. This maximum permissible ABC is intended for bycatch in other target fisheries and minimize targeting.
12/ OFL for Atka mackerel is equal to average catch from 1978 to 1995.

Table 4. Maximum permissible fishing mortality rates and ABCs as defined in Amendment 56 to the GOA and BSAI Groundfish FMPs, and the Plan Team's 2008 recommended fishing mortality rates and ABCs, for those species whose recommendations were below the maximum. Relative to last year, Pacific cod were removed from this table.

Species	Tier	2008 *Max* F_{ABC}	*Max* ABC	F_{ABC}	2008 ABC
Pollock[1]	3b	0.15	62,610	0.13	51,940
Demersal shelf rockfish	4	0.026	496	0.02	382

1/ The Plan Team recommended 2008 W/C pollock ABC of 51,940 mt is reduced by 1,650 mt to accommodate the Prince William Sound GHL. For comparisons in this table, the maximum permissible ABC of 62,610 mt should be compared with the full ABC 53,590 mt.

Table 5. Groundfish landings (metric tons) in the Gulf of Alaska, 1956-2007.

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[H]	51,779	36,696	12,539	14,260	25,073	18,540

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, 1956-2007.

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[H]	3,329	178	769	1,441	3,498	2,695	170,797

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 3rd, 2007.
i/ Includes all species except arrowtooth.
j/ Does not include state fisheries
k/ Includes all managed skates species

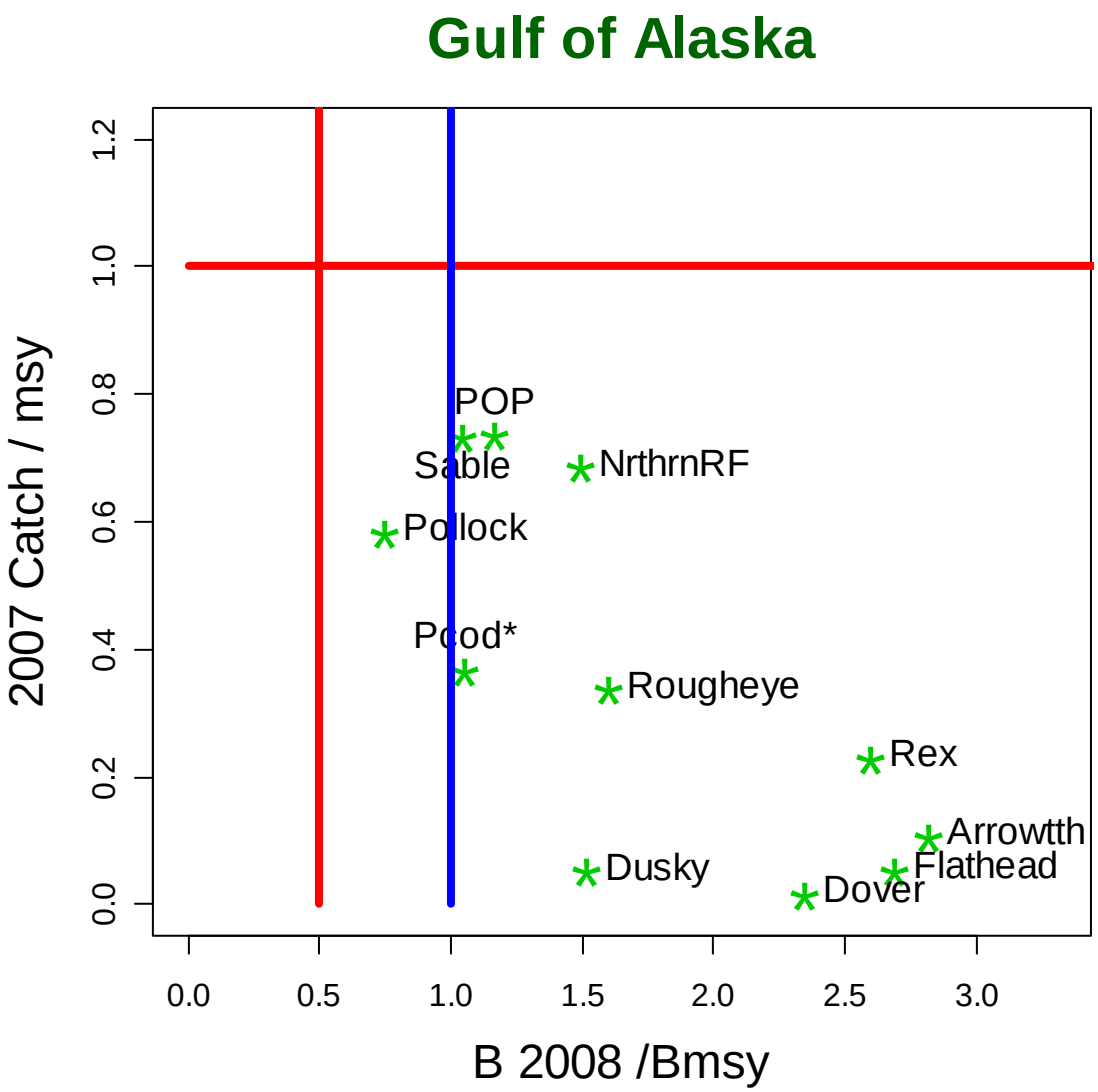

Figure 1. Summary status of age-structured GOA species relative to 2007 catch levels (vertical axis) and projected 2008 spawning biomass relative to B_{msy} levels. Note that the 2007 MSY level is taken as the 2007 OFL (which is defined as the catch at F_{msy}). Also, Pacific cod is based on last year's assessment.

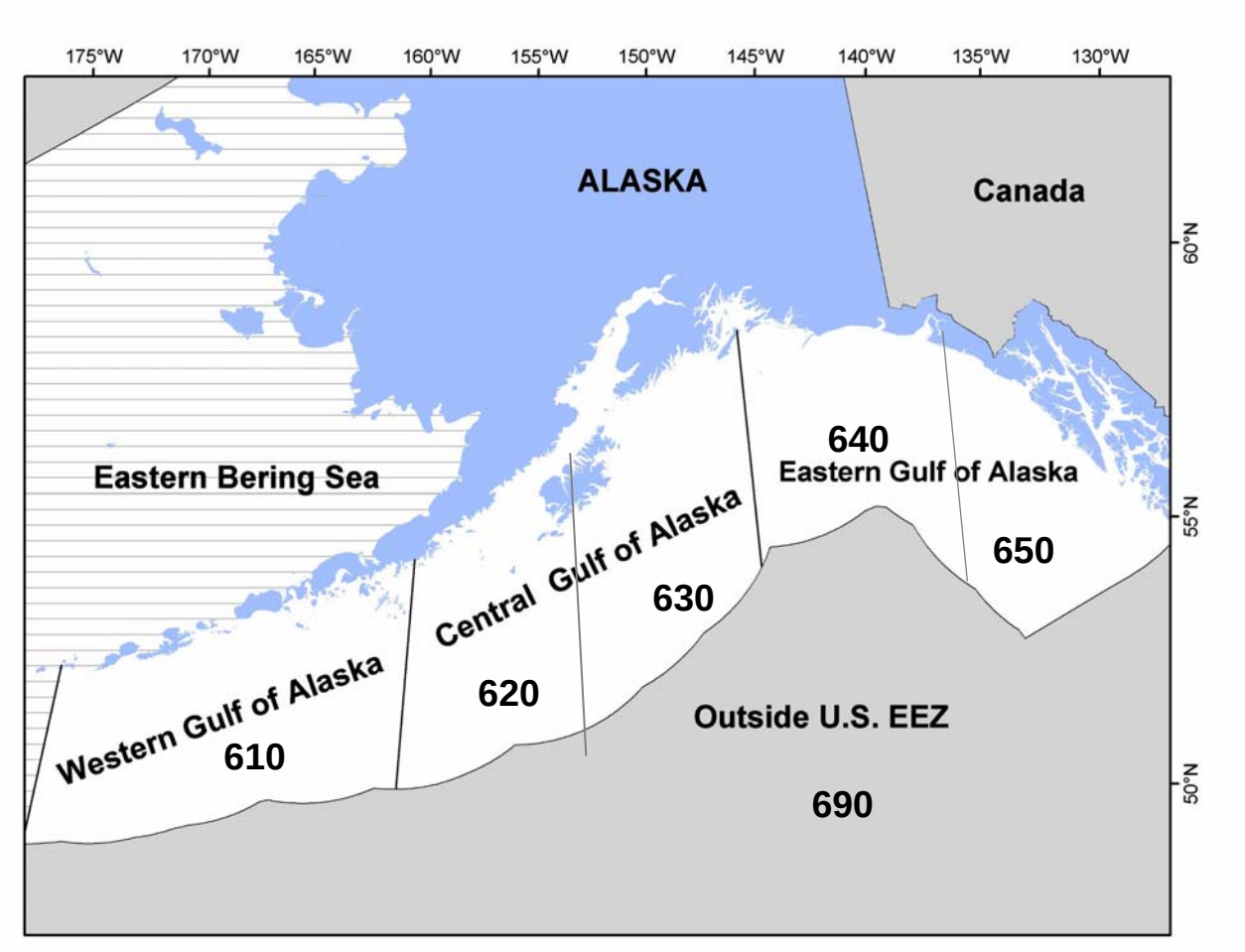

Figure 2. Gulf of Alaska statistical and reporting areas.