APPENDIX B

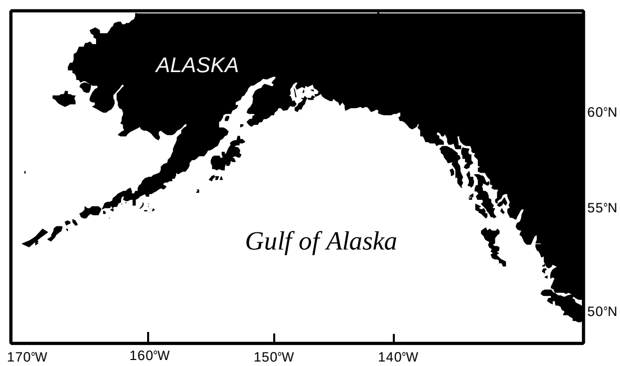
STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

FOR THE GROUNDFISH RESOURCES

OF THE GULF OF ALASKA

Compiled by

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



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November 1999

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Stock Assessment and Fishery Evaluation Report
for the Groundfish Resources
of the Gulf of Alaska
as Projected for 2000

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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 September and December Council meetings.

The SAFE report for the Gulf of Alaska (GOA) groundfish fisheries managed by the North Pacific Fishery Management Council (Council) is compiled by the GOA Groundfish Plan Team from chapters contributed by scientists at NMFS Alaska Fisheries Science Center (AFSC) and the Alaska Department of Fish and Game. These SAFE reports include separate stock assessment and fishery evaluation sections. 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 Plan Team for the Gulf of Alaska Groundfish Fishery Management Plan met in Seattle on November 15-19, 1999 to review the status of stocks of sixteen species or species groups that are managed under the FMP. The Plan Team review was based on presentations by Alaska Department of Fish and Game (ADF&G), and NMFS Alaska Fisheries Science Center scientists, results from the NMFS 1999 Gulf of Alaska trawl survey, and the 1999 sablefish longline survey. For the first time, stock assessment information was formally presented for “other species”. This information is contained in two SAFE report appendices (Appendices D & E). Members of the Plan Team who compiled the SAFE report were Sandra Lowe, (chair), Nicole Kimball for Jane DiCosimo (plan coordinator), Bill Bechtol, Lynn Denlinger, Lew Haldorsen, Jeff Fujioka, Jim Ianelli, Jon Heifetz, Dave Jackson, Tom Pearson, Farron Wallace, Victoria O’Connell, Gregg Williams, and Beth Sinclair.

The FMP recognizes single species and species complex management strategies. Single species management is recommended for stocks that are easily targeted by the harvesting sector, and for which minimal mixing of other species occurs in the targeted catch. In the Gulf of Alaska, Pacific cod, pollock, sablefish, Pacific ocean perch, thornyhead rockfish, flathead sole, rex sole, arrowtooth flounder, northern rockfish, and Atka mackerel are managed as single species. Other groundfish species that are usually caught in groups have been managed as assemblages. For example, shortraker and rougheye rockfish, other slope rockfish, pelagic shelf rockfish, demersal shelf rockfish, deepwater flatfish, shallow water flatfish, and “other groundfish” have been managed within complexes. The FMP, however, authorizes splitting species, or groups of species, from the complexes for purposes of promoting the goals and objectives of the FMP.

Fishermen do not always catch species in a complex in proportion to the species composition, i.e., certain segments of the complex may be more easily harvested than others, or they may be more valuable. Consequently, the implicit risk in species complex management is that one or more of the species in the complex may be overharvested or underharvested. Recognition of this risk is important. Alternative management strategies can be imposed to limit this risk, including removing a species from a complex and managing as a single species, or reducing the quota of the complex to protect the more vulnerable species. The Plan Team gave close scrutiny to the species composition of the catch from the species complex management units and made recommendations for adjustments as required. 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, along with other species found to be primary food sources for other marine animals. As part of that same action, commercial fisheries on species in this category were prohibited.

Groundfish catches are managed against TAC specifications for EEZ and near coastal waters of the GOA. State of Alaska internal water groundfish populations are not surveyed by NMFS and catches from internal water fisheries should <u>not</u> be counted against the TAC. For 1998 and 1999, the SSC and Council recommended and NMFS approved a reduction of the GOA pollock ABC by 1,800 mt and 2,100 mt, respectively, to account for anticipated Prince William Sound (PWS) harvests from a State waters fishery. The Team noted that internal water bycatches of shortraker/rougheye rockfish in Chatham Strait are also counted against the Federal TAC and that this practice should not continue. The Team has recommended that these catches represent unassessed fish, and should not be counted against an ABC or TAC. This year the pollock assessment has incorporated the ADF&G survey pollock biomass, therefore, the Plan Team acknowledges that is would be appropriate to reduce the Western, Central and West Yakutat combined GOA pollock ABC by the anticipated PWS harvest level for the State fishery.

NEW INFORMATION

The Team discussed the trawl ban for east of 140EW in the Eastern Gulf approved under Amendment 41 and implemented in January 1998. The Team reexamined whether the trawl ban necessitates separation of the Eastern Gulf area into West Yakutat and East Yakutat/Southeast Outside subareas. In 1998, the Plan Team provided subarea ABC recommendations on a case by case basis for 1999 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 EY/SE subarea ABC splits. For three 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. The Team continues to support this rationale for determining 2000 ABCs. The Team presents both the point estimate and the upper 95% confidence limit, but we based our 2000 recommendations on the upper 95% confidence limit.

NO SPLIT	**SPLIT, POINT ESTIMATE**	**Upper 95% CL**
Pacific cod, Atka mackerel, SRRE, thornyhead, northern rockfish, DSR	DWF, SWF, rex sole, sablefish ATF, flathead sole, OSR, pollock	POP, PSR

Since the Stock Assessment and Fishery Evaluation Report (SAFE) for 1999 was issued (NPFMC 1998), the following new information has been incorporated in the stock assessments:

(1) Pollock: a) the stock assessment was extended eastward to 140EW to coincide with the area open for trawling in the GOA; b) 1999 bottom trawl survey biomass and length composition; c) the 1997 and 1998 echo integration trawl survey age composition; d) an evaluation of 1989-98 ADF&G coastal trawl survey data in the model; e) age composition and catch data from the 1998 fisheries.

(2) Pacific cod: a) Size composition data from the 1998 and January-August 1999 commercial fisheries were incorporated into the model; b) biomass and size composition from the 1999 bottom trawl survey; c) weight-at-length data from recent bottom trawl surveys.

(3) Flatfish: a) updated catch information; b) biomass and size composition from the 1999 bottom trawl survey; c) a model for flathead sole using ADModel Builder was presented as an appendix.

(4) Arrowtooth: a) biomass and size composition from the 1999 bottom trawl survey; b) a projection of biomass based on an ADModel Builder model which is now being used as the main assessment model; and c) differential mortality values for males and females.

(5) Sablefish: a) relative abundance and length data from the 1999 longline survey; b) historical catch data from 1960-1978; c) catch rate and length data from the Japanese longline fishery from 1964-1981; d) length data from the Japanese trawl fishery from 1964-1971; e) catch rate date from the U.S. longline fishery from 1990-1999; f) length data from the U.S. trawl fishery from 1990-1996; g) age composition data from the 1998 sablefish longline survey; and h) length data from the 1999 longline fishery.

(6) Slope Rockfish: a) updated catch information; b) biomass and size composition from the 1999 bottom trawl survey; c) a projection of biomass based on the stock synthesis model for POP.

(7) Pelagic shelf rockfish: a) biomass and size compositions from the 1999 bottom trawl survey; b) revised von Bertalanffy growth parameters for dusky rockfish; c) age at 50% maturity for female dusky rockfish (11.3) years); d) revised estimates of age at 50% recruitment for dusky rockfish (10 years).

(8) Demersal shelf rockfish: a) updated catch information; b) density estimates fro the SSEO and EYAK areas from the 1999 line transect survey; c) revised estimates of rocky habitat areas.

(9) Thornyheads: a) updated estimated catch information; b) biomass and size composition from the 1999 bottom trawl survey.

(10) Atka mackerel: updated catch information.

(11) Groundfish, generally: updated harvest and discard data from the NMFS Observer Program and Regional Office for 1998 and 1999.

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. Fish species or complexes included in each of the first three categories listed below.

Target Species	Other Species	Prohibited Species
Pollock	Octopus	Pacific halibut
Pacific cod	Squid	Pacific herring
Flounders	Sculpins	Pacific salmon
Rockfishes	Sharks	Steelhead trout
Sablefish	Skates	King crab
Atka mackerel		Tanner crab

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" and catch records need not be kept. 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. This SAFE report describes stock status of target species only.

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 ($F_{P\%}$). Fishing mortality rate reduces the slope of the yield per recruit curve (plotted against F) to 10% of the slope at the origin ($F_{0.1}$). 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 BSAI Groundfish FMP, approved by the Council in June 1998, defines ABC and OFL for the BSAI groundfish fisheries. The new definitions are shown below, where the fishing mortality rate is denoted F, stock biomass (or spawning stock biomass, as appropriate) is denoted B, and the F and B levels corresponding to MSY are denoted F_{MSY} and B_{MSY} respectively.

Acceptable Biological Catch is a preliminary description of the acceptable harvest (or range of harvests) for a given stock or stock complex. Its derivation focuses on the status and dynamics of the stock, environmental conditions, other ecological factors, and prevailing technological characteristics of the fishery. The fishing mortality rate used to calculate ABC is capped as described under "overfishing" below.

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

Tier

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

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

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

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

$F_{OFL} = F_{35\%}$

F_{ABC} # $F_{40\%}$

5) *Information available: Reliable point estimates of B and natural mortality rate M.*

$F_{OFL} = M$

F_{ABC} # $0.75 \times M$

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 # 0.75 × OFL

OVERVIEW OF STOCK ASSESSMENTS

The current status of individual groundfish stocks managed under the FMP are summarized in this section. The abundances of Pacific cod, thornyhead, and arrowtooth flounder are above target stock size. The abundances of pollock, Pacific ocean perch, and sablefish are below target stock size. The relative abundances of deep-water flatfish, shallow-water flatfish, flathead sole, demersal shelf rockfish, northern rockfish, pelagic shelf rockfish, other slope rockfish, and Atka mackerel are unknown.

Tables 1 and 2 provide a summary of the current status of the groundfish stocks, including catch statistics, ABCs, and TACs for 1999, and recommendations for ABCs and overfishing levels for 2000. Fishing mortality rates and overfishing levels used to set these specifications are listed in Table 3. ABCs and TACs are specified for each of the Gulf of Alaska regulatory areas illustrated in Figure 1. Table 4 provides a list of species for which the ABC recommendations are below the maximum permissible. Table 5 provides historical groundfish catches in the GOA, 1956-1999.

The sum of the preliminary 2000 ABCs for target species is 451,100 mt, which is within the FMP-approved optimum yield (OY) of 116,000 - 800,000 mt for the Gulf of Alaska. The Team notes that because of halibut bycatch mortality considerations in the high-biomass flatfish fisheries, an overall OY for 2000 will be considerably under this upper limit. For perspective, in 1999 the sum of the TACs was 306,535 mt, and the sum of the ABCs was 532.590 mt.

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 1998 and 1999 ABCs correspond to the values (in mt) approved by the Council. The values listed for 2000 correspond to the Plan Team recommendations.

(4) The exploitable biomass for 1998 and 1999 that are reported in the following summaries were estimated by the assessment in those years. Comparisons of the 2000 biomass with previous years' levels should be made with biomass levels from the revised hindcast reported in each assessment.

POLLOCK

	ABC[1]			EXPLOITABLE	
	W/C	S/E	TOTAL	BIOMASS	CATCH
1998	119,150	10,850	130,000	1,156,000	125,471
1999	94,590	8,620	103,210	737,670	91,617[2]
2000	96,560	6,460	103,020	588,000	

1/ ABC for Western and Central (W/C) and Southeast Outside and East Yakutat (SE) areas; West Yakutat was part of W/C after 1998, but part of SE in 1998.
2/ 1999 catch through November 6, 1999.

Projected exploitable biomass for age-3+ pollock in 2000 is 588,000 mt as derived from the current assessment model. Exploitable biomass for the Southeast Outside and East Yakutat areas was 28,709 mt, as derived from CPUE data during the 1999 Gulf trawl survey.

Relative to the 1999 SAFE, new sources of information include: (1) 1997 and 1998 echo integration trawl (EIT) survey age composition; (2) an evaluation of 1989-98 ADF&G coastal trawl survey biomass and length composition data for inclusion in the model; (3) age composition from the 1998 fishery; (4) catch data from the 1999 fisheries; and (5) the 1999 ADF&G summer biomass estimate for Prince William Sound (PWS). The Shelikof EIT survey was not conducted in 1999. In addition, the stock assessment was extended eastward to 140EW to coincide with the area open for trawling in the Gulf of Alaska; this assessment previously extended only to 147EW long. Annual catches and the AFSC bottom trawl survey biomass time series were revised to correspond to the larger area. Biomass estimates in the trawl survey time series were also increased to account for biomass in PWS.

Estimates of OFL and ABC alternatives for 2000 were examined through two models: a base-run model that included the ADF&G trawl survey time series for nearshore waters of the Central and Western Gulf; and a model without ADF&G data. Because both models yielded similar trends, ADF&G data were included.

Projected spawning biomass in 2000 for the Western, Central and West Yakutat areas is 214,900 mt, which is below the $B_{40\%}$ value of 247,000 mt and places Gulf pollock in Tier 3b. Following substantial discussion, the Plan Team recommended the 1999 ABC of 94,400 mt be applied as the 2000 ABC for the Western/Central area. This harvest rate, while less than the maximum permissable of $F_{40\%\ adjusted}$=0.34, was recommended to address some of the following concerns: (1) the stock continues to decline; (2) the stock biomass is now at an all time low; and (3) the large variability around the biomass estimate from the 1999 trawl survey. Given the low biomass and continued decline, the Team felt it inappropriate to increase the ABC relative to 1999. Total recommended ABC for Western, Central, and West Yakutat areas is 96,560 mt, which represents a fishing mortality rate of F = 0.29. The Plan Team recommends the 2000 ABC be apportioned according to mean distribution of the exploitable population biomass in the four most recent bottom trawl surveys. ABC apportionment by mean distribution among surveys is a departure from previous pollock assessments and was used because of the high variability observed in the 1999 trawl survey distributions. This resulted in an apportionment of 41.0% (39,590 mt) to the Shumagin area, 24.4% (23,560 mt) to the Chirikof area, 32.1% (31,000 mt) to the Kodiak area, and 2.5% (2,410 mt) to the West Yakutat area. OFL for gulf pollock in 2000 is defined as $F_{35\%adjusted}$ = 0.40.

Pollock in the Southeast Outside and East Yakutat areas fall into a Tier 5 assessment. Under this approach, 2000 ABC is 6,460 mt, based on 1999 trawl survey biomass estimate of 28,710 mt and a natural mortality estimate of 0.30. OFL is 8,610 mt. The assessment authors noted that pollock catch in the pooled Southeast Outside and East Yakutat areas never exceeded 100 mt during 1991-98.

The Team acknowledges that current data do not indicate that PWS pollock are a discrete and isolated stock. However, ADF&G conducted a PWS summer survey in 1999 at the same time as the NMFS survey in adjacent federal waters. The PWS survey confirmed the presence of pollock in PWS that were not assessed by the NMFS bottom trawl survey. Management of PWS pollock continues to be based on the estimated summer biomass in PWS. The PWS biomass estimate is conservative based on limited trawl comparison studies that indicated the ADF&G survey gear is less effective at catching pollock than the NMFS survey gear. In an effort to address SSC concerns, the Plan Team in September asked the pollock assessment authors to work with ADF&G staff to explore mechanisms for incorporating ADF&G survey data for PWS into the gulfwide assessment. The 1999 ADF&G survey estimated a PWS biomass of 1.05% of the AFSC survey estimate of Gulf pollock. As an interim approach, pollock biomass estimates from the triennial survey time series were increased by 1.05% prior to Gulf assessment model runs. This allows the PWS ABC to be deducted from the ABC for the combined Western, Central, and West Yakutat areas, consistent with the assessment approach. The PWS ABC is estimated to be approximately 1,420 mt. The Team recommends continued efforts to examine incorporation of PWS data into the Gulf assessment model.

Areal Apportionment of Western, Central, and West Yakutat ABC

Area	Shumagin	Chirikof	Kodiak	West Yakutat	SE
Mean % of Trawl Biomass	41.0%	24.4%	32.1%	2.5%	NA
ABC (mt)	39,590	23,560	31,000	2,410	6,460

PACIFIC COD

YEAR	ABC	EXPLOITABLE BIOMASS[1]	CATCH[2]
1998	77,900	785,000	72320
1999	84,400	648,000	81,566[3]
2000	76,400	567,000	

1/ Age 3+ biomass
2/ Includes State management fisheries.
3/ Catch through November 6, 1999.

Since last year's assessment, 1) size composition data from the 1998 and January-August 1999 commercial fisheries, 2) size composition data from the 1999 GOA bottom trawl survey, 3) the biomass estimate from the 1999 GOA bottom trawl survey, and 4) weight-at-length data from recent GOA bottom trawl surveys have been incorporated. The 1999 bottom trawl survey biomass estimate of 305,823 mt was down about 43% from the 1996 survey estimate.

As in past assessments, the assessment author conducted a Bayesian analysis, providing the joint prior distributions and calculating the joint likelihoods of M and Q, resulting in the posterior distributions for M and Q and the yield that would result from an F40% harvest strategy. The assessment focused on 3 models. Model 1 sets M and Q equal to estimates obtained independently of the assessment models, estimates which are used as the means of the marginal distributions of the prior distributions of the two parameters. Model 2 sets M and Q equal to their maximum likelihood estimates, and Model 3 sets M and Q equal to the mean of their marginal posterior distributions. To generate a set of reference estimates of historic biomass trends, target and limit harvest rates, and biomass projections, the author chose Model 1. Maximum permissible values of ABC and OFL under Tier 3a are the F40% (=0.38) and F35% (=0.46) yields from Model 1, 86,000 and 102,000 mt, respectively. The age 3+ biomass under Model 1 for the year 2000 is 567,000 mt. The author noted that the historic trend of catch and age 3+ biomass shows a pattern in exploitation rate over time where the rate has met or exceeded the average for every year after 1989, while the estimated values fall below average for every year prior to 1990.

The author's ABC recommendation of 76,400 mt is the geometric mean of the posterior distribution of 2000 catch obtained under an F40% harvest strategy and is equivalent to an F=0.33. In past years the author's similarly obtained ABC recommendation represented an increase in ABC, while the assessment indicated a decreasing stock trend. The Team chose in those years to not increase ABC, but to forward the previous year's ABC. This year, the assessment still estimates the stock to be decreasing, however, **76,400 mt** does not represent an increase over the past year's ABC, and is accepted as the Plan Team's recommended ABC for the year 2000.

The author notes in his report that if the TAC is to be distributed between regulatory areas in proportion to the biomass estimates from the most recent trawl survey, the proportions are: Western-36% , Central-57%, and Eastern-7%, which would result in 27,500 mt, 43,550 mt, and 5,350 mt, respectively, for a 76,400 mt Gulfwide TAC.

FLATFISH

1998 Fishery	ABC	EXPLOITABLE BIOMASS	CATCH
Deep water	7,170	101,430	2,472
Rex sole	9,159	72,330	3,540
Shallow water	43,150	314,960	1,747
Flathead sole	26,110	206,340	2,671
TOTAL	85,580	695,060	10,430

1999 Fishery	ABC	EXPLOITABLE BIOMASS	CATCH
Deep water	6,050	78,300	2,285
Rex sole	9,150	72,330	3,057
Shallow water	43,150	314,960	2,545
Flathead sole	26,110	206,340	891
TOTAL	84,460	671,930	8,778[1]

2000 Fishery	ABC	EXPLOITABLE BIOMASS
Deep water	5,300	74,460
Rex sole	9,440	74,600
Shallow water	37,860	299,100
Flathead sole	26,270	207,520
TOTAL	78,870	655,680

1/Catch through November 6,1999.

The flatfish group is subdivided into deep water flatfishes, rex sole, shallow water flatfishes, and flathead sole. The 2000 exploitable biomass for each category is based on abundance estimated from the 1999 triennial trawl survey. The Team recommends that ABCs for each group be apportioned among the regulatory areas in proportion to biomass distributions in the 1999 trawl survey. The Team further recommends splitting the eastern GOA ABC between the WY and EYAK/SEO subareas. The resulting 2000 ABC's are:

	WESTERN	CENTRAL	WYAK	EYAK/SEO	TOTAL
Deep water	280	2,710	1,240	1,070	5,300
Rex sole	1,230	5,660	1,540	1,010	9,440
Shallow water	19,510	16,400	790	1,160	37,860
Flathead sole	8,490	15,720	1,440	620	26,270
TOTAL	29,510	40,490	5,010	3,860	78,870

The overfishing levels for the flatfish groups are determined by the fishing mortality rates determined from the tier structure to the exploitable biomass estimates. Those fishing mortality rates and associated catch levels are:

	F_{ABC}	F_{OFL}	OVERFISHING LEVEL	TIER
Deep water	0.075	0.10	6,980	5,6
Rex sole	0.15	0.20	12,300	5
Shallow water	0.15-0.17	0.209-0.25	45,320	4,5
Flathead sole	0.15	0.20	34,210	5

ARROWTOOTH FLOUNDER

YEAR	ABC	EXPLOITABLE BIOMASS	CATCH
1998	208,340	2,062,740	13,063
1999	217,110	2,126,714	16,062[1]
2000	145,360	1,571,670	

1/ Catch through November 6, 1999.

The 2000 exploitable biomass is based on abundance estimates derived from an ADModel Builder stock assessment model. There was a change in the way the model accounted for higher proportions of females in the larger size intervals. In the previous model, the changing sex ratio was fit by having different selectivity for males and females as size increased. In the present model, the sex ratio pattern is fit by giving males a higher mortality rate than females. The Plan Team agreed with the assessment authors that this was a more appropriate way to model the pattern in sex ratio, as this pattern (fewer males at larger sizes) is observed in both the Bering Sea and the Gulf of Alaska, and in both survey and commercial catches. This change is largely responsible for the drop in exploitable biomass estimated in 2000, although there was also a less-dramatic decrease in the trawl survey biomass in the 1999 survey. Biomass estimates are estimated to be greater than $B_{40\%}$ and ABC was determined to be 145,360 mt based on Tier 3a calculations ($F_{40\%}$ = 0.134). The Team recommended that ABC be apportioned among regulatory areas in proportion to biomass distributions in the 1999 trawl survey. The resulting ABC's are:

	WESTERN	CENTRAL	WYAK	EYAK/SEO	TOTAL
Arrowtooth	16,160	97,710	23,770	7,720	145,360

Using Tier 3a criteria, the overfishing level based on $F_{35\%}$ = 0.159 is estimated at 173,910 mt.

SABLEFISH

YEAR	ABC	EXPLOITABLE BIOMASS[1]	CATCH
1998	14,123	166,000	18,138
1999	12,700	150,000	12,099[2]
2000	13,400	169,000	

1/ Exploitable biomass defined as age +4.

2/ Catch through November 6, 1999.

Revisions to the sablefish assessment from last year primarily include: the addition of about 20 years of historical data, adding recent fishery catch rate data, the use of ageing imprecision, and a Bayesian decision analyses. Recruitment variability was significantly different compared to last year's assessment. This was due to the addition of true ageing error estimates.

The Team selected the *F40% adjusted rate* that used the split gears for setting the maximum permissible ABC level (Tier 3b). This gave the adjusted GOA value for the year 2000 harvest level of **13.4 thousand t** as the maximum permissible ABC (F_{ABC}=0.109). The Team recommended that this value should also be used for setting the ABC level. The corresponding GOA overfishing level (F_{OFL}=0.136) based on $F_{35\%\ adjusted}$ is **16.7 thousand t.**

The authors constructed an approximate probability figure on the odds of the year 2004 spawning biomass dropping below the projected year 2000 level. They used this method to develop recommendations for year 2000 ABC levels by evaluating different future fixed catch levels. The assumptions of this projection model included: 1) re-sampling recruitment from 1982-1995 year-classes represents both the level and variability expected in future years, 2) the estimated posterior density over the grid of different q and M values adequately integrates the uncertainty in the assessment, 3) trawl and fixed gear fisheries can be adequately represented by a single gear-type, and 4) that future harvest levels would be constant. They determined that a constant 5-year catch scenario of 17,000 tons was appropriate for minimizing the risks of further stock declines (for the entire BS/AI/GOA area).

The Teams noted that the probability figure was a useful approach for evaluating consequences of future fishery scenarios. However, the ABC value recommended using this method did not differ much from the standard maximum permissible F_{ABC} (Tier 3, $F_{40\%}$) value. This confirmed that both approaches were consistent, but this outcome may be only coincidental. The Teams noted that re-sampling from only 14 years of recruitment most likely contributed to the irregularities in the estimated probability figures. Finally, there was some concern that this approach (using the probability figure) for establishing an ABC recommendation may change in the future and caution against its adoption as a standard approach.

The Teams discussed the three different methods for computing area apportionments for sablefish. There are significant differences in the area apportionments depending on the method. The questions are what biological effects area apportionments may have on the sablefish stock. Based on the earlier work of Heifetz *et al.* (1997), area-specific harvest rates begin to have significant impacts at levels (e.g., >30%) significantly higher than what is currently estimated. The Teams suggested that Council should continue to apportion based on the 5-year weighted average as in the past. There are concerns that biases may be introduced by adding the fishery data. While the Team did not have any compelling evidence that suggested biological issues are of concern, they felt that a good strategy continues to be one of area apportionment based on the best estimate of the biomass distribution.

The Team requested that the trawl survey data be used within the model and to evaluate area apportionments (at least for comparisons). The trawl survey may be useful for evaluating incoming year-classes since they generally catch smaller sablefish than longline gear. The Team expressed concern about whether fishery CPUE data should be used in the future. The survey data is quite extensive and should be adequate. The consensus was that alternative models be considered where the CPUE is included and excluded (or possibly with the allowance that catchability can change gradually over time). The Team requested that a figure and some discussion of the stock-recruitment relationship be included in future assessments. This is useful for having some perspective on the recruitment levels at different stock levels.

The area apportionment of ABC for sablefish is as follows:

	Western	Central	West Yakutat	E. Yakutat/SE	Total
ABC	1,960	6,030	1,920	3,490	13,400

SLOPE ROCKFISH

		ABC	EXPLOITABLE BIOMASS	CATCH
1998	Pacific ocean perch	12,820	243,170	8,961
	shortraker/rougheye	1,590	65,380	1,690
	northern rockfish	5,000	83,870	3,051
	other slope rockfish	5,260	103,710	860
	TOTAL	24,670	496,130	14,562[1]
1999	Pacific ocean perch	13,120	228,190	10,476
	shortraker/rougheye	1,590	65,380	1,302
	northern rockfish	5,000	83,870	5,398
	other slope rockfish	5,260	103,710	789
	TOTAL	24,970	485,150	17,965[1]
2000	Pacific ocean perch	13,020	200,310	
	shortraker/rougheye	1,730	70,890	
	northern rockfish	5,120	85,360	
	other slope rockfish	4,900	102,510	
	TOTAL	24,770	459,070	

1/ Catch through November 6, 1999.

PACIFIC OCEAN PERCH

The stock assessment model for Pacific ocean perch was updated to include biomass estimates and size composition from the 1999 trawl survey and size composition and catch from the from the 1999 fishery. The model configuration and implementation software has remained the same as in last year's assessment. The trawl survey biomass estimates for Pacific ocean perch was greatly influenced by one extremely large catch. One haul in the Chirikof area had a catch for Pacific ocean perch of nearly 16 mt, which is the highest single catch ever recorded for this species in any of the triennial surveys. The large biomass for Pacific ocean perch in the Chirikof area in 1999 can be mostly attributed to this one haul. In all other areas there was a substantial decline in trawl survey biomass estimates compared to 1996. The anomalously high catch was responsible for the high variance associated with the Gulfwide biomass estimate for Pacific ocean perch. The coefficient of variation (CV) for the 1999 survey biomass estimate was 53% whereas the previous surveys had CV's less than 30%.

As in the past, the Team and the authors concurred that a model that treats survey biomass as an index of abundance rather than absolute abundance should be used as the basis for ABC and overfishing levels. Thus, survey catchability *q* was estimated in the current stock assessment. Survey catchability *q* was estimated at 2.99, compared with an estimate of $q = 2.78$ for last year's assessment. Justification for an estimate of $q > 1.0$ is based on expansion of the trawl survey estimates to untrawlable areas and on possible herding of fish into the trawl by the bridles and trawl doors. Submersible studies indicate adult Pacific ocean perch often concentrate over trawlable substrates. The Team had a difficult time reconciling the high estimated value for *q*. However, other factors independent of surveys, such as parameter confounding contribute to the estimate of *q*. The model chosen for ABC and OFL recommendations fit the data best ($q = 2.99$) and is in keeping with the desire to remain conservative.

Tier 3 is used to compute ABC and OFL. The current female spawning biomass (B_{2000} = 92,920 mt) is less than $B_{40\%}$ (110,120), where $B_{40\%}$ is determined from the average recruitment of the 1977-92 year classes. Since B_{2000} is less than $B_{40\%}$, the computation in Tier 3b is used to determine the maximum value of F_{ABC}. The current estimate of $F_{40\%}$ is 0.078. Applying Tier 3b results in F_{ABC} # 0.065 and an ABC # 13,020 mt. The Team recommends that the ABC for Pacific ocean perch for the 2000 fishery in the Gulf of Alaska be set at 13,020 mt. The overfishing level based on Tier 3b (adjusted $F_{35\%}$ = 0.078) is 15,390 mt.

The Team and the authors concurred with the method of apportionment used for the past three years. The method weights prior surveys based on the relative proportion of variability attributed to survey error. Survey error is assumed to contribute 2/3 of the total variability in predicting the distribution of biomass. Thus, the weight of a prior survey should be 2/3 the weight of the preceding survey. This results in weightings of 4:6:9 for the 1993, 96, and 99 surveys, respectively and area apportionments of 9.5% for the Western area, 71.0% for the Central area, and 19.4% for the Eastern area. This results in recommended ABCs of 1,240 mt for the Western area, 9,240 mt for the Central area, and 2,540 mt for the Eastern area. For Pacific ocean perch the overfishing level is apportioned by area. Using the same apportionment as used for ABC, results in overfishing levels by area of 1,460 mt in the Western area, 10,930 mt in the Central area, and 3,000 mt in the Eastern area. The authors pointed out that an alternative apportionment scheme may be warranted because variance of the 1999 survey estimate is considerably higher than previous surveys. Thus an alternative weighting scheme that considers year specific estimates of measurement error (i.e. survey variance) may be warranted.

Amendment 41 prohibited trawling in the Eastern area east of 140E W longitude. Since Pacific ocean perch are caught exclusively with trawl gear, there is concern that the entire Eastern area TAC might be taken in the area that will remain open to trawling (WYAK). Thus the Team recommends that a separate ABC be set for Pacific ocean perch in WYAK. Using the same weighted average method as described above results in a point estimate of 0.22 for the proportion of the exploitable biomass in the Eastern area that occurs in WYAK. However, there is considerable uncertainty in this estimate. In an effort to balance this uncertainty with associated costs to the industry, the Team recommends apportionments to West Yakutat, be based on proportions from the upper 95% confidence limit of 0.33. This corresponds to an ABC of 840 mt for WYAK. Under this apportionment strategy, very little of the 1,700 mt assigned to the remaining Eastern area (EYAK/SEO) is expected to be harvested. Note that the combined ABC for the WYAK and EYAK/SEO should not exceed 2,540 mt.

SHORTRAKER/ROUGHEYE

As in the past, the average of the exploitable biomasses in the three most recent surveys (1993, 1996, and 1999) is used to determine current exploitable biomass. The current estimates of exploitable biomass are 22,480 mt for shortraker rockfish and 48,400 mt for rougheye rockfish. Applying the definitions for ABC and OFL places shortraker rockfish in Tier 5 where F_{ABC} #0.75M. Thus, the recommended F_{ABC} for shortraker rockfish is 0.023 (i.e., 0.75 X 0.03). Applying Tier 4 to rougheye rockfish (i.e., F_{ABC} #$F_{40\%}$) allows an F_{ABC} =M= 0.025 which is less than $F_{40\%}$=.032. Applying these F_{ABC} rates to the estimates of exploitable biomass results in ABCs of 520 mt for shortraker rockfish and 1,210 mt for rougheye rockfish and a total ABC for the subgroup of 1,730 mt. Overfishing is defined to occur at the harvest rate set equal to $F_{35\%}$ of 0.038 for rougheye rockfish and at the F=M rate of 0.03 for shortraker rockfish because data are not available to determine $F_{35\%}$ for shortraker rockfish. These harvest rates are applied to estimates of current exploitable biomass to yield an overfishing catch limit of 2,510 mt for the shortraker/rougheye assemblage.

As in last year's assessment, to apportion ABC among areas, the Team recommends that the same methodology used for Pacific ocean perch be applied to shortraker and rougheye rockfish. This method results in apportionments of 210 mt for the Western area, 930 mt for the Central area and 590 mt for the Eastern area. The Team did not split the Eastern area ABC into subareas defined by the 140E boundary in Amendment 41 because this bycatch-only fishery is harvested by both longline and trawl gear.

NORTHERN ROCKFISH

In the past, the unweighted average of the exploitable biomasses in the three most recent surveys (1993, 1996, and 1999) was used to determine current exploitable biomass. This results in exploitable biomass of 125,545 mt. However, variance of the 1999 survey was exceptionally large, approximately 30 and 15 times larger than the 1996 and 1993 survey variances, repectively. This large variance is due to one very large haul in one strata. The biomass estimate for this strata makes up 78% of the 1999 survey estimate of exploitable biomass for northern rockfish. The Team concurred with the author that to account for the increased level of uncertainty in the 1999 survey estimate, exploitable biomass this year should be estimated using a weighted average. Weights for each survey estimate are in proportion to the inverse of their respective variances. This weighted average results in an estimate of 85,360 mt of exploitable biomass for northern rockfish.

Applying the definitions for ABC and OFL places northern rockfish in Tier 4 where F_{ABC} #$F_{40\%}$. As in the past, an F=M harvest strategy is used to determine ABC. This results an F_{ABC} =M= 0.06 which is less than $F_{40\%}$=0.075. Applying the F=0.06 harvest rate to the estimated exploitable biomass of 85,360 mt results in an ABC of 5,120 mt for northern rockfish. Distributing this ABC based on the same method used for Pacific ocean perch results in ABCs of 630 mt in the Western area and 4,485 mt in the Central area. The small ABC of 5 mt apportioned to the Eastern is combined with the WYAK ABC for other slope rockfish. The Eastern area is the edge of the geographical range of northern rockfish and such a small ABC is extremely difficult to manage. Overfishing is defined to occur at the $F_{35\%}$ value of 0.088 for northern rockfish which results in an OFL of 7,510 mt for northern rockfish.

An age structured stock assessment model for northern rockfish has been constructed using AD Model Builder Software. A detailed report describing the model configuration and preliminary results was presented at the September Plan Team meeting. An updated report which includes age composition from the 1996 survey and biomass estimates from the 1999 survey is in an appendix to the slope rockfish chapter. The age structured model will be used for next year's northern rockfish assessment pending minor modifications suggested by the Plan Team.

OTHER SLOPE ROCKFISH

As in the past, the recommended ABC for other slope rockfish is based on F = M or F = 0.75M applied to exploitable biomass. Exploitable biomass is determined from the average of the three most recent trawl surveys. Applying the definitions for ABC and OFL places sharpchin rockfish in Tier 4 where F_{ABC} #$F_{40\%}$, and the other species of other slope rockfish in Tier 5 where F_{ABC} #0.75M. For sharpchin rockfish, F_{ABC} = M = 0.05 is less than $F_{40\%}$ = 0.055. This results in a recommended combined ABC for other slope of 4,900 mt (including 5 mt of northern rockfish in the West Yakatat area). Distributing this ABC based on the same method used for Pacific ocean perch results in ABCs of 20 mt in the Western area, 740 mt in the Central area, and 4,140 mt in the Eastern area. Overfishing is defined as $F_{35\%}$ = 0.064 for sharpchin rockfish and F=M for the other species. This results in an OFL of 6,390 mt.

The Team recommends that a separate ABC be set for other slope rockfish in the West Yakutat area. Using the same weighted average method as used for Pacific ocean perch results in a point estimate of 0.06 for the proportion of the exploitable biomass in the Eastern area that occurs in West Yakutat. Because a small portion of the Eastern ABC of other slope rockfish has been taken recently and some other slope rockfish are caught with longline gear, the Team recommended that this point estimate be used to apportion the ABC. This corresponds to an ABC of 250 mt (including 5 mt of northern rockfish) in West Yakutat and 3,890 mt in the remaining Eastern area.

PELAGIC SHELF ROCKFISH

YEAR	ABC	EXPLOITABLE BIOMASS	CATCH
1998[1]	5,260	55,580	3,109
1999	4,880	54,220	4,657[2]
2000	5,980	66,443	

1/ Includes black and blue rockfishes which were removed from the GOA FMP in 1998.
2/ Through November 6, 1999.

The pelagic shelf rockfish (PSR) assemblage is comprised of dusky, yellowtail, and widow rockfishes. Biomass estimates for PSR indicate that dusky rockfish comprise nearly all the biomass. Based on mean trawl survey data in 1993, 1996, and 1999, the 1999 exploitable biomass was calculated to be 66,443 mt. An F=M strategy equal to 0.09 for dusky rockfish resulted in an ABC of 5,980 mt for the assemblage. This strategy is more conservative than the Tier 4 maximum $F_{40\%}$ of 0.11 and the Team feels a reduction is justified due to concern over the reliability of biomass estimates and the estimates of $B_{40\%}$ for this assemblage. The Team concurs with the authors that sufficient data may now exist to conduct an age-structured assessment for dusky rockfish and recommends that this work proceed. Given the rational described above for Pacific ocean perch, a respective weighting of 4:6:9 applied to PSR geographical distributions from the 1993, 1996, and 1999 surveys results in ABC apportionments of 550 mt to the Western, 4,080 mt to the Central, and 1,350 mt to the Eastern areas.

The Team recommends that the Eastern area ABC be apportioned to West Yakutat according to the upper 95% confidence limit estimate of proportion in West Yakutat from the three most recent survey years with total Eastern area ABC not to exceed 1,350 mt. Point estimates for West Yakutat and SEO are 420 and 930 respectively. The updated point estimate of F_{OFL} under the Amendment 56 overfishing definitions is $F_{35\%}$ (0.136) producing a gulfwide overfishing level of 9,036 mt.

Recommended Area Apportionments

Western	Central	West Yakutat	SEO
550	4,080	580	770

DEMERSAL SHELF ROCKFISH

YEAR	ABC	EXPLOITABLE BIOMASS	CATCH[1]
1998	560	25,031	381
1999	560	25,031	262[2]
2000	340	15,100	

1/ Unreported mortality not included in catch.

2/ Catch through November 6, 1999.

Density estimates for the SSEO and EYKT areas from the 1999 line transect survey were added to the model. Estimates of area of rock habitat by management area were revised and the model was updated using these new estimates. Weight data was updated using 1998 port samples.

Estimates of rock habitat were revised using a combination of information available from submersible dives, sidescan data, NOS data, and commercial logbook data. Areas were digitized into a GIS. Changes from previous estimates were significant and varied by area with some areas showing an increase and some a decrease in estimated area of rock habitat. The overall change was down 34%, with 3,095 km^2 compared to 5,758 km^2 used in previous assessments. Area estimates will most likely change in the future as more information on habitat is collected.

The exploitable biomass estimate for yelloweye rockfish, based on the sum of the lower 90% confidence limit of biomass is 15,100 mt. This is a decrease of 40% over the 1999 estimate. This decrease is largely due to the change in estimate of rock habitat as well as the lower density for EYKT.

Because of the continued uncertainty in estimation of yelloweye biomass due to difficulties in estimation of total area of rock habitat, and our inability to include the uncertainty of this estimate in our assessment, we continue to advocate using the lower 90% confidence limits of biomass, as the reference number for setting ABC. Consistent with past years, the exploitable biomass estimate is based on the sum of the lower 90% confidence limits for each management area. This is appropriate as there are significant differences in density between management areas and the directed fishery quota is set by management area.

The SEO exploitable biomass estimate for 1999 is 15,100 mt. Using tier 4 and adjusting for the 10% of other species landed in the assemblage, the F_{ABC} was set at F=M=0.02, more conservative than the $F_{40\%}$ rate and yields an ABC of 340. The overfishing level was set at $F_{35\%}$=0.0279 = 420 mt.

THORNYHEAD ROCKFISH

YEAR	ABC	EXPLOITABLE BIOMASS	CATCH
1998	2,000	52,300	1,148
1999	1,999	53,200	1,167[1]
2000	2,360	53,200	

1/ Catch through November 6, 1999.

Shortspine thornyheads were assessed using the same model as in the preceding year. The 1999 NMFS survey extended into deeper water thereby covering more of the shortspine thornyhead habitat. The authors treated the 1999 estimate the same as the earlier surveys where deeper areas had been surveyed. The general trend showed an increase in biomass. The Team concurred with the author's recommendation for a year 2000 ABC of **2,360 t** (based on Tier 3a; F_{ABC} = 0.077). The corresponding overfishing level is **2,830 t** (F_{OFL}=0.092).

The Team expressed concern that the survey estimates showed what appeared to be significant increases in stock abundance yet the model predictions indicate a slight decline. The authors responded that this might be due to model mis-specification problems related to the assumptions about growth (and the effect this assumption has on natural mortality). The Team suggested that the authors evaluate model runs where the 1999 biomass estimate was derived from only shallower tows (as in 1990, 1993, and 1996). This may provide insight on the importance of the deeper stations.

The area specific apportionments give 425, 991, and 944 tons to the Western, Central and Eastern Gulf of Alaska, respectively.

ATKA MACKEREL

YEAR	ABC	CATCH
1998	600	316
1999	600	262[2]
2000	600	

1/ Through November 6, 1999.

Prior to 1997, exploitable biomass and ABC for GOA Atka mackerel were based on triennial bottom trawl survey estimates. However, schooling behavior, patchy distribution, and habitat preference makes this species difficult to sample with standard trawl survey gear. Atka mackerel are also poor targets for hydroacoustic surveys because they lack swim bladders. Re-evaluation of historical survey data indicated abundance estimates prior to 1997 were also compromised by high variability. Thus, existing GOA bottom trawl survey data has limited utility for either absolute abundance estimates or indices for Atka mackerel.

The Plan Team supports a bycatch only fishery as a conservative harvest policy for Atka mackerel because: (1) there is no reliable biomass estimate; (2) localized depletion may occur; and (3) this species has previously exhibited a particular vulnerability to fishing pressure in the GOA. The Team recommends an ABC of 600 mt in 2000 to satisfy bycatch needs in other fisheries. Under Tier 6 criteria, the overfishing level is equal to 6,200 mt, the average catch for 1978-1995.

OVERVIEW OF APPENDICES

Appendix A: Pacific Halibut Stock Assessment and Fishery Evaluation

A separate SAFE report on the Pacific halibut (Hippoglossus stenolepis) resource and fishery has been prepared by the staff of the International Pacific Halibut Commission (IPHC) and is included in this SAFE report as Appendix A.

The Teams reviewed the IPHC report during their November meeting. Commercial catches increased slightly in 1998 over 1997 as did fishery discards and estimates of personal use, whereas removals from bycatch mortality and the sport fishery declined slightly.

The most recent assessment was conducted by IPHC in the fall of 1998. Using a relatively new age- and length-structured model which incorporates fishery and survey data, individual assessments were done for Regulatory Area 2A/B, 2C, and 3A. Assessments of Area 3B and 4 were hampered somewhat by low exploitation of the stocks in those areas.

A major change in the assessment model was the lowering of natural mortality *M* from 0.20 to 0.15, based on analysis of survey data in the 1990s. This change had the effect of lowering abundance estimates for Areas 2A through 3A by 30%. In Areas 3B and 4 the estimates are only about 20% lower than last year’s because the 1998 surveys showed an increase in biomass in those areas relative to the central and eastern Gulf of Alaska. Total coastwide exploitable biomass estimates remain high, however, totaling 568 million pounds net (342,600 mt round weight). Overall setline CEY (Constant Exploitation Yield) was still very high at 99 million pounds (59,700 mt round weight).

The assessment also showed that the 1987 year class is strong, with subsequent year classes not as strong, although those age classes were estimated imprecisely in 1998.

Appendix B: Pacific Halibut Discard Mortality Rates

The report by IPHC staff on the results of analyses of 1998 observer data examining halibut discard mortality rates (DMRs) is included as Appendix B. The report was reviewed in a joint session of the Plan Teams during the November meeting. The Teams endorse the IPHC recommendations for Preseason Assumed DMRs for the 2000 fisheries.

The IPHC recommendations are included in the summary table below. The recommended Preseason Assumed DMRs are based on (1) an average of the two most recent years where no trend exists in a fishery's annual DMR, or (2) the most recent year when a trend (increasing/decreasing) is shown across the most recent 4 years. In the GOA, all recommendations were derived from the 2-year mean. In the BSAI, only two fisheries exhibited increasing or decreasing trends, so the 2-year mean was used for most fisheries. Trawl cod DMRs trended up during 1995-1998 and trawl rock sole trended down, so the 1998 DMR was used as the recommendation for 2000.

The analysis examined splitting the DMR for the GOA trawl fishery for flathead sole between catcher vessels (CV) and catcher/processors (C/P). Variability between sectors across years and among vessels within years was so large that there was no statistical difference in DMRs between sectors. Consequently, a single DMR (0.57) is recommended for the fishery for 2000 using the 2-year mean of 1997-1998 overall fishery DMRs.

A proposal to split the DMR for the GOA trawl deep water flatfish fishery by season was examined in the analysis. However, it was found that practically all fishing takes places during one month (April), so seasonal DMRs were not recommended.

Data for CDQ fisheries were collected in 1998 and fishing was primarily on pollock (trawls) and cod (hook & line) that year. DMRs for those fisheries were carried forward as recommendations for monitoring in 2000 CDQ targets. The analysis recommended monitoring bycatch mortality in other CDQ targets using the open access DMRs.

The DMR recommendation for the IFQ fishery was 0.23, which is a mean of the 1990-1994 BSAI and GOA sablefish fishery DMRs. Data collection in the IFQ fishery currently is not adequate for estimating DMRs and solutions are being explored by IPHC and the NMFS Domestic Observer Program. However, solutions will not be ready for 2000, so 0.23 is recommended in the interim.

Recommendations for Preseason Assumed DMRs for monitoring halibut bycatch mortality in 2000.

BSAI Target	Recommendations for 2000	GOA Target	Recommendations for 2000
Trawl		**Trawl**	
Atka mackerel	81	Atka mackerel	57
Bottom pollock	76	Bottom pollock	61
Pacific cod	66	Pacific cod	63
Other Flatfish	75	Deep water flatfish	56
Rockfish	64	Shallow water flatfish	69
Flathead sole	64	Rockfish	66
Other species	66	Flathead sole	57
Pelagic pollock	87	Other species	66
Rock sole	79	Pelagic pollock	75
Sablefish	23	Sablefish	71
Turbot	81	Arrowtooth flounder	55
Yellowfin sole	81	Rex sole	53
Pot		**Pot**	
Pacific cod	9	Pacific cod	14
Other species	9	Other species	14
Longline		**Longline**	
Pacific cod	11	Pacific cod	17
Rockfish	28	Rockfish	11
Other species	11	Other species	17
Turbot	20		
IFQ		***IFQ***	
All targets	23	All targets	23
CDQ Trawl			
Bottom Pollock	90		
Pelagic Pollock	90		
CDQ Longline			
Pacific cod	10		

Appendix C: Prohibited Species Catch Summary for Halibut

Information on halibut bycatch in the groundfish fisheries conducted in the Gulf of Alaska (GOA) is provided in Appendix C. It is intended for use by the Council in its utilization of the halibut species bycatch framework measures.

The PSC limits for halibut in the Gulf of Alaska are set by gear type and apportioned seasonally over the fishing year (Amendment 21). For 1998 the Council recommended the following halibut PSC apportionments for the Gulf of Alaska groundfish fisheries:

Trawl gear		Hook and Line gear	
1st quarter	600 mt (30%)	1st trimester	250 mt (86%)
2nd quarter	400 mt (20%)	2nd trimester	15 mt (5%)
3rd quarter	600 mt (30%)	3rd trimester	25 mt (9%)
4th quarter	400 mt (20%)	DSR	10 mt
TOTAL	2,000 mt		300 mt

Bycatch mortality of Pacific halibut in the 1999 Gulf of Alaska groundfish fisheries totaled 2,458 mt for trawl and hook-and-line fisheries through October 31, 1999. Halibut mortality was 2,114 mt from trawl gear and 344 mt for hook-and-line gear.

Appendix D: Other Species Considerations for the Gulf of Alaska

Appendix D is the first assessment of domestic observer data, triennial Gulf surveys, and life history information collated from the scientific literature to examine whether the conservation goals of the individual species or species groups of the Gulf of Alaska “other species” category are being met. This model highlights some of the available data for these species and develops some approaches toward evaluating the harvest levels and resource abundances. It allows a first-stage method of applying some aspects of the biological attributes to the survey biomass estimates. It revealed that, based on approximate values for natural mortality rates (and corresponding OFL levels), the chance that any of the groups are being over-exploited is small. However, there is insufficient information at the individual species level to make this determination. It is possible for a directed fishery to develop for a single species within its group which may be harvested disproportionately.

Appendix E: An Approach to Analyzing Multi-Species Complexes in Data-Limiting Situations

The Gulf of Alaska “other species” management category comprises multiple non-target species groups: sharks, skates, smelts, squids, octopus, and sculpins. “Other species” are considered ecologically important and may have future economic potential; therefore an aggregate annual quota limits their catch. One management goal is to prevent overfishing of any single component of the category while the aggregate catch is maintained within allowable limits. However, data on catch and abundance for these species are extremely "noisy" and result in estimates with high variance. The problem facing analysts is thus to find appropriate methods to deal with this “signal to noise” problem. Such methods should provide conservation recommendations that are robust to problems with the data while giving stability that fisheries management desires. For example, in the Gulf of Alaska, managers may want to avoid linking conservation regulations directly to survey data recognizing that survey biomass estimates for certain species have high variability due to measurement error. This model attempts to account for both observation error and process error in estimating biomass and exploitation rates for each species group. Here, process error was assumed to be different for species groups reflecting the diversity expected between short-lived smelts and long-lived sharks. The potential problem of incorrectly specifying the ratio of process to observation error was illustrated. In practice, specifying the variance ratio may be less problematic since a species life-history traits are generally known, as are the problems associated with survey abundance estimates.

Appendix F: Definitions of Common Acronyms

A collection of acronym definitions used in the SAFE has been included as Appendix E.

Table 1. Gulf of Alaska groundfish 1999 and 2000 ABCs, 1999 TACs, and 1999 catches reported through November 6, 1999. MSY is unknown for all species.

SPECIES		ABC (mt) 2000		ABC (mt) 1999	TAC 1999	CATCH 1999
Pollock	W (61)	39,590	W (61)	23,120	23,120	23,387
	C (62)	23,560	C (62)	38,840	38,840	38,135
	C (63)	31,000	C (63)	30,520	30,520	30,095
	WYAK	2,410	E	8,440	2,110	1,759
	EYAK/SEO	6,460			6,330	4
	TOTAL	103,020	**TOTAL**	100,920	100,920	93,380
Pacific Cod	W	27,500	W	29,540	23,630	23,154
	C	43,550	C	53,170	42,935	44,559
	E	5,350	E	1,690	1,270	857
	TOTAL	76,400	**TOTAL**	84,400	67,835	68,570
Deep water flatfish[1]	W	280	W	240	240	22
	C	2,710	C	2,740	2,740	1,865
	WYAK	1,240	E	1,720	1,720	389
	EYAK/SEO	1,070		1,350	1,350	9
	TOTAL	5,300	**TOTAL**	6,050	6,050	2,285
Rex sole	W	1,230	W	1,190	1,190	603
	C	5,660	C	5,490	5,490	2,391
	WYAK	1,540	E	850	850	41
	EYAK/SEO	1,010		1,620	1,620	22
	TOTAL	9,440	**TOTAL**	9,150	9,150	3,057
Shallow water flatfish[2]	W	19,510	W	22,570	4,500	252
	C	16,400	C	19,260	12,950	2,282
	WYAK	790	E	250	250	6
	EYAK/SEO	1,160		1,070	1,070	5
	TOTAL	37,860	**TOTAL**	43,150	18,770	2,545
Flathead sole	W	8,490	W	8,440	2,000	184
	C	15,720	C	15,630	5,000	680
	WYAK	1,440	E	1,270	1,270	16
	EYAK/SEO	620		770	770	11
	TOTAL	26,270	**TOTAL**	26,110	9,040	891
Arrowtooth flounder	W	16,160	W	34,400	5,000	3,656
	C	97,710	C	155,930	25,000	11,787
	WYAK	23,770	E	13,260	2,500	383
	EYAK/SEO	7,720		13,520	2,500	236
	TOTAL	145,360	**TOTAL**	217,110	35,000	16,062
Sablefish	W	1,960	W	1,820	1,820	1,487
	C	6,030	C	5,590	5,590	5,828
	WYAK	1,920	WY	5,290	2,090	1,704
	EYAK/SEO	3,490	EY/SEO		3,200	3,080
	TOTAL	13,400	**TOTAL**	12,700	12,700	12,099
Other Slope rockfish	W	20	W	20	20	40
	C	740	C	650	650	615
	WYAK	250 [3]	E	470	470	122
	EYAK/SEO	3,890		4,130	4,130	12
	TOTAL	4,900	**TOTAL**	5,270	5,270	789

(Table 1 continued)

SPECIES		ABC (mt) 2000		ABC (mt) 1999	TAC 1999	CATCH 1999
Northern rockfish	W	630	W	840	840	573
	C	4,490	C	4,150	4,150	4,825
	E	0 [3]	E			0
	TOTAL	5,120	**TOTAL**	4,990	4,990	5,398
Pacific ocean perch	W	1,240	W	1,850	1,850	1,935
	C	9,240	C	6,760	6,760	7,914
	WYAK	840	E	1,350	820	627
	EYAK/SEO	1,700		3,160	3,160	0
	TOTAL	13,020	**TOTAL**	13,120	12,590	10,476
Shortraker/rougheye	W	210	W	160	160	194
	C	930	C	970	970	577
	E	590	E	460	460	531
	TOTAL	1,730	**TOTAL**	1,590	1,590	1,302
Pelagic shelf rockfish	W	550	W	530	530	130
	C	4,080	C Inshore	3,370	3,370	3,835
	WYAK	580	C Offshore	740	740	672
	EYAK/SEO	770	E	240	240	20
	TOTAL	5,980	**TOTAL**	4,880	4,880	4,657
Demersal Shelf Rockfish		340		560	560	262
Atka Mackerel	GW	600	GW	600	600	262
Thornyhead rockfish		430	Western	260	260	282
		990	Central	700	700	582
		940	Eastern	1,030	1,030	410
	TOTAL	2,360	**TOTAL**	1,990	1,990	1,274
Other Species	GW	NA	GW	NA	14,600	3,735
TOTAL		451,100		532,590	306,535	227,044

1/ Deep water flatfish includes dover sole, Greenland turbot and deepsea sole.
2/ "Shallow water flatfish" includes rock sole, yellowfin sole, butter sole, starry flounder, English sole, Alaska plaice, and sand sole.
3/ The EGOA ABC of 5 mt for northern rockfish has been included in the WYAK ABC for other slope rockfish.

NOTE:
ABCs and TACs are rounded to nearest 10, except for Pacific ocean perch.
GW means Gulfwide.
Catch data source: NMFS Blend Reports.

Table 2. Gulf of Alaska 2000 ABCs and overfishing levels, and estimated trends and abundance for Western, Central, Eastern, Gulfwide, West Yakutat, and Southeast Outside regulatory areas.

		2000			
SPECIES		ABC	Biomass	Overfishing Level	Abundance,[2] Trend
Pollock	W (61)	39,590	(W/C + WYAK)		Below,
	C (62)	23,560	588,000	130,760	Increasing
	C (63)	31,000			
	WYAK	2,410	(EYAK/SEO)		
	EYAK/SEO	6,460	28,710	8,610	
	TOTAL	103,020		139,370	
Pacific Cod	W	27,500			Above,
	C	43,550			Declining
	E	5,350			
	TOTAL	76,400	567,000	102,000	
Deep water flatfish	W	280			Unknown,
	C	2,710			Unknown
	WYAK	1,240			
	EYAK/SEO	1,070			
	TOTAL	5,300	74,370 [4]	6,980	
Rex sole	W	1,230			Unknown,[3]
	C	5,660			Stable
	WYAK	1,540			
	EYAK/SEO	1,010			
	TOTAL	9,440	74,600	12,300	
Shallow water flatfish	W	19,510			Unknown,[3]
	C	16,400			Stable
	WYAK	790			
	EYAK/SEO	1,160			
	TOTAL	37,860	299,100	45,330	
Flathead sole	W	8,490			Unknown,[3]
	C	15,720			Stable
	WYAK	1,440			
	EYAK/SEO	620			
	TOTAL	26,270	207,520	34,210	
Arrowtooth flounder	W	16,160			Above,
	C	97,710			Declining
	WYAK	23,770			
	EYAK/SEO	7,720			
	TOTAL	145,360	1,571,670	173,910	
Sablefish	W	1,960			Low,
	C	6,030			Declining
	WYAK	1,920			
	EY/SEO	3,490			
	TOTAL	13,400	169,000	16,660	
Other Slope rockfish	W	20			Unknown,
	C	740			Unknown
	WYAK	250 [1]			
	EYAK/SEO	3,890			
	TOTAL	4,900	102,510	6,390	

(Table 2 continued)

		2000			
SPECIES		ABC		Overfishing Level	Abundance,[2] Trend
Northern rockfish	W	630			Unknown,
	C	4,490			Unknown
	E	[1]			
	TOTAL	5,120	85,360	7,510	
Pacific ocean perch	W	1,240		1,460	Below,
	C	9,240		10,930	Increasing
	WYAK	840			
	EY/SEO	1,700		3,000	
	TOTAL	13,020	200,310	15,390	
Shortraker/ rougheye	W	210			Unknown,
	C	930			Unknown
	E	590			
	TOTAL	1,730	70,880	2,510	
Pelagic shelf rockfish	W	550			Unknown,
	C	4,080			Unknown
	WYAK	580			
	EY/SEO	770			
	TOTAL	5,980	66,440	9,040	
Demersal shelf rockfish	SEO	340	15,100	420	Unknown, Unknown
Atka mackerel	GW	600	Unknown	6,200	Unkown, Unknown
Thornyhead rockfish	Western	430			Above,
	Central	990			Stable
	Eastern	940		2,820	
	Total	2,360	52,950		
Other species					TAC = 5% of the sum of TACs.

1/ The EGOA ABC of 5 mt 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:

ABCs are rounded to nearest 10.

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, 2000.

Species	Tier	F_{ABC}[1]	Strategy	F_{OFL}[2]	Strategy
Pollock	3b	0.29	F_{ABC}	0.40	$F_{35\%\ adjusted}$
Pacific cod	3a	0.33	F_{ABC}	0.46	$F_{35\%}$
Deepwater flatfish	5,6[3]	NA	F_{ABC}[3]	NA	F_{OFL}[4]
Rex sole	5	0.15	F=.75M	0.20	F=M
Flathead sole	5	0.15	F=.75M	0.20	F=M
Shallow water flatfish	4,5[5]	0.15-0.17	F=.75M, $F_{40\%}$[5]	0.2-0.209	$F_{35\%,}$ F=M[6]
Arrowtooth	3a	0.134	$F_{.40\%}$	0.159	$F_{35\%}$
Sablefish	3b	.109	$F_{40\%\ adjusted}$	0.136	$F_{35\%adjusted}$
Pacific ocean perch	3b	0.065	$F_{40\%\ adjusted}$	0.078	$F_{35\%\ adjusted}$
Shortraker/rougheye	4,5[7]	0.23/0.025	F=.75M, F=M[7]	0.03/.038	F=M, $F_{35\%}$[8]
Rockfish (other slope)	4,5[9]	0.03-0.75	F=.75M, F=M[9]	0.04-0.10	$F_{35\%}$, F=M[10]
Northern rockfish	4	0.06	F=M	0.088	$F_{35\%}$
Pelagic Shelf Rockfish	4	0.09	F=M	0.136	$F_{35\%}$
Demersal Shelf Rockfish	4	0.02	F=M	0.028	$F_{35\%}$
Thornyhead rockfish	3a	0.77	$F_{40\%}$	0.092	$F_{35\%}$
Atka mackerel	6	NA	F_{ABC}[11]	NA	F_{OFL}[12]

1/ Fishing mortality rate corresponding to acceptable biological catch.
2/ Maximum fishing mortality rate allowable under overfishing definition.
3/ F_{ABC}=.75M for Dover sole (Tier 5), ABC=.75 x average catch (1978-1995) for other deepwater flatfish (Tier 6).
4/ F=M for Dover sole, average catch (1978-1995) for other deepwater flatfish.
5/ $F_{40\%}$ for rocksole (Tier 4), F=.75M for remaining shallowater flatfish (Tier 5).
6/ $F_{35\%}$ for rocksole, F=M for remaining shallow water flatfish.
7/ F=.75M for shortraker (Tier 5), F=M for rougheye (Tier4).
8/ F=M for shortraker, $F_{35\%}$ for rougheye.
9/ F=M for sharpchin rockfish (Tier 4), F=.75M for other species (Tier 5).
10/ $F_{35\%}$ for sharpchin, F=M for other species.
11/ ABC for Atka mackerel is 600 mt for bycatch in other target fisheries.
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 2000 Plan Team recommended fishing mortality rates and ABCs, for those species whose recommendations were below the maximum.

Gulf of Alaska

Species	Tier	2000 Max. Permissible F_{ABC}	2000 Max. Permissible ABC	2000 F_{ABC}	2000 ABC
Pollock[1]	3b	0.34	111,310	0.290	96,560
Pacific cod	3a	0.380	86,000	0.330	76,400
Rougheye rockfish	4	0.032	1,550	0.025	1,210
Shortraker rockfish	5	0.023	520	0.023	520
Total Shortraker/Rougheye	4,5		2,070		1,730
Northern rockfish	4	0.075	6,400	0.060	5,120
Other slope rockfish (sharpchin)	4	0.055	1,980	0.050	1,800
Other slope rockfish (redstripe)	5	0.075	1,240	0.075	1,240
Other slope rockfish (harlequin)	5	0.045	560	0.045	560
Other slope rockfish (silvergrey)	5	0.030	780	0.030	780
Other slope rockfish (redbanded)	5	0.045	290	0.045	290
Other slope rockfish (minor species)	5	0.045	220	0.045	220
Total other slope rockfish	4,5		5,070		4,890
Pelagic shelf rockfish	4	0.110	7,310	0.090	5,980
Demersal shelf rockfish	4	0.025	420	0.020	340
Atka mackerel	6	NA	4,700	NA	600

1/ Western, Central and West Yakutat area.

Table 5. Groundfish landings (metric tons) in the Gulf of Alaska, 1956-1999.

Year	Pollock	Pacific Cod	Flat Fish	Arrowtooth Flounder	Sable Fish	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	1,028		2,457	243,385
1965	2,749	599	4,727		3,458	348,598
1966	8,932	1,376	4,937		5,178	200,749
1967	6,276	2,225	4,552		6,143	120,010
1968	6,164	1,046	3,393		15,049	100,170
1969	17,553	1,335	2,630		19,376	72,439
1970	9,343	1,805	3,772		25,145	44,918
1971	9,458	523	2,370		25,630	77,777
1972	34,081	3,513	8,954		37,502	74,718
1973	36,836	5,963	20,013		28,693	52,973
1974	61,880	5,182	9,766		28,335	47,980
1975	59,512	6,745	5,532		26,095	44,131
1976	86,527	6,764	6,089		27,733	46,968
1977	112,089	2,267	16,722		17,140	23,453
1978	90,822	12,190	15,198		8,866	8,176
1979	98,508	14,904	13,928		10,350	9,921
1980	110,100	35,345	15,846		8,543	12,471
1981	139,168	36,131	14,864		9,917	12,184
1982	168,693	29,465	9,278		8,556	7,991
1983	215,567	36,540	12,662		9,002	7,405
1984	307,400	23,896	6,914		10,230	4,452
1985	284,823	14,428	3,078		12,479	1,087
1986	93,567	25,012	2,551		21,614	2,981
1987	69,536	32,939	9,925		26,325	4,981
1988	65,625	33,802	10,275		29,903	13,779
1989	78,220	43,293	11,111		29,842	19,002
1990	90,490	72,517	15,411		25,701	21,114
1991	107,500	76,997	20,068		19,580	13,994
1992	93,904	80,100	28,009		20,451	16,910
1993	108,591	55,994	37,853		22,671	14,240
1994	110,891	47,985	29,958		21,338	11,266
1995	73,248	69,053	32,273		18,631	15,023
1996	50,206	67,966	19,838	22,183	15,826	14,288
1997	89,892	68,474	17,179	16,319	14,129	15,304
1998[h]	123,751	62,101	11,263 [i]	12,974	12,758	14,402
1999j	93,380	68,570	8,778	16,062	12,099	17,965

Table 5. (continued)

Year	Pelagic Shelf Rockfish	Demersal Shelf Rockfish[b]	Thorny Heads[c]	Atka Mackerel[e]	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	230,448
1998	3,111	552	1,136	317	3,748	246,113
1999	4,657	262	1,274	262	3,735	227,044

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 stablized 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 seperate target species.

e/ Atka mackerel was added to the Other Species category in 1988.

f/ PSR includes light dusky rockfish, black rockfish, yellowtail rockfish, widow rockfish, dark dusky rockfish, and blue rockfish.

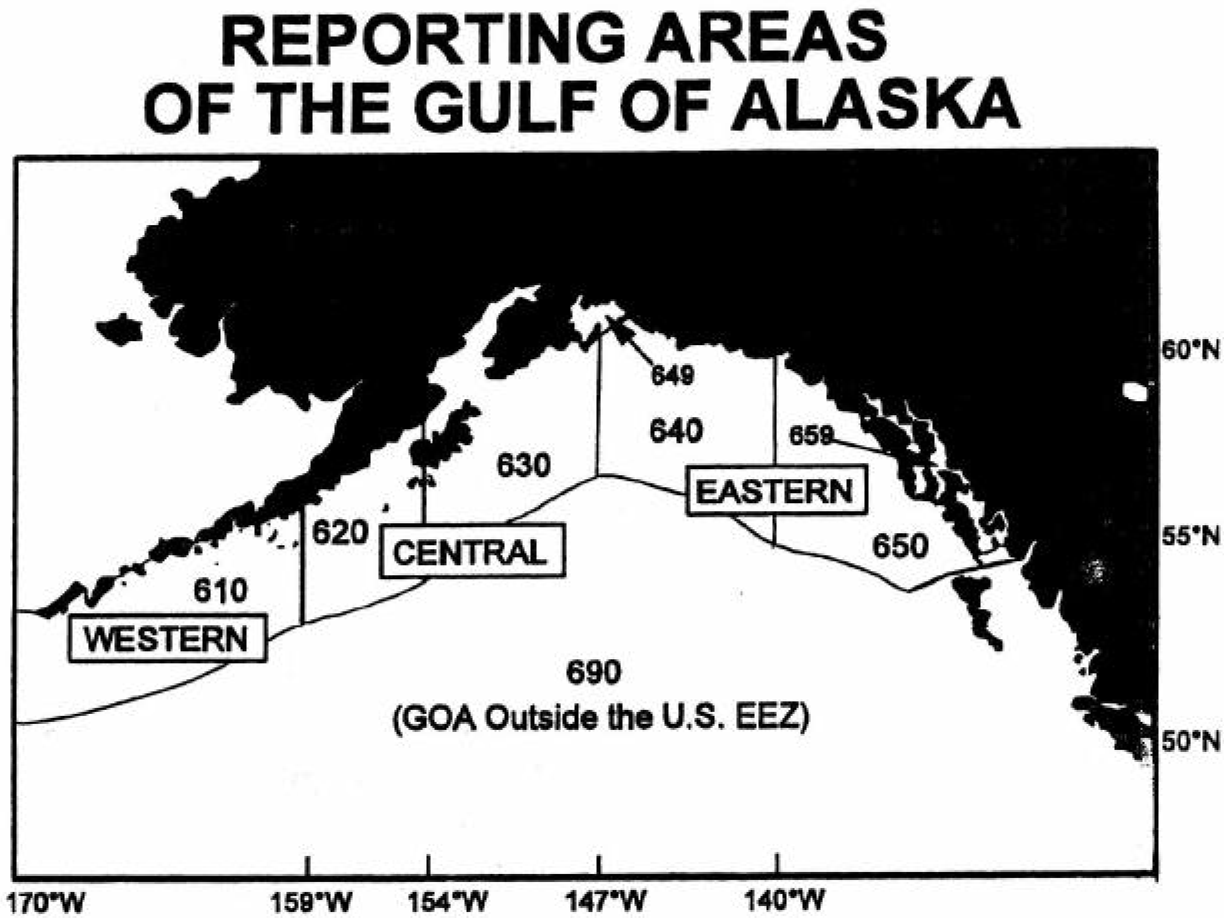
g/ Does not include at-sea discards.

h/ Catch data reported through November 6, 1999.

i/ Includes all species except arrowtooth.

j/ Catch data reported through October 30, 1999.

For 1999 other species includes sculpins, sharks, skates, squid and octopus.
Eulachon and capelin are forage fish


REPORTING AREAS
OF THE GULF OF ALASKA
649
640
659
630
620
CENTRAL
EASTERN
650
610
WESTERN
690
(GOA Outside the U.S. EEZ)
60°N
55°N
50°N
170°W
159°W
154°W
147°W
140°W