

**STOCK ASSESSMENT AND FISHERY EVALUATION REPORT  
FOR THE GROUND FISH RESOURCES  
OF THE BERING SEA/ALEUTIAN ISLANDS REGION**

**Compiled by**

The Plan Team for the Groundfish Fisheries  
of the Bering Sea and Aleutian Islands

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

ABSTRACT

This is a preliminary assessment report of the status of the groundfish stocks managed by the United States of America in the Gulf of Alaska for 1997. The current status of the groundfish stocks, including historical catch statistics, preliminary Acceptable Biological Catch recommendations (ABCs), and Total Allowable Catches (TACs) are reported for each stock. The fishing mortality rates used to set these specifications are also provided. The abundances of Pacific cod 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 thornyheads and Atka mackerel are not well known. The sum of the preliminary 1998 ABCs for the Gulf of Alaska groundfish complex is 531,970 t, up from 493,050 t in 1997.

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## SUMMARY

by

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

INTRODUCTION

The *Guidelines for Fishery Management Plans (602 Guidelines)* 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 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 September 2-5, 1997 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 1996 Gulf of Alaska trawl survey, and the 1997 Shelikof Strait hydroacoustic survey. Members of the Plan Team who compiled the SAFE report were Sandra Lowe, (chair), Jane DiCosimo (plan coordinator), Lew Haldorsen, Jeff Fujioka, Jim Hastie, Jim Ianelli, Jon Heifetz, Tom Pearson, Farron Wallace, Megan Cartwright for Victoria O'Connell, Gregg Williams, and John Sease. Dave Jackson and Vivian Mendenhall were absent.

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 and Atka mackerel have been managed as single species. Beginning this year, a separate stock assessment chapter for arrowtooth flounder has been prepared. Other groundfish species that are usually caught in groups have been managed as complex assemblages. For example, shortraker and roughey rockfish, other slope rockfish, pelagic shelf rockfish, demersal shelf rockfish, northern rockfish, deepwater flatfish, shallow water flatfish, and other groundfish have been managed as 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. Atka mackerel was split out from "other species" beginning in 1994. To prevent localized depletion of nearshore pelagic shelf rockfish in the central Gulf, allow controlled development of the nearshore jig fishery in the eastern and western Gulf, and prevent preemption of the dusky rockfish fishery by the nearshore jig fishery, the Council submitted a plan amendment (Amendment 46) to remove black and blue rockfishes from the FMP and manage the remaining offshore component (dusky, widow, and yellowtail rockfishes under the Pelagic Shelf Rockfish assemblage. ADF&G would manage black

and blue rockfishes on behalf of the State of Alaska. A decision by the Secretary of Commerce on Amendment 46 is pending.

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 the 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.

Except where the State of Alaska manages separate groundfish harvests quotas specified in 5 Alaska Administrative Code (AAC) 28.160, all groundfish catches in waters of the State of Alaska, including internal waters, are managed against TAC specifications. The exceptions pertain to guideline harvest ranges for sablefish and demersal shelf rockfish in the inside subdistricts of the southeast subdistrict as defined at 5 AAC 28.105 Description of Districts, Subdistricts, and Sections.

#### NEW INFORMATION

Since the Stock Assessment and Fishery Evaluation Report (SAFE) for 1997 was issued (NPFMC 1996), the following new information has become available:

1. Pollock: a) the 1997 Shelikof Strait hydroacoustic biomass estimate; b) length frequency data from the 1997 hydroacoustic survey; c) age composition data from the 1996 fisheries; d) updated estimates of discard and catch for 1996 and 1997; and e) results of a sensitivity analysis exploring a reduction in the effective sample size of age records and the influence of combining various years to estimate fishery selectivities.
2. Pacific cod: no new information.
3. Flatfish: a) updated catch information.
4. Arrowtooth: a) a projection of biomass based on the stock synthesis model; b) the 1996 fishery length composition.
5. Sablefish: a) updated catch data for 1996 and 1997; b) results from recruitments to the age-structured model; c) age data from the 1996 sablefish longline survey.
6. Slope rockfish: a) updated catch information; b) a projection of biomass based on the stock synthesis models.
7. Pelagic shelf rockfish: a) updated catch and discard information; b) update the proposed removal of black and blue rockfish from the pelagic shelf assemblage (Am. 46); c) new information on size of maturity of light dusky rockfish.
8. Demersal shelf rockfish: a) updated catch information.

9. Thornyheads: no new information.
10. Atka mackerel: a) updated catch information.
11. Groundfish, generally: a) updated harvest and discard data from the NMFS Observer Program and Regional Office for 1996 and 1997.

## 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). Four categories of finfishes and invertebrates have been designated for management purposes. They are prohibited species, target species, other species and non-specified species. Fish species or complexes included in each category are listed below.

| <u>Target Species</u> | <u>Other Species</u> | <u>Prohibited Species</u> |
|-----------------------|----------------------|---------------------------|
| Pollock               | Octopus              | Pacific halibut           |
| Pacific cod           | Squid                | Pacific herring           |
| Flounders             | Sculpins             | Pacific salmon            |
| Rockfishes            | Sharks               | Steelhead trout           |
| Sablefish             | Skates               | King crab                 |
| Atka mackerel         | Eulachon             | Tanner crab               |
|                       | Smelts               |                           |
|                       | Capelin              |                           |

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). Also used are the fishing mortality rates which reduce the level of spawning biomass per recruit to some percentage  $P$  of the pristine level ( $F_{p\%}$ ), and the fishing mortality rate which 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 44 to the GOA Groundfish FMP, approved by the Council in June of this year and currently awaiting final secretarial approval by the Secretarial of Commerce, 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. The revised definition replaces the Plan Team's previous policy statements for defining overfishing and creating a buffer between ABC and 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 Council's Scientific and Statistical Committee (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 (1-3), 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  $F=F_{40\%}$ .

- 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  
 $F_{ABC} \leq m_H$ , the harmonic mean of the pdf
- 1b) *Stock status:  $a < B/B_{MSY} \leq 1$*   
 $F_{OFL} = m_A \times (B/B_{MSY} - a)/(1 - a)$   
 $F_{ABC} \leq m_H \times (B/B_{MSY} - a)/(1 - a)$
- 1c) *Stock status:  $B/B_{MSY} \leq a$*   
 $F_{OFL} = 0$   
 $F_{ABC} = 0$
- 2) *Information available: Reliable point estimates of  $B$ ,  $B_{MSY}$ ,  $F_{MSY}$ ,  $F_{30\%}$ , and  $F_{40\%}$ .*
- 2a) *Stock status:  $B/B_{MSY} > 1$*   
 $F_{OFL} = F_{MSY} \times (F_{30\%}/F_{40\%})$   
 $F_{ABC} \leq F_{MSY}$
- 2b) *Stock status:  $a < B/B_{MSY} \leq 1$*   
 $F_{OFL} = F_{MSY} \times (F_{30\%}/F_{40\%}) \times (B/B_{MSY} - a)/(1 - a)$   
 $F_{ABC} \leq F_{MSY} \times (B/B_{MSY} - a)/(1 - a)$
- 2c) *Stock status:  $B/B_{MSY} \leq a$*   
 $F_{OFL} = 0$   
 $F_{ABC} = 0$
- 3) *Information available: Reliable point estimates of  $B$ ,  $B_{40\%}$ ,  $F_{30\%}$ , and  $F_{40\%}$ .*
- 3a) *Stock status:  $B/B_{40\%} > 1$*   
 $F_{OFL} = F_{30\%}$   
 $F_{ABC} \leq F_{40\%}$
- 3b) *Stock status:  $a < B/B_{40\%} \leq 1$*   
 $F_{OFL} = F_{30\%} \times (B/B_{40\%} - a)/(1 - a)$   
 $F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - a)/(1 - a)$
- 3c) *Stock status:  $B/B_{40\%} \leq a$*   
 $F_{OFL} = 0$   
 $F_{ABC} = 0$
- 4) *Information available: Reliable point estimates of  $B$ ,  $F_{30\%}$ , and  $F_{40\%}$ .*  
 $F_{OFL} = F_{30\%}$   
 $F_{ABC} \leq F_{40\%}$
- 5) *Information available: Reliable point estimates of  $B$  and natural mortality rate  $M$ .*  
 $F_{OFL} = M$   
 $F_{ABC} \leq 0.75 \times M$
- 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  
 $ABC \leq 0.75 \times OFL$

## 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 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 thornyheads and Atka mackerel are not well known.

Tables 1 and 2 provide a summary of the current status of the groundfish stocks, including catch statistics, ABCs, and TACs for 1997, and recommendations for ABCs and overfishing levels for 1997. Fishing mortality rates 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 historical groundfish catches in the GOA, 1956-1997.

The sum of the preliminary 1998 ABCs for target species is 531,970 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 1997 will be considerably under this upper limit. For perspective, in 1997 the sum of the TACs was 282,815 mt, and the sum of the ABCs was 493,050 mt.

In this overview and corresponding tables, the following conventions 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). It is important to note that 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 value listed as 1996 and 1997 ABCs correspond to the values approved by the Council. The values listed for 1998 correspond to the Plan Team recommendations for the next year.

**POLLOCK**

| <u>YEAR</u> | <u>ABC</u> <sup>1</sup> | EXPLOITABLE<br><u>BIOMASS</u> | <u>CATCH</u>        |
|-------------|-------------------------|-------------------------------|---------------------|
| 1996        | 54,800                  | 574,000                       | 49,836              |
| 1997        | 79,980                  | 1,105,420                     | 42,027 <sup>2</sup> |
| 1998        | 96,800                  | 1,103,800                     |                     |

1/ ABC for Western/Central and Eastern areas

2/ 1997 Western/Central catch through August 23, 1997

The exploitable biomass estimates from 1996 and 1997 are from the stock synthesis model as estimated in those years. The projected 1998 exploitable biomass for pollock of 1,103,800 mt includes age 3+ biomass estimated from the current stock assessment model. Comparisons of the 1998 biomass with previous years' levels should be made with biomass levels from the revised hindcast.

Relative to the 1997 SAFE, new sources of information include: a) the 1997 Shelikof Strait hydroacoustic biomass estimate b) length frequency data from the 1997 hydroacoustic survey; c) age composition data from the 1996 fisheries; d) updated estimates of discard and catch for 1996 and 1997; e) results of a sensitivity analysis exploring a reduction in the emphasis on age composition data; f) an updated model including predation mortality by arrowtooth flounder, Pacific halibut, and Steller sea lions (Appendix 1); and g) an alternative model constructed using C++ software and automatic differentiation library (AD model builder; Appendix 2).

The 1997 Shelikof Strait biomass estimate was 570,100 mt (compared to 745,400 mt from the 1996 survey). These values were scaled in the stock assessment to allow a time series comparison with data collected historically by a previous hydroacoustic system. Length frequency data from the 1989 to 1997 hydroacoustic surveys showed the progression of the strong 1988 year class through the population. In the 1995 and 1996 surveys, a strong 1994 year class was also evident. In 1996, 82.2% of the population numbers were 16-25 cm (age 2, 1994 year class). Age 1 (<16 cm) pollock of the 1995 year class represented 1.3% of the population numbers. The 1994 year class, which represented the largest estimates of 1- and 2-year-old fish in the history of the Shelikof Strait area EIT surveys, continued as 3-year olds to dominate the total number of pollock estimated in 1997.

The biomass estimate for the area west of Cape St. Elias from the 1996 bottom trawl survey was 653,900 mt, similar in magnitude to previous trawl survey estimates. Length frequency distributions from the 1996 bottom trawl survey showed the strong 1994 year class in the Western and Central Gulf. In the Eastern Gulf and the Shumagin region, a second mode was observed and assumed to be the 1995 year class. By comparison, the 1996 and 1997 hydroacoustic surveys found relatively low numbers of 1-year old pollock.

Length frequency information from the 1996 fisheries showed evidence of the 1994 year class in the first trimester. The fishery catch-at-age data also reflected the strong 1988, 1989, and 1994 year classes.

The Team evaluated and concurred with the preliminary stock synthesis model configuration chosen by the assessment scientists. The new model differed from last year's configuration by a reduction of the sample size (effective N) in the multinomial from 400 to 60, and the estimation of a single fishery selectivity vector for 1994-1997 instead of multiple vectors. The stock assessment scientist noted that year-specific estimates of the effective N based on the number of deliveries that were sampled for pollock otoliths may be presented for the

final SAFE. The Plan Team has requested further exploration of the impact of reducing the effective  $N$ , and a stronger rationale for choosing specific values.

Estimates of various fishing mortality rates based on biological reference points were determined from the stock synthesis model. The estimated  $F_{30\%}$ ,  $F_{35\%}$ , and  $F_{40\%}$  full-selection fishing mortality rates were 0.523, 0.430, and 0.358, respectively. The  $B_{40\%}$  female spawner biomass (264,300 mt) was estimated to be higher than the projected 1998 female spawner biomass of 241,340 mt. Average historical recruitment from the 1964-1995 year classes was used in the calculation of  $B_{40\%}$  with the 1994 year class represented by the median of the upper quartile of recruitment estimates.

Because pollock fall under tier 3b of the ABC/OFL guidelines,  $F_{ABC}$  cannot exceed the  $F_{40\%}$  fishing mortality rate adjusted by the ratio of current spawner biomass to  $B_{40\%}$ . **The  $F_{ABC}$  ( $F_{40\%}$ adjusted) fishing mortality rate is 0.325, resulting in a yield of 96,800 mt for the Western/Central Gulf as the recommended preliminary 1998 Western/Central ABC.**

The Plan Team recommended the ABC be apportioned according to the biomass distribution of the exploitable population (>20 cm) in the 1996 bottom trawl survey: **25% in the Shumagin area (24,200 mt), 42% in the Chirikof area (40,660 mt), and 33% in the Kodiak area (31,940 mt).** Relative to the 1993 distribution, the current biomass distribution has increased in the Kodiak area and decreased in the Shumagin area, and is similar to the 1990 survey distribution.

The overfishing mortality rate (0.477) is  $F_{30\%}$  adjusted by the ratio of current spawner biomass to  $B_{40\%}$ , and corresponds to a harvest of 137,900 mt for the Western and Central Gulf of Alaska. Therefore, pollock are not considered overfished at the ABC level.

The Team has no new information to set an ABC for the Eastern Gulf. Lack of adequate age composition data has precluded any age-structured analysis similar to that conducted for the W/C areas. However, analysis of Eastern Gulf length frequency data show that recruitment patterns appear similar to that observed in the W/C Gulf. Thus, the Team agreed that it would be appropriate to apply the ratio of W/C ABC to 1996 W/C survey exploitable biomass to the Eastern Gulf 1996 exploitable biomass estimate. The recommended Eastern Gulf ABC is 8,800 mt. Similarly calculated, the overfishing level for the Eastern Gulf is 12,600 mt.

The Plan Team again expressed interest in continued development of the predation model and the new development of the pollock model using an alternative and more flexible software program. In light of the indications of higher natural mortality, particularly on younger fish, the Plan Team has asked for an exploration of differential mortality at age in the main stock assessment for the November SAFE.

## PACIFIC COD

| <u>YEAR</u> | <u>ABC</u> | <u>EXPLOITABLE<br/>BIOMASS</u> | <u>CATCH</u> |
|-------------|------------|--------------------------------|--------------|
| 1996        | 65,000     | 557,000                        | 68,279       |
| 1997        | 81,500     | 739,000                        | 62,230*      |
| 1998        | 81,500     |                                |              |

1/ Data through August 23, 1997

Since no new analyses were presented to the Plan Team at the September 1997 meeting, the ABC recommendation was rolled over from the previous year's analyses. The exploitable biomass (here defined as age all fish aged 3 years and older) is estimated at 557,000 and 739,000 tons for 1996 and 1997 respectively. The full selection fishing mortality rate for deriving the ABC and OFL harvest levels are 0.18 and 0.45 respectively. These harvest rates correspond to 81,500 tons for ABC and 180,000 tons for OFL.

The Plan Team discussed the issue of Pacific cod harvests that occurs within State of Alaska waters and was presented with catch statistics broken out by area from within state waters.

### FLATFISH

| <u>1996 Fishery</u> | <u>ABC</u>    | EXPLOITABLE<br><u>BIOMASS</u> | <u>CATCH</u> <sup>1</sup> |
|---------------------|---------------|-------------------------------|---------------------------|
| Deep water          | 14,590        | 116,570                       | 2,193                     |
| Rex sole            | 11,210        | 89,660                        | 5,874                     |
| Shallow water       | 52,270        | 355,590                       | 9,350                     |
| Flathead sole       | <u>28,790</u> | <u>198,470</u>                | <u>3,107</u>              |
| TOTAL               | 106,860       | 760,290                       | 19,838                    |

| <u>1997 Fishery</u> | <u>ABC</u>    | EXPLOITABLE<br><u>BIOMASS</u> | <u>CATCH</u> <sup>1</sup> |
|---------------------|---------------|-------------------------------|---------------------------|
| Deep water          | 7,170         | 101,430                       | 2,469                     |
| Rex sole            | 9,150         | 72,330                        | 5,484                     |
| Shallow water       | 43,150        | 314,960                       | 2,014                     |
| Flathead sole       | <u>26,110</u> | <u>206,340</u>                | <u>2,608</u>              |
| TOTAL               | 85,580        | 695,060                       | 12,575                    |

| <u>1998 Fishery</u> | <u>ABC</u>    | EXPLOITABLE<br><u>BIOMASS</u> | <u>CATCH</u> <sup>1</sup> |
|---------------------|---------------|-------------------------------|---------------------------|
| Deep water          | 7,150         | 101,430                       |                           |
| Rex sole            | 9,150         | 72,330                        |                           |
| Shallow water       | 43,150        | 314,960                       |                           |
| Flathead sole       | <u>26,110</u> | <u>206,340</u>                |                           |
| TOTAL               | 85,560        | 695,060                       |                           |

<sup>1</sup>/ Catch through August 28, 1997.

The flatfish group is subdivided into deep water flatfishes, rex sole, shallow water flatfishes, and flathead sole. The 1998 exploitable biomass for each category is based on abundance estimated from the 1996 triennial trawl survey. For 1998, ABC for the deepwater group was determined by applying tiers 4, 5, and 6 as indicated below.

The Team recommends that ABCs for each group be apportioned among the three regulatory areas in proportion to biomass distributions in the 1996 trawl survey. The resulting ABCs are:

|               | <u>WESTERN</u> | <u>CENTRAL</u> | <u>EASTERN</u> | <u>TOTAL</u>  |
|---------------|----------------|----------------|----------------|---------------|
| Deep water    | 340            | 3,680          | 3,130          | 7,150         |
| Rex sole      | 1,190          | 5,490          | 2,470          | 9,150         |
| Shallow water | 22,570         | 19,260         | 1,320          | 43,150        |
| Flathead sole | <u>8,440</u>   | <u>15,630</u>  | <u>2,040</u>   | <u>26,110</u> |
| TOTAL         | 32,540         | 44,070         | 8,970          | 85,560        |

Under the Council overfishing guidelines the overfishing catch levels for the flatfish groups are determined by applying the fishing mortality rates determined from the tier structure to the exploitable biomass estimates.

Those fishing mortality rates and their associated catch levels are:

|                | <u>F<sub>abc</sub></u> | <u>F<sub>on</sub></u> | <u>OVERFISHING<br/>CATCH LEVEL</u> | <u>TIER</u> |
|----------------|------------------------|-----------------------|------------------------------------|-------------|
| Deep water     | 0.075                  | 0.10                  | 9,420                              | 6           |
| Rex sole       | 0.15                   | 0.20                  | 11,920                             | 5           |
| Shallow water  |                        |                       | 59,540                             |             |
| rock sole      | 0.17                   | 0.25                  |                                    | 4           |
| yellowfin sole | 0.15                   | 0.20                  |                                    | 5           |
| other species  | 0.15                   | 0.20                  |                                    | 5           |
| Flathead sole  | 0.15                   | 0.20                  | 34,010                             | 5           |

The Team expressed some concern about using the maturity schedules for Bering Sea rock sole for both species in the Gulf of Alaska. The team expressed a strong interest in having maturity schedules developed for all flatfish species in the assessments. The Team also expressed concern over the lack of deep water survey coverage to assess Dover sole.

### ARROWTOOTH FLOUNDER

| <u>YEAR</u> | <u>ABC</u> | <u>EXPLOITABLE<br/>BIOMASS</u> | <u>CATCH</u> |
|-------------|------------|--------------------------------|--------------|
| 1996        | 198,130    | 1,585,040                      | 22,583       |
| 1997        | 197,840    | 1,971,170                      | 12,189       |
| 1998        | 208,340    | 2,062,740                      |              |

1/ Catch through August 28, 1996.

The 1998 exploitable biomass is based on abundance estimated from a stock synthesis model, and is estimated to be greater than  $B_{40\%}$ ; therefore, arrowtooth flounder is in tier 3a of the overfishing definitions. The  $F_{40\%}$  fishing mortality rate is 0.189, based on tier 3a calculations, and was applied to the exploitable biomass estimate to determine an ABC estimate of 208,340 mt for arrowtooth flounder.

The Team recommended that ABC be apportioned among the three regulatory areas in proportion to biomass distributions in the 1996 trawl survey. The resulting ABCs are:

|            | <u>WESTERN</u> | <u>CENTRAL</u> | <u>EASTERN</u> | <u>TOTAL</u> |
|------------|----------------|----------------|----------------|--------------|
| Arrowtooth | 33,010         | 149,640        | 25,690         | 208,340      |

Using tier 3a criteria the overfishing level is set at the catch resulting from the  $F_{30\%}$  fishing mortality rate. For arrowtooth flounder  $F_{30\%} = 0.276$  and the associated catch is estimated at 295,970 mt.

**SABLEFISH**

| <u>YEAR</u> | <u>ABC</u> | <u>EXPLOITABLE<br/>BIOMASS</u> | <u>CATCH</u>        |
|-------------|------------|--------------------------------|---------------------|
| 1996        | 17,080     | 169,500                        | 15,826              |
| 1997        | 16,560     | 199,920                        | 12,304 <sup>1</sup> |
| 1998        | 16,560     | 199,920                        |                     |

1/ Catch through August 23, 1997.

Exploitable biomass for 1996 was estimated by delay difference analysis and is age 5+ biomass. Exploitable biomass for 1997 and 1998 was estimated by separable age-structured analysis and is age 4+ biomass.

The following changes were made in this year's preliminary SAFE:

Age data from the 1996 sablefish longline survey of the eastern Aleutian Islands and Gulf of Alaska were incorporated into the model.

Catch under reporting during 1986-1990 were estimated annually, whereas single hypothetical levels of catch under reporting for the 1986-90 period were fixed in last year's SAFE. A penalty function on the likelihood term containing the reporting rate estimates was necessary to obtain reasonable parameter estimates. Biomass estimates are sensitive to the value of the penalty function.

Variability of the survey abundance index and age data were estimated independently of population modeling. These estimates were used to weight the likelihood components of the age-structured population model. The relative weighting of the likelihood components for the survey abundance index, age and length data was arbitrary in last year's SAFE. Various values were tested and included the likelihood weight,  $\lambda = 7$ , for the survey abundance index, equivalent to the independent variance estimates computed for this year's SAFE.

No substantial changes in values used to calculate ABC resulted from the refinements to the model. An updated recommendation for ABC will not be done until after incorporation of the 1997 longline survey results which are unavailable at this time. It is recommended no change in ABC be made at this time.

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$F_{ABC}$  for 1997 and 1998 is 0.076 and  $F_{OFL}$  for 1997 and 1998 is 0.175.

The Team recommends that the fishery and survey length frequencies be presented in the assessment to provide industry with information on strength of recruiting year classes.

The Team requests that the authors examine Japanese longline fishery data prior to 1979 for recruitment strength and biomass estimates.

**SLOPE ROCKFISH**

|      |                     | <u>ABC</u>   | <u>EXPLOITABLE<br/>BIOMASS</u> | <u>CATCH</u> <sup>1</sup> |
|------|---------------------|--------------|--------------------------------|---------------------------|
| 1996 | Pacific ocean perch | 8,060        | 163,220                        | 8,378                     |
|      | shortraker/rougheye | 1,910        | 71,810                         | 1,661                     |
|      | northern rockfish   | 5,270        | 87,850                         | 3,343                     |
|      | other slope species | <u>7,110</u> | <u>112,810</u>                 | <u>881</u>                |
|      | TOTAL               | 22,350       | 435,090                        | 14,263                    |
| 1997 | Pacific ocean perch | 12,990       | 242,300                        | 9,485                     |
|      | shortraker/rougheye | 1,590        | 65,380                         | 1,449                     |
|      | northern rockfish   | 5,000        | 83,890                         | 2,976                     |
|      | other slope species | <u>5,260</u> | <u>103,710</u>                 | <u>1,206</u>              |
|      | TOTAL               | 24,840       | 495,260                        | 15,116                    |
| 1998 | Pacific ocean perch | 15,840       | 361,150 <sup>2</sup>           |                           |
|      | shortraker/rougheye | 1,590        | 65,380                         |                           |
|      | northern rockfish   | 5,000        | 83,870                         |                           |
|      | other slope species | <u>5,260</u> | <u>103,710</u>                 |                           |
|      | TOTAL               | 27,690       | 511,100                        |                           |

1/ Catch through August 23, 1997.

2/ Age 6+.

**PACIFIC OCEAN PERCH**

The only new information available for Pacific ocean perch is updated catch data. Since little new information is available a detailed stock assessment report was not presented. In past assessments when only catch data was available, a projection of the population to the current year using results from the stock synthesis model was used to determine ABC.

Tier 3 is used to compute ABC and OFL. The current spawning biomass ( $B_{1998} = \text{xxxx mt}$ ) is less than  $B_{40\%}$  (xxxxxx mt), where  $B_{40\%}$  is determined from average recruitment of the 1976-92 year-classes. Estimates of the strength of earlier year classes is based on historical and less reliable data, and the year 1976 coincides with the beginning of a regime shift of oceanic conditions in the North Pacific Ocean. Since  $B_{1998}$  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 0.076. Applying tier 3b results in  $F_{ABC} \leq 0.064$  and an  $ABC \leq 15,880$  mt. The Team recommends that the preliminary ABC for Pacific ocean perch for the 1998 fishery in the Gulf of Alaska be set at 15,880 mt. The over fishing level based on tier 3b is 22,590 mt ( $F_{OFL} = 0.092$ ).

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. It was assumed that survey error contributes 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 weighting of 4:6:9 for

the 1990, 93, and 96 surveys, respectively. Using area apportionments of 14.1% for the Western area, 51.5% for the Central area, and 34.4% for the Eastern area results in recommended ABCs of 2,230 mt for the Western area, 8,160 mt for the Central area, and 5,450 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 3,190 mt in the Western area, 11,630 mt in the Central area, and 7,770 mt in the Eastern area.

#### SHORTTRAKER/ROUGHEYE

Because little new assessment information is available for shorttraker/rougheye rockfish beyond last year's SAFE, the Team recommends that the ABC values adopted by the Council in 1997 also be used as preliminary values for 1998. As in the past, the average of the exploitable biomasses in the three most recent surveys (1990, 1993, and 1996) is used to determine current exploitable biomass. The current estimates of exploitable biomass are 16,673 mt for shorttraker rockfish and 48,709 mt for rougheye rockfish. Applying the definitions for ABC and OFL places shorttraker rockfish in tier 5 where  $F_{ABC} \leq 0.75M$ . Thus, the recommended  $F_{ABC}$  for shorttraker rockfish is 0.023 (i.e.,  $0.75 \times 0.03$ ). Applying tier 4 to rougheye rockfish (i.e.,  $F_{ABC} \leq F_{40\%}$ ) results in an  $F_{ABC} = M = 0.025$  which is less than  $F_{40\%} = 0.032$ . Applying these  $F_{ABC}$  rates to the estimates of exploitable biomass results in ABCs of 375 mt for shorttraker rockfish and 1,218 mt for rougheye rockfish and a preliminary ABC for the subgroup of 1,590 mt. Overfishing is defined to occur at the harvest rate set equal to  $F_{30\%}$  of 0.046 for rougheye rockfish and at the  $F=M$  rate of 0.03 for shorttraker rockfish because data are not available to determine  $F_{30\%}$  for shorttraker rockfish. These harvest rates are applied to estimates of current exploitable biomass to yield an overfishing catch limit of 2,740 mt for the shorttraker/rougheye assemblage.

As in last year's assessment, to apportion ABC among areas the Team recommends that the same methodology as used for Pacific ocean perch be applied to shorttraker and rougheye rockfish. By weighting prior surveys based on the relative proportion of variability attributed to survey error, this methodology recognizes the uncertainty in estimation of biomass and adapts to current information. If it is assumed that survey error contributes 2/3 of the total variability in predicting the distribution of biomass (a reasonable assumption), the weight of a prior survey should be 2/3 the weight of the preceding survey. This results in weighting of 4:6:9 for the 1990, 93, and 96 surveys, respectively. This method results in apportionments of 160 mt for the Western area, 970 mt for the Central area and 460 mt for the Eastern area.

#### NORTHERN ROCKFISH

Because little new assessment information is available for northern rockfish beyond last year's SAFE, the Team recommends that the ABC values adopted by the Council in 1997 also be used as preliminary values for 1998. As in the past, the average of the exploitable biomasses in the three most recent surveys (1990, 1993, and 1996) is used to determine current exploitable biomass. The current estimate of exploitable biomass is 83,370 mt. Applying the definitions for ABC and OFL places northern rockfish in tier 4 where  $F_{ABC} \leq F_{40\%}$ . 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 83,370 mt results in an ABC of 5,000 mt for northern rockfish. Distributing this ABC based on the weighted-average proportional distribution of exploitable biomass in the 1990 - 96 trawl surveys results in ABCs of 840 in the Western area, 4,150 mt in the Central area, and 10 mt in the Eastern area. Overfishing is defined to occur at the  $F_{30\%}$  value of 0.113 for northern rockfish which results in an OFL of 9,420 mt for northern rockfish.

#### OTHER SLOPE ROCKFISH

Because little new assessment information is available for other slope rockfish beyond last year's SAFE, the Team recommends that the ABC values adopted by the Council in 1997 also be used as preliminary values for 1998. As in the past, the recommended ABC for other slope rockfish is based on a harvest rate set equal to natural mortality (M) applied to exploitable biomass. Exploitable biomass is determined from the average of the three most recent trawl surveys. Applying the new definitions for ABC and OFL places sharpchin rockfish in tier 4 where  $F_{ABC} \leq F_{40\%}$  and the other species of other slope rockfish in tier 5 where  $F_{ABC} \leq 0.75M$ . 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 5,260 mt. Distributing this ABC based on the weighted-average proportional distribution of exploitable biomass in the 1990 - 96 trawl surveys results in ABCs of 20 mt in the Western area, 650 mt in the Central area, and 4,590 mt in the Eastern area. Overfishing is defined to occur at the  $F_{30\%}$  of 0.08 for sharpchin rockfish and  $F=M$  for the other species. This results in an OFL of 7,560 mt.

### PELAGIC SHELF ROCKFISH

| <u>YEAR</u> | <u>ABC</u>       | <u>EXPLOITABLE<br/>BIOMASS</u> | <u>CATCH</u>       |
|-------------|------------------|--------------------------------|--------------------|
| 1996        | 5,190            | 56,500                         | 2,302              |
| 1997        | 5,140            | 54,220                         | 2,727 <sup>1</sup> |
| 1998        | 4,880 - Offshore | 54,220 <sup>2</sup>            |                    |
| " "         | 260 - Nearshore  |                                |                    |

1/ Through August 28, 1997.

2/ Derived from the 1996 triennial trawl survey.

Because little new assessment information is available for pelagic shelf rockfish (PSR) beyond last year's final SAFE report, the Team recommends that the ABC values adopted by the Council for PSR in 1997 also be used as preliminary values for 1998. In June 1997 the NPFMC approved Alternative 3 of Amendment 46 to the Gulf of Alaska FMP, to remove black and blue rockfishes from the FMP and transfer management authority for these species gulfwide to the State of Alaska. Pending review of Amendment 46 by the Secretary of Commerce, the Team recommends managing the assemblage according to a nearshore component comprised of black and blue rockfishes, and an offshore component comprised of dusky, yellowtail, and widow rockfishes. The exploitable biomass and recommended ABC for the offshore component is based on a tier 4 assessment using Gulf of Alaska triennial trawl surveys in 1990, 1993, and 1996. The exploitable biomass is 54,220 mt. Similar to previous assessments, an  $F=M$  strategy was used to set the exploitation rate to 0.09 for dusky rockfish, resulting in an ABC of 4,880 mt for the offshore complex. The  $F=M$  strategy is more conservative than the tier 4 maximum  $F_{40\%}$  of 0.10. Applying a respective weighting of 4:6:9 to the geographical distributions from the 1990, 1993, and 1996 surveys gives ABC apportionments of 570 mt to the Western, 3,320 mt to the Central, and 990 mt to the Eastern areas. Under a tier 4 assessment,  $F_{OFL} = F_{30\%} = 0.15$  produces a gulfwide overfishing level of 8,400 mt.

If secretary approval of Amendment 46 does not occur prior to this year's final SAFE, the Team further recommends the preliminary ABC for the nearshore component be set at 260 mt for the Central area based upon a tier 6 approach and similar to specifications adopted last year by the NPFMC. This ABC equals 75% of the average black rockfish catch from this area during 1991-1996, the only time and area representing a developed fishery. This ABC will be adjusted in November based on updated catch values.



**DEMERSAL SHELF ROCKFISH**

| <u>YEAR</u> | <u>ABC</u> | <u>EXPLOITABLE<br/>BIOMASS<br/>YELLOWEYE</u> | <u>CATCH</u>     |
|-------------|------------|--|------------------|
| 1995        | 580        | 26,093                                       | 282              |
| 1996        | 950        | 42,552                                       | 436 <sup>1</sup> |
| 1997        | 950        | 42,552                                       | 289 <sup>1</sup> |

1/ Catch through August 30, 1997. Does not include estimated unreported mortality.

Exploitable biomass and ABC for demersal shelf rockfish (DSR) is based on results of the 1994 and 1995 line transect submersible survey of yelloweye rockfish in the Eastern Gulf of Alaska. Therefore, the 1997 ABC for DSR remained the same as 1996.

Last year the plan team expressed concern about the high level of unreported DSR mortality associated with the halibut fishery. For this reporting period, the authors included estimates of unreported DSR mortality associated with the halibut fishery for 1993-1996. In addition, Alaska Department of Fish and Game has submitted a proposal to the Council to develop an accurate accounting system for total bycatch mortality of DSR.

The ABC and exploitable biomass were set equal to 1996. Using an ABC (tier 4) and adjusting for the 10% of other species landed in the assemblage, the FABC was set at  $F=M=0.02$ , more conservative than the  $F40\%$  rate. The overfishing level was set at 1,447 mt, using an  $F30\%=0.34$ .

**THORNYHEADS**

| <u>YEAR</u> | <u>ABC</u> | <u>EXPLOITABLE<br/>BIOMASS</u> | <u>CATCH</u>     |
|-------------|------------|--------------------------------|------------------|
| 1996        | 1,560      | 41,060                         | 1,132            |
| 1997        | 1,700      | 46,108                         | 962 <sup>1</sup> |
| 1998        | 1,700      |                                |                  |

1/ Data through August 23, 1997.

The Team rolled over last year's recommendation of 1,700 tons for ABC and an overfishing level 2,440 within Tier 3a) of the Amendment 44 guidelines. New analyses presented for the November Plan Team meeting will incorporate some recommendations made by the external review panel during June of 1997.

The exploitable biomass (defined as fish aged 5 years and older) was 41,060 and 46,108 tons for 1996 and 1997 respectively. The full-selection fishing mortality rates for the ABC and OFL are 0.062 and 0.089.

**ATKA MACKEREL**

| <u>YEAR</u> | <u>ABC</u> | <u>CATCH</u>     |
|-------------|------------|------------------|
| 1996        | 3,240      | 1,586            |
| 1997        | 1,000      | 331 <sup>1</sup> |
| 1998        | 1,000      |                  |

1/ Catch through August 7, 1997

In previous assessments, exploitable biomass and ABC for GOA Atka mackerel have been based on the triennial GOA bottom trawl survey biomass estimates. Their schooling behavior, patchy distribution and habitat preference make this species extremely difficult to sample with standard trawl survey gear and are poor targets for hydroacoustic surveys since they lack swimbladders. In 1996, an estimate of biomass could not be determined from trawl survey data due to extreme catch variances. Reevaluation of abundance estimates from past surveys showed that they have also been compromised by large confidence intervals. It can be concluded that the GOA bottom trawl survey and resulting biomass estimates have little or no value as absolute estimates of abundance or as indices of trend for Atka mackerel.

Atka mackerel schooling behavior makes them vulnerable to targeted fishing. The Team supports a conservative harvest policy for GOA Atka mackerel because: 1) there is no reliable estimate of current biomass; 2) there may be some evidence of localized depletion and; 3) the species has exhibited vulnerability to fishing pressure in the past. The Team recommended an ABC of 1,000 mt which is equal to the current 1997 ABC and TAC, enough to satisfy bycatch needs of other fisheries. Using tier 6 criteria the 1998 overfishing level is set equal to the average catch from 1978-1995 which equals 6,200 mt.

Table 1. Gulf of Alaska groundfish 1997 and 1998 ABCs, 1997 TACs, and 1997 catches reported through August 23, 1997. MSY is unknown for all species.

| SPECIES                             |              | ABC (mt)       |                | TAC           | CATCH         |
|-------------------------------------|--------------|----------------|----------------|---------------|---------------|
|                                     |              | 1997           | 1998           | 1997          | 1997          |
| Pollock                             | W (61)       | 18,600         | 24,200         | 18,600        | 10,157        |
|                                     | C (62)       | 31,250         | 40,660         | 31,250        | 16,809        |
|                                     | C (63)       | 24,550         | 31,940         | 24,550        | 15,061        |
|                                     | E            | 5,580          | 8,800          | 5,580         | 5,890         |
|                                     | <b>TOTAL</b> | <b>79,980</b>  | <b>105,600</b> | <b>79,980</b> | <b>47,917</b> |
| Pacific Cod                         | W            | 28,500         | 28,500         | 24,225        | 24,024        |
|                                     | C            | 51,400         | 51,400         | 43,690        | 37,572        |
|                                     | E            | 1,600          | 1,600          | 1,200         | 634           |
|                                     | <b>TOTAL</b> | <b>81,500</b>  | <b>81,500</b>  | <b>69,115</b> | <b>62,230</b> |
| Deep water flatfish <sup>1</sup>    | W            | 340            | 340            | 340           | 16            |
|                                     | C            | 3,690          | 3,680          | 3,690         | 2,401         |
|                                     | E            | 3,140          | 3,130          | 3,140         | 52            |
|                                     | <b>TOTAL</b> | <b>7,170</b>   | <b>7,150</b>   | <b>7,170</b>  | <b>2,469</b>  |
| Rex sole                            | W            | 1,190          | 1,190          | 1,190         | 683           |
|                                     | C            | 5,490          | 5,490          | 5,490         | 1,908         |
|                                     | E            | 2,470          | 2,470          | 2,470         | 17            |
|                                     | <b>TOTAL</b> | <b>9,150</b>   | <b>9,150</b>   | <b>9,150</b>  | <b>2,608</b>  |
| Shallow water flatfish <sup>2</sup> | W            | 22,570         | 22,570         | 2,000         | 446           |
|                                     | C            | 19,260         | 19,260         | 5,000         | 4,986         |
|                                     | E            | 1,320          | 1,320          | 2,040         | 46            |
|                                     | <b>TOTAL</b> | <b>43,150</b>  | <b>43,150</b>  | <b>9,040</b>  | <b>5,478</b>  |
| Flathead sole                       | W            | 8,440          | 8,440          | 4,500         | 434           |
|                                     | C            | 15,630         | 15,630         | 12,950        | 1,567         |
|                                     | E            | 2,040          | 2,040          | 1,180         | 13            |
|                                     | <b>TOTAL</b> | <b>26,110</b>  | <b>26,110</b>  | <b>18,630</b> | <b>2,014</b>  |
| Arrowtooth flounder                 | W            | 31,340         | 33,010         | 5,000         | 2,759         |
|                                     | C            | 142,100        | 149,640        | 25,000        | 9,064         |
|                                     | E            | 24,400         | 25,690         | 5,000         | 361           |
|                                     | <b>TOTAL</b> | <b>197,840</b> | <b>208,340</b> | <b>35,000</b> | <b>12,184</b> |
| Sablefish                           | W            | 1,860          | 1,860          | 1,860         | 1,451         |
|                                     | C            | 6,410          | 6,410          | 6,410         | 6,184         |
|                                     | WY           | 2,410          | 2,410          | 2,410         | 1,774         |
|                                     | EY/SEO       | 3,840          | 3,840          | 3,840         | 2,895         |
|                                     | <b>TOTAL</b> | <b>14,520</b>  | <b>14,520</b>  | <b>14,520</b> | <b>12,304</b> |
| Other Slope rockfish                | W            | 20             | 20             | 20            | 68            |
|                                     | C            | 650            | 650            | 650           | 936           |
|                                     | E            | 4,590          | 4,590          | 1,500         | 202           |
|                                     | <b>TOTAL</b> | <b>5,260</b>   | <b>5,260</b>   | <b>2,170</b>  | <b>1,206</b>  |

(Table 1 continued)

| SPECIES                              |              | ABC (mt)       |                | TAC            | CATCH          |
|--------------------------------------|--------------|----------------|----------------|----------------|----------------|
|                                      |              | 1997           | 1998           | 1997           | 1997           |
| Northern rockfish                    | W            | 840            | 840            | 840            | 68             |
|                                      | C            | 4,150          | 4,150          | 4,150          | 2,894          |
|                                      | E            | 10             | 10             | 10             | 14             |
|                                      | <b>TOTAL</b> | <b>5,000</b>   | <b>5,000</b>   | <b>5,000</b>   | <b>2,976</b>   |
| Pacific ocean perch                  | W            | 1,840          | 2,230          | 1,472          | 1,814          |
|                                      | C            | 6,690          | 8,160          | 5,352          | 6,703          |
|                                      | E            | 4,460          | 5,450          | 2,366          | 968            |
|                                      | <b>TOTAL</b> | <b>12,990</b>  | <b>15,840</b>  | <b>9,190</b>   | <b>9,485</b>   |
| Shortraker/rougheye                  | W            | 160            | 160            | 160            | 135            |
|                                      | C            | 970            | 970            | 970            | 881            |
|                                      | E            | 460            | 460            | 460            | 433            |
|                                      | <b>TOTAL</b> | <b>1,590</b>   | <b>1,590</b>   | <b>1,590</b>   | <b>1,449</b>   |
| Pelagic shelf rockfish <sup>3</sup>  | W            | 570            | 570            | 570            | 86             |
|                                      | C offshore   | 3,320          | 3,320          | 3,320          | 1,911          |
|                                      | C inshore    | 260            | 230            | 260            | 175            |
|                                      | E            | 990            | 990            | 990            | 555            |
|                                      | <b>TOTAL</b> | <b>5,140</b>   | <b>5,110</b>   | <b>5,140</b>   | <b>2,727</b>   |
| Demersal Shelf Rockfish <sup>4</sup> |              | 950            | 950            | 950            | 331            |
| Atka Mackerel                        | GW           | 1,000          | 1,000          | 1,000          | 331            |
| Thornyhead rockfish                  | GW           | 1,700          | 1,700          | 1,700          | 962            |
| Other Species                        | GW           | NA             | NA             | 13,470         | 4,344          |
| <b>TOTAL</b>                         |              | <b>493,050</b> | <b>531,970</b> | <b>282,815</b> | <b>171,015</b> |

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/ Plan Team has recommended removal of black and blue rockfishes from the FMP.

4/ Redbanded rockfish was removed from DSR and combined with other slope rockfish beginning in 1995.

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 1998 ABCs and overfishing levels, and estimated trends and abundance for Western, Central, Eastern, Gulfwide, West Yakutat, and Southeast Outside regulatory areas.

| SPECIES                |              | 1998           |                   | 1998                   |       |
|------------------------|--------------|----------------|-------------------|------------------------|-------|
|                        |              | ABC            | Overfishing Level | Abundance <sup>1</sup> | Trend |
| Pollock                | W (61)       | 24,200         |                   | Below                  |       |
|                        | C (62)       | 40,660         | 137,900           | increasing             |       |
|                        | C (63)       | 31,940         |                   |                        |       |
|                        | E            | 8,800          | 12,600            |                        |       |
|                        | <b>TOTAL</b> | <b>105,600</b> | <b>150,500</b>    |                        |       |
| Pacific Cod            | W            | 28,500         |                   | Above                  |       |
|                        | C            | 51,400         |                   | declining              |       |
|                        | E            | 1,600          |                   |                        |       |
|                        | <b>TOTAL</b> | <b>81,500</b>  | <b>180,000</b>    |                        |       |
| Deep water flatfish    | W            | 340            |                   | Unknown,               |       |
|                        | C            | 3,680          |                   | Unknown                |       |
|                        | E            | 3,130          |                   |                        |       |
|                        | <b>TOTAL</b> | <b>7,150</b>   | <b>9,420</b>      |                        |       |
| Rex sole               | W            | 1,190          |                   | Unknown, <sup>2</sup>  |       |
|                        | C            | 5,490          |                   | decreasing             |       |
|                        | E            | 2,470          |                   |                        |       |
|                        | <b>TOTAL</b> | <b>9,150</b>   | <b>11,920</b>     |                        |       |
| Shallow water flatfish | W            | 22,570         |                   | Unknown, <sup>2</sup>  |       |
|                        | C            | 19,260         |                   | stable                 |       |
|                        | E            | 1,320          |                   |                        |       |
|                        | <b>TOTAL</b> | <b>43,150</b>  | <b>59,540</b>     |                        |       |
| Flathead sole          | W            | 8,440          |                   | Unknown, <sup>2</sup>  |       |
|                        | C            | 15,630         |                   | stable                 |       |
|                        | E            | 2,040          |                   |                        |       |
|                        | <b>TOTAL</b> | <b>26,110</b>  | <b>34,010</b>     |                        |       |
| Arrowtooth flounder    | W            | 33,010         |                   | Above,                 |       |
|                        | C            | 149,640        |                   | increasing             |       |
|                        | E            | 25,690         |                   |                        |       |
|                        | <b>TOTAL</b> | <b>208,340</b> | <b>295,970</b>    |                        |       |
| Sablefish              | W            | 1,860          |                   | Low,                   |       |
|                        | C            | 6,410          |                   | declining              |       |
|                        | WYK          | 2,410          |                   |                        |       |
|                        | EY/SEO       | 3,840          |                   |                        |       |
|                        | <b>TOTAL</b> | <b>14,520</b>  | <b>30,360</b>     |                        |       |
| Other Slope rockfish   | W            | 20             |                   | Unknown,               |       |
|                        | C            | 650            |                   | unknown                |       |
|                        | E            | 4,590          |                   |                        |       |
|                        | <b>TOTAL</b> | <b>5,260</b>   | <b>7,560</b>      |                        |       |

(Table 2 continued)

| SPECIES                             |              | 1998          |                   | 1998<br>Abundance Trend            |
|-------------------------------------|--------------|---------------|-------------------|------------------------------------|
|                                     |              | ABC           | Overfishing Level |                                    |
| Northern rockfish                   | W            | 840           |                   | Unknown,<br>unknown                |
|                                     | C            | 4,150         |                   |                                    |
|                                     | E            | 10            |                   |                                    |
|                                     | <b>TOTAL</b> | <b>5,000</b>  | <b>9,420</b>      |                                    |
| Pacific ocean perch                 | W            | 2,230         | 3,190             | Below,<br>increasing               |
|                                     | C            | 8,160         | 11,630            |                                    |
|                                     | E            | 5,450         | 7,770             |                                    |
|                                     | <b>TOTAL</b> | <b>15,840</b> | <b>22,590</b>     |                                    |
| Shortraker/ rougheye                | W            | 160           |                   | Unknown,<br>Unknown                |
|                                     | C            | 970           |                   |                                    |
|                                     | E            | 460           |                   |                                    |
|                                     | <b>TOTAL</b> | <b>1,590</b>  | <b>2,740</b>      |                                    |
| Pelagic shelf rockfish <sup>3</sup> | W            | 570           |                   | Unknown,<br>Unknown                |
|                                     | C offshore   | 3,320         |                   |                                    |
|                                     | C inshore    | 230           | 310               |                                    |
|                                     | E            | 990           |                   |                                    |
|                                     | <b>TOTAL</b> | <b>5,110</b>  | <b>8,190</b>      |                                    |
| Demersal shelf rockfish             | SEO          | 950           | 1,450             | Unkown,<br>unknown                 |
| Atka mackerel                       | GW           | 1,000         | 6,200             | Unkown,<br>unknown                 |
| Thornyhead rockfish                 | GW           | 1,700         | 2,400             | Unknown,<br>stable                 |
| Other species                       |              |               |                   | TAC = 5%<br>of the sum of<br>TACs. |

1/ Abundance relative to target stock size as specified in SAFE documents.

2/ Historically lightly exploited therefore expected to be above the specified reference point.

3/ Plan Team has recommended removal of black and blue rockfishes for the FMP.

NOTE:

ABCs are rounded to nearest 10.

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

Northern rockfish were separated from slope rockfish in 1993.

Rex sole was part of deepwater flatfish until 1994.

Redbanded rockfish removed from DSR beginning in 1995 and combined with other slope rockfish.

Table 3. Summary of fishing mortality rates for the Gulf of Alaska, 1998.

| Species                 | FABC <sup>1</sup> | Rate                                  | FOFL <sup>2</sup> | Rate                                 |
|-------------------------|-------------------|---------------------------------------|-------------------|--------------------------------------|
| Pollock                 | 0.325             | F <sub>40%</sub> adjusted             | 0.477             | F <sub>30%</sub> adjusted            |
| Pacific cod             | 0.18              | F <sub>ABC</sub>                      | 0.45              | F <sub>30%</sub>                     |
| Deepwater flatfish      | NA                | F <sub>ABC</sub> <sup>3</sup>         | NA                | F <sub>off</sub> <sup>4</sup>        |
| Rex sole                | 0.15              | F=.75M                                | 0.20              | F=M                                  |
| Flathead sole           | 0.15              | F=.75M                                | 0.20              | F=M                                  |
| Shallow water flatfish  | 0.15-0.17         | F=.75M, F <sub>40%</sub> <sup>5</sup> | 0.2-0.25          | F <sub>30%</sub> , F=M <sup>6</sup>  |
| Arrowtooth              | 0.189             | F <sub>0.40%</sub>                    | 0.276             | F <sub>30%</sub>                     |
| Sablefish               | .076              | F <sub>ABC</sub>                      | 0.175             | F <sub>30%</sub> adjusted            |
| Pacific ocean perch     | 0.064             | F <sub>40%</sub> adjusted             | 0.XX              | F <sub>30%</sub> adjusted            |
| Shortraker/roughey      | 0.22/0.025        | F=.75M, F=M <sup>7</sup>              | 0.03/0.046        | F=M, F <sub>30%</sub> <sup>8</sup>   |
| Rockfish (other slope)  | 0.03-0.75         | F=.75M, F=M <sup>9</sup>              | 0.04-0.10         | F <sub>30%</sub> , F=M <sup>10</sup> |
| Northern rockfish       | 0.060             | F=M                                   | 0.113             | F <sub>30%</sub>                     |
| Pelagic Shelf Rockfish  | 0.09              | F=M                                   | 0.151             | F <sub>30%</sub>                     |
| Demersal Shelf Rockfish | 0.020             | F=M                                   | 0.034             | F <sub>30%</sub>                     |
| Thornyhead rockfish     | .062              | F <sub>40%</sub>                      | 0.89              | F <sub>30%</sub>                     |
| Atka mackerel           | NA                | F <sub>ABC</sub> <sup>11</sup>        | NA                | F <sub>OFL</sub> <sup>12</sup>       |

- 1/ Fishing mortality rate corresponding to acceptable biological catch.  
2/ Maximum fishing mortality rate allowable under overfishing definition.  
3/ F<sub>ABC</sub>=.75M for Dover sole, ABC=.75 x average catch (1978-1996) for other deepwater flatfish.  
4/ F=M for Dover sole, average catch (1978-1996) for other deepwater flatfish.  
5/ F<sub>40%</sub> for rocksole, F=.75M for remaining shallow water flatfish.  
6/ F<sub>30%</sub> for rocksole, F=M for remaining shallow water flatfish.  
7/ F=.75M for shortraker, F=M for roughey  
8/ F=M for shortraker, F<sub>30%</sub> for roughey.  
9/ F=M for sharpchin rockfish, F=.75M for other species  
10/ F<sub>30%</sub> for sharpchin, F=M for other species.  
11/ ABC for Atka mackerel is 1000 mt for bycatch in other target fisheries.  
12/ OFL for Atka mackerel is equal to average catch from 1978 to 1995.

Table 4. Groundfish landings (metric tons) in the Gulf of Alaska, 1956-1997.

| Year              | 24      |                |              |                        |               | Slope<br>Rock<br>Fish <sup>a</sup> |
|-------------------|---------|----------------|--------------|------------------------|---------------|------------------------------------|
|                   | Pollock | Pacific<br>Cod | Flat<br>Fish | Arrowtooth<br>Flounder | Sable<br>Fish |                                    |
| 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 <sup>h</sup> | 47,917  | 62,230         | 12,569       | 12,184                 | 12,304        | 15,116                             |

Table 4. (continued)

| Year | 25                           |  |                              |                               |                               | Total<br>All<br>Species |
|------|------------------------------|--|------------------------------|-------------------------------|-------------------------------|-------------------------|
|      | Pelagic<br>Shelf<br>Rockfish | Demersal<br>Shelf<br>Rockfish <sup>b</sup> | Thorny<br>Heads <sup>c</sup> | Atka<br>Mackerel <sup>e</sup> | Other<br>Species <sup>d</sup> |                         |
| 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 <sup>f</sup>           | 540  | 1,320                        | 3,538                         | 2,752                         | 232,578                 |
| 1995 | 2,891                        | 219 <sup>g</sup>                           | 1,113                        | 701                           | 3,433                         | 216,585                 |
| 1996 | 2,302                        | 401  | 1,100                        | 1,580                         | 4,302                         | 199,992                 |
| 1997 | 2,727                        | 331  | 962                          | 331                           | 4,344                         | 171,015                 |

a/ Catch defined as follows: (1) 1961-78. Pacific ocean perch (*S. alutus*) only; (2) 1979-1987, the Pacific ocean perch complex; 1988-90, the 18 species of the slope rock assemblage; 1991- 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, s 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 19 thereafter Atka mackerel was assigned a separate 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 du and blue rockfish.

g/ Does not include at-sea discards.

h/ Catch data reported through August 23, 1997

Figure 1.

# 1996 REPORTING AREAS OF THE GULF OF ALASKA

