

APPENDIX A

STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

FOR THE GROUND FISH RESOURCES

OF THE BERING SEA/ALEUTIAN ISLANDS REGIONS

Compiled by

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of the Bering Sea and Aleutian Islands

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SUMMARY

by
The Plan Team for the Groundfish Fisheries
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INTRODUCTION

The *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, marine ecosystems, and fisheries being managed under Federal regulation, thereby providing information to the Councils for determining annual harvest levels from each stock, documenting significant trends or changes in the resource, marine ecosystems, and fishery over time, and assessing the relative success of existing state and Federal fishery management programs. In the case of the FMP for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area, the SAFE report is published in three sections: a “Stock Assessment” section, which comprises the bulk of the present document, and “Fishery Evaluation” and “Ecosystem Considerations” sections, which are bound separately.

The Stock Assessment section of the SAFE report for the Bering Sea and Aleutian Islands (BSAI) groundfish fisheries is compiled by the Plan Team for the Groundfish Fisheries of the BSAI (Plan Team) from chapters contributed by scientists at NMFS' Alaska Fisheries Science Center (AFSC) and includes a recommended acceptable biological catch (ABC) and an overfishing level (OFL) for each stock and stock complex managed under the FMP. The ABC recommendations are reviewed by the Scientific and Statistical Committee (SSC), which may confirm the Plan Team recommendations or develop its own. The ABC recommendations, together with social and economic factors, are considered by the North Pacific Fishery Management Council (Council) in determining total allowable catches (TACs) and other measures used to manage the fisheries.

The BSAI groundfish FMP requires that a draft of the SAFE report be produced each year in time for the October and December meetings of the Council. Because data from the current year's AFSC trawl survey of the eastern Bering Sea shelf are usually not available prior to the September Plan Team meeting, however, most stock assessments are not revised in the first draft. For the present (final) draft, however, each stock or stock complex is represented in the report by a revised chapter containing the latest stock assessment.

Members of the Plan Team who compiled this SAFE report were Loh-lee Low (chair), Michael Sigler, David Witherell (plan coordinator), Andrew Smoker, Grant Thompson, Ivan Vining, Farron Wallace, Lowell Fritz, and Gregg Williams.

BACKGROUND INFORMATION

Management Areas and Species

The BSAI management area lies within the 200-mile U.S. Exclusive Economic Zone (EEZ) of the United States (Figure 1). International North Pacific Fisheries Commission (INPFC) statistical areas 1 and 2 make up the EBS. The Aleutian Islands (AI) region is INPFC area 5.

Four categories of finfishes and invertebrates have been designated for management purposes (Table 1). They are (a) prohibited species, (b) target species, (c) other species, (d) forage fish, and (e) non-specified species. This SAFE report describes the status of the stocks in categories (b) and (c) only.

Historical Catch Statistics

Catch statistics since 1954 are shown for the EBS subarea in Table 2. The initial target species was yellowfin sole. During the early period of these fisheries, total catches of groundfish reached a peak of 674,000 metric tons (t) in 1961. Following a decline in abundance of yellowfin sole, other species (principally walleye pollock) were targeted upon, and total catches rose to 2.2 million t in 1972. Catches have since varied from one to two million t as catch restrictions and other management measures were placed on the fishery.

Catches in the Aleutian region have always been much smaller than those in the EBS. Target species have also been different (Table 3): In the Aleutians, Pacific ocean perch (POP) was the initial target species. During the early years of exploitation, overall catches of Aleutian groundfish reached a peak of 112,000 t in 1965. As POP abundance declined, the fishery diversified to other species. Total catches from the Aleutians in recent years have been about 100,000 t annually.

Recent Total Allowable Catches

Amendment 1 to the BSAI Groundfish FMP provides the framework to manage the groundfish resources as a complex. Maximum sustainable yield (MSY) for this complex was originally estimated at 1.8 to 2.4 million t. The optimum yield (OY) range was set at 85% of the MSY range, or 1.4 to 2.0 million t. The sum of the total allowable catches established by the Council equals OY for the groundfish complex, which is currently constrained by the 2.0 million t cap. Fifteen percent (15%) of the total TAC is set aside as reserve, which may be released during the season by the NMFS Regional Director.

Definition of Acceptable Biological Catch and the Overfishing Level

Amendment 56 to the BSAI Groundfish FMP, approved by the Council in June 1998 and by the Secretary of Commerce in January 1999, 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.

Overfishing is defined as any amount of fishing in excess of the maximum fishing mortality threshold (MFMT). This MFMT is prescribed through a set of six tiers which are listed below in descending order of

preference, corresponding to descending order of information availability. The SSC will have final authority for determining whether a given item of information is “reliable” for the purpose of this definition, and may use either objective or subjective criteria in making such determinations. For Tier 1, a “pdf” refers to a probability density function. For Tiers 1-2, if a reliable pdf of B_{MSY} is available, the preferred point estimate of B_{MSY} is the geometric mean of its pdf. For Tiers 1-5, if a reliable pdf of B is available, the preferred point estimate is the geometric mean of its pdf. For Tiers 1-3, the coefficient α is set at a default value of 0.05, with the understanding that the SSC may establish a different value for a specific stock or stock complex as merited by the best available scientific information. For Tiers 2-4, a designation of the form “ $F_{X\%}$ ” refers to the F associated with an equilibrium level of spawning per recruit (SPR) equal to $X\%$ of the equilibrium level of spawning per recruit in the absence of any fishing. If reliable information sufficient to characterize the entire maturity schedule of a species is not available, the SSC may choose to view SPR calculations based on a knife-edge maturity assumption as reliable. For Tier 3, the term $B_{40\%}$ refers to the long-term average biomass that would be expected under average recruitment and $F=F_{40\%}$.

1) *Information available: Reliable point estimates of B and B_{MSY} and reliable pdf of F_{MSY} .*

1a) *Stock status: $B/B_{MSY} > 1$*

$$F_{OFL} = \mu_A, \text{ the arithmetic mean of the pdf}$$

$$F_{ABC} \leq \mu_H, \text{ the harmonic mean of the pdf}$$

1b) *Stock status: $\alpha < B/B_{MSY} \leq 1$*

$$F_{OFL} = \mu_A \times (B/B_{MSY} - \alpha)/(1 - \alpha)$$

$$F_{ABC} \leq \mu_H \times (B/B_{MSY} - \alpha)/(1 - \alpha)$$

1c) *Stock status: $B/B_{MSY} \leq \alpha$*

$$F_{OFL} = 0$$

$$F_{ABC} = 0$$

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

2a) *Stock status: $B/B_{MSY} > 1$*

$$F_{OFL} = F_{MSY}$$

$$F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%})$$

2b) *Stock status: $\alpha < B/B_{MSY} \leq 1$*

$$F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)$$

$$F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)$$

2c) *Stock status: $B/B_{MSY} \leq \alpha$*

$$F_{OFL} = 0$$

$$F_{ABC} = 0$$

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

3a) *Stock status: $B/B_{40\%} > 1$*

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

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

3b) *Stock status: $\alpha < B/B_{40\%} \leq 1$*

$$F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$$

$$F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$$

3c) *Stock status: $B/B_{40\%} \leq \alpha$*

$$F_{OFL} = 0$$

$$F_{ABC} = 0$$

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

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

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

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 ASSESSMENT” SECTION

Summary and Use of Terms

Plan Team recommendations for 2002 ABCs are summarized in Tables 4-5. The sum of the recommended ABCs for 2001 is 3,185,076 t, about 1,185,000 t above the 2,000,000 t TAC cap. Overall, the status of the stocks continues to appear relatively favorable, although some stocks are declining due to poor recruitment in recent years. Stock status is summarized, ABC recommendations are given, and OFLs presented on a species-by-species basis in the remainder of this Overview, with the following conventions observed:

- 1) “Fishing mortality rate” refers to the full-selection F (i.e., the rate that applies to fish of fully selected sizes or ages), except in the case of the EBS walleye pollock assessment. In the EBS walleye pollock assessment model, an “average” fishing mortality rate is calculated by constraining the age-specific selectivities so that the average selectivity is 1.0 (in other age- or length-structured models, the selectivities are constrained so that the *maximum* is 1.0). It is important to remember that a full-selection F should be interpreted in the context of the selectivity schedule to which it applies.
- 2) “Projected age+ biomass” refers to the total biomass of all cohorts of ages greater than or equal to some minimum age, as projected for January 1 of the coming year. The minimum age varies from species to species. When possible, the minimum age corresponds to the age of recruitment listed in the respective stock assessment. Otherwise, the minimum age corresponds to the minimum age included in the assessment model. When a biomass estimate from the trawl survey is used as a proxy for projected age+ biomass, the minimum age is equated with the age of recruitment, even though the survey may not select that age fully and undoubtedly selects fish of younger ages to some extent. Note that a projected age+ biomass listed in this summary section may differ from a projected “exploitable” biomass listed in the corresponding stock assessment, which may be computed by multiplying biomass at age by selectivity at age and summing over all ages (in models assuming knife-edge recruitment, age+ biomass and exploitable biomass are equivalent).
- 3) “Exploitation rate” refers to the ratio between catch (in numbers) and start-of-year stock size (also in numbers). Where information is lacking, the exploitation rate is sometimes multiplied by start-of-year biomass to compute ABC.
- 4) Projected ABC, OFL, and biomass levels are reported to three significant digits, except when quoting a Council-approved value with more than three significant digits. Fishing mortality rates are reported to two significant digits.
- 5) The figures listed as last years ABCs correspond to the values approved by the Council. The figures listed as next years ABCs correspond to the Plan Team's recommendations.

Projection Scenarios and Status Determination

A standard set of projections is required for each stock managed under Tiers 1, 2, or 3 of Amendment 56. This set of projections encompasses seven harvest scenarios designed to satisfy the requirements of Amendment 56, the National Environmental Protection Act, and the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA).

For each scenario, the projections begin with the vector of 2001 numbers at age estimated in the assessment. This vector is then projected forward to the beginning of 2002 using the schedules of natural mortality and selectivity described in the assessment and the best available estimate of total (year-end) catch for 2001. In each subsequent year, the fishing mortality rate is prescribed on the basis of the spawning biomass in that year and the respective harvest scenario. In each year, recruitment is drawn from a distribution whose parameters consist of maximum likelihood estimates determined from the time series of recruitments estimated in the assessment. Because an environmental regime shift appears to have occurred around 1977, only year classes

spawned after 1976 are included in this time series. Spawning biomass is computed in each year based on the time of peak spawning and the maturity and weight schedules described in the assessment. Total catch is assumed to equal the catch associated with the respective harvest scenario in all years. This projection scheme is run 1000 times to obtain distributions of possible future stock sizes, fishing mortality rates, and catches.

Five of the seven standard scenarios will be used in an Environmental Assessment prepared in conjunction with the final SAFE. These five scenarios, which are designed to provide a range of harvest alternatives that are likely to bracket the final TAC for 2002, are as follow (“ $max F_{ABC}$ ” refers to the maximum permissible value of F_{ABC} under Amendment 56):

Scenario 1: In all future years, F is set equal to $max F_{ABC}$. (Rationale: Historically, TAC has been constrained by ABC, so this scenario provides a likely upper limit on future TACs.)

Scenario 2: In all future years, F is set equal to a constant fraction of $max F_{ABC}$, where this fraction is equal to the ratio of the F_{ABC} value for 2002 recommended in the assessment to the $max F_{ABC}$ for 2001. (Rationale: When F_{ABC} is set at a value below $max F_{ABC}$, it is often set at the value recommended in the stock assessment.)

Scenario 3: In all future years, F is set equal to 50% of $max F_{ABC}$. (Rationale: This scenario provides a likely lower bound on F_{ABC} that still allows future harvest rates to be adjusted downward when stocks fall below reference levels.)

Scenario 4: In all future years, F is set equal to the 1995-1999 average F . (Rationale: For some stocks, TAC can be well below ABC, and recent average F may provide a better indicator of F_{TAC} than F_{ABC} .)

Scenario 5: In all future years, F is set equal to zero. (Rationale: In extreme cases, TAC may be set at a level close to zero.)

Two other scenarios are needed to satisfy the MSFCMA’s requirement to determine whether a stock is currently in an overfished condition or is approaching an overfished condition. These two scenarios are as follow (for Tier 3 stocks, the MSY level is defined as $B_{35\%}$):

Scenario 6: In all future years, F is set equal to F_{OFL} .

Scenario 7: In 2002 and 2003, F is set equal to $max F_{ABC}$, and in all subsequent years, F is set equal to F_{OFL} .

Harvest scenarios #6 and #7 are intended to permit determination of the status of a stock with respect to its minimum stock size threshold (MSST). Any stock that is below its MSST is defined to be *overfished*. Any stock that is expected to fall below its MSST in the next two years is defined to be *approaching* an overfished condition. Harvest scenarios #6 and #7 are used in these determinations as follows:

Is the stock overfished? This depends on the stock's estimated spawning biomass in 2001:

- (1) If spawning biomass for 2002 is estimated to be below $\frac{1}{2} B_{35\%}$, the stock is below its MSST. If spawning biomass for 2002 is estimated to be above $B_{35\%}$, the stock is above its MSST.
- (2) If spawning biomass for 2002 is estimated to be above $\frac{1}{2} B_{35\%}$ but below $B_{35\%}$, the stock's status relative to MSST is determined by referring to harvest scenario #6. If the mean spawning biomass for 2012 is below $B_{35\%}$, the stock is below its MSST. Otherwise, the stock is above its MSST.

Is the stock approaching an overfished condition? This is determined by referring to harvest scenario #7:

- (1) If the mean spawning biomass for 2004 is below $\frac{1}{2} B_{35\%}$, the stock is approaching an overfished condition.
- (2) If the mean spawning biomass for 2004 is above $B_{35\%}$, the stock is not approaching an overfished condition.
- (3) If the mean spawning biomass for 2004 is above $\frac{1}{2} B_{35\%}$ but below $B_{35\%}$, the determination depends on the mean spawning biomass for 2014. If the mean spawning biomass for 2014 is below $B_{35\%}$, the stock is approaching an overfished condition. Otherwise, the stock is not approaching an overfished condition.

It is currently impossible to evaluate the status of stocks in Tiers 4 through 6 with respect to their MSSTs because stocks qualify for management under these tiers only if reference stock levels (such as MSST) cannot be estimated reliably.

Uncertainty / Ecosystem Considerations / Research

Uncertainty is dealt with in each individual assessment, and to some degree is addressed by the tiers used to establish ABCs. In some assessments (Pacific cod, Atka mackerel, and sablefish), additional analysis of parameter uncertainty was undertaken, and the resulting ABC recommendations adjusted accordingly as part of the assessment. In other assessments (Greenland turbot, other species) uncertainty was dealt with by recommending a more precautionary ABC (below the maximum allowed under the tiers). The Plan Team could not agree on a way to present information on relative uncertainty for individual stock assessments.

Ecosystem considerations were included in individual stock assessments. All of our groundfish species are predators or prey at some life stage. The Team was unable to isolate individual cases where ABC adjustments needed to be made to address ecosystem concerns. A review of ecosystem status and trends is provided in the Ecosystem Considerations chapter.

Walleye Pollock

Status and catch specifications (t) of **pollock** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2002 are those recommended by the Plan Team. Catch data are current through 10/27/2001.

<u>Area</u>	<u>Year</u>	<u>Age 3+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
EBS	2000	7,700,000	1,680,000	1,139,000	1,139,000	1,132,736
	2001	10,500,000	2,350,000	1,842,000	1,400,000	1,381,598
	2002	9,800,000	3,530,000	2,110,000	n/a	n/a
AI	2000	106,000	31,700	23,800	2,000	1,244
	2001	106,000	31,700	23,800	2,000	819
	2002	106,000	31,700	23,800	n/a	n/a
Bogoslof	2000	475,000	95,000	71,300	1,000	28
	2001	300,000	60,200	45,200	1,000	29
	2002	232,000	46,400	4,310	n/a	n/a

Eastern Bering Sea:

This year's pollock chapter features new data from the 2001 fishery and bottom trawl and echo-integration trawl surveys. The 2001 bottom trawl survey estimated a biomass of 4,140,000 t, a decrease of 19% relative to the 2000 estimate. Other new inputs include a revised age-length key for the 2000 echo-integration trawl (EIT) survey, age composition data from the 2000 fishery, and a revised fishery weight-at-age schedule. The reference model includes one methodological change from last year, consisting of a different (logistic) selectivity function for the bottom trawl survey schedule.

Seven alternative models (including the reference model) are presented in the chapter, all of which follow the statistical age-structured approach that has been used for the last few years. All of these models give point estimates of 2001 age 3+ biomass in the range 9,680,000 t to 15,900,000 t. Concurring with the assessment authors, the Plan Team based its recommendations for 2002 on the reference model (Model 1), which is similar to previous models used for this purpose.

The current assessment indicates that biomass is higher than estimated in last year's assessment. For example, this year's estimate of 2000 age 3+ biomass (11,700,000 t) is 11% higher than last year's estimate of 2000 age 3+ biomass (10,500,000 t). The assessment authors note that such variability is well within the confidence intervals of the estimates. The coefficient of variation (CV) for the 2000 biomass estimate produced last year was 34%, and the CV for the same estimate produced this year was 33%. Figure 1.30 compares estimates of year class strength between the current and previous assessments. Relative to last year's assessment, the current assessment gives higher estimates for the 1992 year class (as reflected in estimates of age composition from recent bottom trawl surveys and the fishery, [Figures 1.35 and 1.32], the 1995 year class (as reflected in estimates of age composition from recent bottom trawl surveys, [Figure 1.35], and the 1996 year class (as reflected in the new estimate of the age composition from the 2000 EIT survey, [Figure 1.37].

The SSC determined that reliable estimates of B_{MSY} and the probability density function for F_{MSY} exist for this stock, and that EBS walleye pollock therefore qualified for management under Tier 1. The senior assessment

author continues to feel that the Tier 1 reference points are reliably estimated given the structure of the model, a conclusion with which the Plan Team concurs. The updated estimates of B_{MSY} and the harmonic and arithmetic means for F_{MSY} from the present assessment are 2,140,000 t, 0.52, and 1.2, respectively, compared to 1,780,000 t, 0.71, and 1.2, respectively, from last year's assessment. Projected spawning biomass for 2002 is 2,960,000 t, placing EBS walleye pollock in sub-tier "a" of Tier 1. The maximum permissible value of F_{ABC} under Tier 1a is 0.52, the harmonic mean of the probability density function for F_{MSY} . A fishing mortality rate of 0.52 translates into a 2002 catch of 2,110,000 t, which would be the maximum permissible ABC under Tier 1a (compared to 2,130,000 t in last year's assessment). Last year the senior assessment author and Plan Team recommended setting ABC at a lower value, specifically, the maximum permissible level that would be allowed under Tier 3a. This year, however, the maximum permissible ABC under Tier 3a exceeds the maximum permissible ABC under Tier 1a. Therefore, the Plan Team concurs with the senior assessment author's recommendation to set 2002 ABC at 2,110,000 t, which is the maximum permissible value under Tier 1a. The senior assessment author notes that a catch of this magnitude has only a 6% chance of pushing the stock below $B_{20\%}$ by 2003 and a 55% chance of pushing the stock below $B_{35\%}$ by 2003 ($B_{35\%}$ is substantially higher than B_{MSY} for this stock). Given that TAC will necessarily be set below the recommended ABC, the assessment also provides alternative harvest scenarios, including the seven standard scenarios analyzed in all age-structured assessments and two constant catch scenarios (1,300,000 t and 1,400,000 t).

The OFL fishing mortality rate under Tier 1a is 1.2, the harmonic mean of the probability density function for F_{MSY} . A fishing mortality rate of 1.2 translates into a 2002 OFL of 3,530,000 t. The EBS walleye pollock stock is neither overfished nor approaching an overfished condition.

Aleutians:

The 2000 bottom trawl survey of the Aleutians Islands region resulted in a biomass estimate of 106,000 t, an increase of 13% relative to the 1997 estimate (last year, discovery of discrepancies in stratum definitions caused the estimate from the 1997 survey to be revised downward from the value of 106,000 t used previously; if the 1997 estimate had not been revised, the 2000 and 1997 estimates would have been equal). Last year, the SSC determined that Aleutian pollock qualified for management under Tier 5. The maximum permissible ABC under Tier 5 is 75% of the product of the natural mortality rate (0.30) and biomass, giving a value of 23,800 t, which is the Plan Team's recommended ABC for 2002. This is identical to last year's recommendation. The overfishing level under Tier 5 is the product of the natural mortality rate and biomass, giving an OFL of 31,700 t for 2002. This is identical to the 2001 OFL. As a Tier 5 stock, it is not possible to determine whether Aleutian pollock is overfished or whether it is approaching an overfished condition.

Bogoslof:

The 2001 hydroacoustic survey of the Bogoslof region resulted in a biomass estimate of 232,000 t. Last year, the SSC determined that Bogoslof pollock qualified for management under Tier 5. The maximum permissible ABC under Tier 5 is 75% of the product of the natural mortality rate (0.20) and biomass, giving a value of 34,800 t, which is the Plan Team's recommendation for ABC. The overfishing level under Tier 5 is the product of the natural mortality rate and biomass, giving an OFL of 46,400 t for 2002. As a Tier 5 stock, it is not possible to determine whether Aleutian pollock is overfished or whether it is approaching an overfished condition.

Pacific Cod

Status and catch specifications (t) of **Pacific cod** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2002 are those recommended by the Plan Team. Catch data are current through 10/27/2001.

<u>Area</u>	<u>Year</u>	<u>Age 3+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2000	1,300,000	240,000	193,000	193,000	191,056
	2001	1,320,000	248,000	188,000	188,000	154,991
	2002	1,540,000	294,000	223,000	n/a	n/a

The present assessment is a straightforward update of last year's assessment, incorporating new catch and survey information. This year's EBS bottom trawl survey resulted in a biomass estimate of 830,000 t. Biomass increased 57% from last year's estimate, which was the lowest observed value for the survey. The Aleutian Islands were surveyed in 2000; the biomass increased 63% from 1997. Estimates of abundance are higher for the 2001 assessment compared to the 2000 assessment. For example, estimated 2002 spawning biomass for the BSAI stock is 425,000 t, up about 25% from last year's F_{ABC} projection for 2002. The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, and that this stock therefore qualify for management under tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 431,000 t, 0.30, and 0.36, respectively. Pacific cod qualify for management under sub-tier "b" of tier 3 because projected biomass for 2002 is about 1% less than $B_{40\%}$. Fishing at an instantaneous rate of 0.30 is projected to result in a 2002 catch of 253,000 t, which is the maximum permissible ABC under Amendment 56. However, the Plan Team concurs with the chapter authors' recommendation to set 2002 ABC at 223,000 t, 12% below the maximum permissible level. This recommendation is based on a risk-averse optimization procedure which considers uncertainty in the estimates of the survey catchability coefficient and the natural mortality rate in the computation of an $F_{40\%}$ harvest level. The Bayesian meta-analysis which has formed the basis for a risk-averse ABC recommendation in the last four assessments was not performed for the present assessment. Instead the ratio between last year's recommended F_{ABC} and $F_{40\%}$ (0.87) was assumed to apply this year as well.

The Plan Team feels that a 12% reduction from the maximum permissible ABC is justified because of decision-theoretic concerns, because estimated spawning biomass from the model has declined continuously since 1988, and because four of the last five year classes (assessed at age 3) appear to be below average. A 2002 catch of 223,000 t would represent an increase of 19% over the 2001 ABC of 188,000 t, the same direction as the 57% increase in the trawl survey biomass estimate. Spawning biomass projected for 2002 is 39% of its unfished level. Spawning biomass is projected to decline through 2003, reaching a minimum of 407,000 t. This projection is much more optimistic than last year's assessment, which projected spawning biomass to reach a minimum of 314,000 t in 2003. A 2002 catch of 223,000 t corresponds to a fishing mortality rate of 0.26, below the value of 0.30 which constitutes the upper limit on F_{ABC} under tier 3b.

The Plan Team's recommended OFL was determined from the tier 3b formula, where fishing at a rate of 0.32 gives a 2001 catch of 248,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

The Plan Team continues to be concerned that the model estimate of trawl survey selectivity is sharply dome-shaped (Table 2.23), implying significant amounts of large fish outside of the survey frame. There is no evidence presented to support this result. Gary Walters, a Bering Sea trawl survey scientist, has stated that

the slope trawl survey data implies that there's not much fish outside the survey frame in deep water. His statement's implication is that biomass is overestimated in the model, which is a management concern given the 20% higher ABC recommended for 2002, an ABC surpassed only by the 1995 to 1997 catches. We request that the authors examine the slope trawl survey and longline survey data, tabulating the proportion of cod by size class outside the shelf trawl survey frame and evaluating whether dome-shaped selectivity is reasonable for the shelf survey.

The Plan Team notes two other concerns raised during their meeting regarding the increased ABC. 1) Some longline fishermen voiced concern that their catch rate patterns over the last decade do not support a 20% increase in ABC for 2002. Their recent catch rates have increased somewhat, but not 20%. They also are concerned that an increased quota would remove substantial amounts of young fish from the apparently strong 1999 year class before they have had a chance to grow. 2) The trawl survey biomass estimate from the 2001 winter survey was only about 50,000 mt on what likely is a spawning concentration, compared to the 2001 summer survey estimate of over 800,000 mt.

We are encouraged by the development of a new ageing method for Pacific cod. The reliance on length data alone in the stock assessment has added uncertainty to abundance estimates. Adding age data to the assessment should reduce this uncertainty, for example by providing data to more reliably estimate the degree of dome-shape in the selectivity curves.

Yellowfin Sole

Status and catch specifications (t) of **yellowfin sole** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2002 are those recommended by the Plan Team. Catch data are current through 10/27/2001.

<u>Area</u>	<u>Year</u>	<u>Age 2+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2000	2,820,000	226,000	191,000	123,262	84,070
	2001	2,380,000	209,000	176,000	113,000	54,340
	2002	1,597,000	136,000	115,000	n/a	n/a

The present assessment is a straightforward update of last year's assessment, including incorporation of new catch and survey information. This year's EBS bottom trawl survey resulted in a biomass estimate of 1,855,000 t, an increase of 17% from last year's survey, but still a 20% decline from 1998. Colder water temperatures in part may have reduced biomass estimates during 1999 and 2000 by decreasing catchability and delaying spawning so that some fish remain at the spawning grounds in shallow water outside the standard survey area.

Previous assessments assumed that survey catchability equaled 1.0. In this year's assessment, the authors tested whether survey catchability differed from 1.0 and whether water temperature affected catchability. Both models significantly improved fit to the observed survey data. The temperature affect model provided the best fit and was adopted as the best representation of the yellowfin sole population. The Plan Team agrees with their choice. Estimated catchability for this model averages 1.36 for the period 1982-2001, lowering abundance estimates compared to last year's assessment, which assumed catchability was 1.0. For example the estimate of the 2001 biomass is 68% of the value estimated when catchability equals 1.0.

Reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, and therefore qualifies for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 392,000 t, 0.11, and 0.13, respectively. Given that the projected 2002 spawning biomass of 454,000 t exceeds $B_{40\%}$, the Plan Team's ABC and OFL recommendations for 2002 were calculated under sub-tier "a" of Tier 3. The Plan Team recommends setting F_{ABC} at the $F_{40\%}$ (=0.11) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2002 ABC of 115,000 t.

The Plan Team's OFL was determined from the Tier 3a formula, where an $F_{35\%}$ value of 0.13 gives a 2002 OFL of 136,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

The yellowfin sole stock continues to decline, as do several other flatfish stocks, despite low exploitation rates. The decline is due to the low recruitment in the last decade.

Greenland turbot

Status and catch specifications (t) of **greenland turbot** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2002 are those recommended by the Plan Team. Catch data are current through 10/27/2001.

<u>Area</u>	<u>Year</u>	<u>Age 1+</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2000	233,000	42,000	9,300	9,300	5,888
	2001	210,000	31,000	8,400	8,400	4,210
	2002	208,000	36,500	8,100	n/a	n/a

The current assessment model uses the same data as past assessments, but now aggregates across both sexes. The updated model incorporated new catch data, an aggregated longline survey index and trawl survey information on biomass and length frequency data. Reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock and stock status relative to $B_{40\%}$ qualified the stock for management under Tier 3a of the BSAI Groundfish FMP.

Updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 83,000 t, 0.26, and 0.32, respectively. Projected spawning biomass for 2002 is 132,000 t. The maximum permissible value of F_{ABC} under Amendment 56 Tier 3a translates into a 2002 catch of 32,400 t.

Stock condition has not changed substantially over the past several years. The Plan Team continues to agree with the authors' recommendation to set the 2002 ABC at a value substantially less than the maximum permissible. Using $F_{ABC} = 0.25 \times \max F_{ABC}$, results in a 2002 ABC of 8,100 t corresponding to a full selection fishing mortality rate of 0.065. The OFL fishing mortality rate is computed under Tier 3a, $F_{OFL} = F_{35\%} = 0.32$, and translates into a 2002 OFL of 36,500 t.

This reduction is warranted for the following reasons: 1) stochastic trajectory of female spawning biomass and projected catches at maximum F_{ABC} indicate that the population would decline below $F_{35\%}$ within three years; 2) estimated age 1+ biomass has trended downward continually since 1972; 3) annual catches have average less than 8,000 tons over the last 15 years and if the maximum permissible ABC of 32,400 t were

actually caught, this would constitute the highest catch since 1983, even though spawning biomass in 2002 is projected to be less than half of what it was in 1983.

The Plan Team and author acknowledged large uncertainties in the assessment and conclude that biomass estimates may not be reliable. Arbitrary adjustments to ABC made in the assessment are due to this uncertainty. The Plan Team does not recommend tier adjustment at this time since the author adjusted F_{ABC} provides appropriate resource protection. However, additional information will need to be incorporated into future stock assessments or a suitable tier adjustment will be necessary. Tier 5 or 6 status may be more appropriate if uncertainty in biomass estimates can not be reduced.

Plan team notes that analysis of a 2000 pilot survey of the EBS slope region has been completed and a new survey will commence in summer of 2002. These data will substantially enhance current knowledge of Greenland turbot and other species susceptible to trawl gear in this region.

Arrowtooth flounder

Status and catch specifications (t) of **arrowtooth flounder** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2001 are those recommended by the Plan Team. Catch data are current through 10/27/01.

<u>Area</u>	<u>Year</u>	<u>Age 1+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2000	785,000	160,000	131,000	131,000	13,228
	2001	701,000	141,500	117,000	22,011	13,464
	2002	671,000	137,000	113,000	n/a	n/a

The present assessment is a straightforward update of last year's assessment, with incorporation of new catch and survey information. This year's EBS bottom trawl survey resulted in a biomass estimate of 409,000 t, a 20% increase relative to last year's estimate.

Last year, the SSC determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, therefore qualifying arrowtooth flounder for management under Tier 3. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 180,000 t, 0.22 and 0.28, respectively. Given that the projected 2002 spawning biomass of 423,000 t exceeds $B_{40\%}$, the Plan Team's ABC and OFL recommendations for 2001 were calculated under sub-tier "a" of Tier 3. The Plan Team recommends setting F_{ABC} at the $F_{40\%}$ (=0.22) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2002 ABC of 113,000 t.

The OFL fishing mortality rate under Tier 3a is $F_{35\%}$ (=0.28), translating into a 2002 OFL of 137,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Recommendations for next year's assessment

The assessment authors and other coworkers are currently investigating whether recruitment of arrowtooth flounder is related to advection. They also plan to determine whether survey catchability can be estimated within the assessment model for this species, and to explore the possibility that survey catchability for this species is temperature dependent. The Plan Team encourages these developments.

Rock sole

Status and catch specifications (t) of **rock sole** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2002 are those recommended by the Plan Team. Catch data are current through 10/27/2001.

<u>Area</u>	<u>Year</u>	<u>Age 2+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2000	2,070,000	273,000	230,000	134,760	49,186
	2001	1,940,000	271,000	228,000	75,000	28,882
	2002	1,850,000	268,000	225,000	n/a	n/a

The present assessment is a straightforward update of last year's assessment with incorporation of new catch and survey information. This year's EBS bottom trawl survey resulted in a biomass estimate of 2,420,000 t.

Reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, and that this stock therefore qualified for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 268,000 t, 0.16, and 0.20, respectively. Given that the projected 2002 spawning biomass of 658,000 t exceeds $B_{40\%}$, the Plan Team's ABC and OFL recommendations for 2001 were calculated under sub-tier "a" of Tier 3. The Plan Team recommends setting F_{ABC} at the $F_{40\%}$ (=0.16) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2002 ABC of 225,000 t.

The Plan Team's OFL was determined from the Tier 3a formula, where an $F_{35\%}$ value of 0.20 gives a 2002 OFL of 268,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

The rock sole stock continues to decline, as do several other flatfish stocks, due to the low recruitment in the last decade. For next years assessment, the author plans on estimating the survey catchability in the model, and investigating its possible relationship with temperature.

Flathead Sole

Status and catch specifications (t) of **flathead sole** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued the preceding year. The OFL and ABC for 2002 are those recommended by the Plan Team. Catch data are current through 10/27/2001.

<u>Area</u>	<u>Year</u>	<u>Age 3 + Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2000	660,000	90,000	73,500	52,652	19,983
	2001	618,000	102,000	84,000	40,000	17,087
	2002	695,000	101,000	82,600	n/a	n/a

The present assessment is a straightforward update of last year's assessment with incorporation of new catch and survey information. This year's EBS bottom trawl survey resulted in a biomass estimate of 514,000 t, about a 25% increase relative to last year's estimate.

Reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, and therefore is qualified for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 142,000 t, 0.30, and 0.38, respectively. Given that the projected 2002 spawning biomass of 262,000 t exceeds $B_{40\%}$, the Plan Team's ABC and OFL recommendations for 2002 were calculated under sub-tier "a" of Tier 3. The Plan Team recommends setting F_{ABC} at the $F_{40\%}$ (=0.30) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2002 ABC of 82,600 t.

The Plan Team's OFL was determined from the Tier 3a formula, where an $F_{35\%}$ value of 0.38 gives a 2002 OFL of 101,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

The Plan Team suggests investigation of environmental effects on decreased recruitment and ensuing decreased biomass might be more profitable than further pursuing spawner-recruit relationships.

Other flatfish complex

Status and catch specifications (t) of **other flatfish** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2002 are those recommended by the Plan Team. Catch data are current through 10/27/01.

	<u>Year</u>	<u>Age 1 + Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2000	829,000	141,000	117,000	83,813	16,403
	2001	865,000	147,000	122,000	28,000	9,577
	2002	1,11,000	172,000	143,000	n/a	n/a

The present assessment is a straightforward update of last year's assessment, including use of AD Model Builder as a modeling platform for Alaska plaice only. The assessment incorporates new catch and survey information. This year's EBS bottom trawl survey resulted in biomass estimates of 538,000 t for Alaska plaice and 78,300 t for the remaining species in the "other flatfish" complex. The other "other flatfish" are Dover sole (<1%), rex sole (28%), longhead dab (16%), Sakhalin sole (<1%), starry flounder (55%), butter sole

(1%) and English sole (<1%). This represents an increase of 18% in Alaska plaice, which is similar to the 1999 EBS survey. There was an increase of 10% of “other flatfish” relative to last year's estimates.

Reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock complex, and therefore it qualifies for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 133,000 t (Alaska plaice only), 0.28, and 0.34 respectively. Given that the projected 2002 spawning biomass (Alaska plaice only) of 265,000 t exceeds $B_{40\%}$, the Plan Team's ABC and OFL recommendations for 2002 were calculated under sub-tier “a” of Tier 3. Because 85% of the “other flatfish” category is Alaska plaice and the assessment author calculates plaice separately, the Plan Team recommends setting the ABC and OFL for Alaska plaice separately from the other species. For Alaska plaice, the Plan Team recommends F_{ABC} at the $F_{40\%}$ level (=0.28), which is the maximum allowable under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2002 ABC of 143,000 t for Alaska plaice. For the remaining species in the flatfish complex, the Plan Team recommends F_{ABC} at the $F_{40\%}$ level (=0.30), which is the maximum allowable under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2002 ABC of 18,100 t for “other” non-plaice flatfish.

As with the ABC, the plan recommends separating Alaska plaice from “other” flatfish for OFL. The Plan Team's OFL was determined from the Tier 3a formula, where, for Alaska plaice an $F_{35\%}$ value (=0.34) gives a 2002 OFL of 172,000 t. For the “other flatfish” species, the Plan Team recommends an $F_{35\%}$ value (=0.38) giving a 2002 OFL of 21,800 t. Model projections indicate that this stock complex is neither overfished nor approaching an overfished condition.

Sablefish

Status and catch specifications (t) of **sablefish** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2002 are those recommended by the Plan Team. Catch data are current through 10/27/2001.

<u>Area</u>	<u>Year</u>	<u>Age 4+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
EBS	2000	18,000	1,750	1,470	1,470	742
	2001	20,000	1,910	1,560	1,560	842
	2002	28,000	2,900	1,930	n/a	n/a
AI	2000	33,000	3,090	2,430	2,430	1,020
	2001	38,000	3,070	2,500	2,500	1,033
	2002	39,000	3,850	2,550	n/a	n/a

Sablefish abundance increased during the mid-1960's due to strong year classes from the late 1950's and 1960's. Abundance subsequently dropped during the 1970's due to heavy fishing; catches peaked at 56,988 mt in 1972. The population recovered due to exceptional year classes from the late 1970's; spawning abundance peaked again in 1987. The population then decreased because these exceptional year classes are dying off.

The survey abundance index increased 16% in numbers and 13% in weight from 2000 to 2001. These increases follow decreases from 1999 to 2000 in the survey abundance index of 10% in numbers and 8% in weight and in the fishery abundance index of 5% in weight, so that relative abundance in 2001 is slightly

higher than 1999. Fishery abundance data for 2001 were not analyzed because the fishery remains open. Exploitable and spawning biomass are projected to increase 4 and 2%, respectively, from 2001 to 2002. Alaska sablefish abundance now appears low and slowly increasing. The slow increase confirms the projection from last year's assessment that the abundance will increase slowly due to the above average 1995 and 1997 year classes; the size of the increase depends on the actual strength of the 1997 and another year class that likely is above average, the 1998 year class. Spawning biomass is projected to increase to 35% of unfished biomass in 2002, having been as low as 33% of unfished spawning biomass during 1998 to 2000.

A decision analysis was completed to determine what catch levels will result in stable or increasing spawning biomass. The decision analysis indicates that a yield of 17,300 mt will maintain spawning biomass. The maximum permissible yield from an adjusted $F_{40\%}$ strategy is much higher, 21,300 mt. In contrast to a yield of 17,300 mt, the $F_{40\%}$ yield has a high probability (>0.99 , decision analysis) of decreasing 2006 spawning biomass below 2002 spawning biomass and a substantial probability (0.18) of decreasing 2006 spawning biomass below 90% of 2002 spawning biomass. We recommend a 2002 ABC of 17,300 mt for the combined stock, a yield likely to maintain spawning biomass, and a yield slightly higher than the 2001 ABC of 16,900 (2% increase).

The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{30\%}$ existed for this stock, and that this stock therefore qualified for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 221,000 t (combined across the EBS, AI, and GOA), 0.13, and 0.17, respectively. Projected spawning biomass (combined areas) for 2002 is 193,000 t, placing sablefish in sub-tier "b" of Tier 3. The maximum permissible value of F_{ABC} under Tier 3b is computed as follows:

$$F_{ABC} \leq F_{40\%} \times (B_{2000}/B_{40\%} - 0.05)/(1 - 0.05) = 0.13 \times (193,000/221,000 - 0.05)/0.95 = 0.12$$

A fishing mortality rate of 0.12 translates into a 2002 catch (combined areas) of 21,300 t, which is the maximum permissible ABC under Amendment 56. The Plan Team's recommended 2001 ABC is 17,300 mt and corresponds to $F = 0.09$. A 5-year exponential weighting of longline survey and longline fishery relative abundance may be used to apportion the combined 2001 ABC among regions, resulting in the following values: EBS--1,930 t, AI--2,550 t, and GOA--12,820 t.

The OFL fishing mortality rate is computed under Tier 3b as follows:

$$F_{OFL} = F_{35\%} \times (B_{2000}/B_{35\%} - 0.05)/(1 - 0.05) = 0.17 \times (193,000/221,000 - 0.05)/0.95 = 0.14$$

A fishing mortality rate of 0.14 translates into a 2002 OFL (combined areas) of 26,100 t. Using the abundance-based apportionment scheme described above, 2002 OFL also may be apportioned among regions and results in the following values: EBS--2,900 t, AI--3,850 t, and GOA--19,350 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Pacific ocean perch (POP)

Status and catch specifications (t) of **Pacific ocean perch**. Biomass corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2002 are those recommended by the Plan Team. Catch data are current through 10/13/01.

Pacific Ocean Perch

<u>Area</u>	<u>Year</u>	<u>Age 3 + Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BS & AI	2001	n/a	13,800	11,900	11,930	8,708
BSAI	2002	374,000	17,500	14,800	-	-

The present assessment is based on a new assessment model that combines the AI and BS areas, and incorporates new information. Reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, and that this stock therefore qualified for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 141,000 t, 0.048, and 0.057, respectively. Projected spawning biomass for 2002 is 135,000 t, placing POP in the EBS in sub-tier "b" of Tier 3. The maximum F_{ABC} value allowed under Tier 3b is computed as follows:

$$F_{ABC} \leq F_{40\%} \times (B_{2002} / B_{40\%} - 0.05) / (1 - 0.05) = 0.048 \times (134,694 / 140,660 - 0.05) / 0.95 = 0.046$$

Projected harvesting at a fishing mortality rate of 0.046 gives a 2002 catch of 14,800 t, which is the Plan Team's recommended ABC. The team recommends that ABCs be set regionally based on the 2001 apportionment as follows: BS = 2,620 t, area 541=3,460 t, area 542=3,060 t, area 543=5,660 t.

The OFL fishing mortality rate is computed under Tier 3b as follows:

$$F_{OFL} = F_{35\%} \times (B_{2002} / B_{40\%} - 0.05) / (1 - 0.05) = 0.057 \times (134,694 / 140,660 - 0.05) / 0.95 = 0.055$$

Projected harvesting at a fishing mortality rate of 0.055 gives a 2002 catch of 17,500 t, which is the Plan Team's recommended OFL for the BSAI. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Other Red Rockfish

Status and catch specifications (t) of **Other red rockfish**. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2002 are those recommended by the Plan Team.

<u>Area</u>	<u>Year</u>	<u>Survey Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
<u>Northern Rockfish</u>						
BSAI	2002	150,000	9,020	6,760	n/a	n/a
<u>Rougheye Rockfish</u>						
BSAI	2002	14,000	349	262	n/a	n/a
<u>Shortraker Rougheye</u>						
BSAI	2002	34,000	1,020	766	n/a	n/a

Through 2000, the other red rockfish complex was split out into northern/sharpchin and rougheye/shortraker groups in the AI, and a combined other red rockfish group for the eastern Bering Sea. The assessment authors provided an assessment for these species groups, by incorporating recent catch data and the 2000 AI survey results.

For 2001 and again in 2002, the Plan Team recommends that the complex be broken out to separate species and managed accordingly. The Plan Team feels this is a conservation issue, because when managed as a species complex, there is a risk that one stock would be fished disproportional to its abundance, resulting in overfishing of that stock. This is especially true when one species has a higher value to the fishery than the other species. This has happened in the other red rockfish complex, and the assessment appendix showed that on a species basis, catches have sometimes exceeded what OFL would have been. This occurred for rougheye rockfish in the AI in 1997 and 2001, and northern rockfish in the Bering Sea in 2000. Establishing ABCs on a species by species basis would help prevent overfishing.

For each species, the Plan Team recommends setting F_{ABC} at the maximum value allowable under Tier 5, which is 75% of M . Accepted values for M are: rougheye rockfish--0.025, shortraker rockfish--0.030, and northern rockfish--0.060. Multiplying these rates by the best estimates of species-specific biomass gives the following 2002 ABC's:

Northern Rockfish (BSAI)	6,760 mt
Rougheye Rockfish (BSAI)	262 mt
Shortraker Rockfish (BSAI)	766 mt

Note that sharpchin rockfish are at the extent of their range in the BSAI, and are not common. Therefore, no specifications for this species are recommended. Further, the Plan team recommends that sharpchin rockfish be moved into the other rockfish category.

There is some risk associated with establishing area-wide ABCs if there are truly separate stocks of shortraker and rougheye rockfish in the AI and EBS. For rougheye rockfish, there has been some genetic samples collected in the EBS, but most of the research to date has been done in the Gulf of Alaska. To address this

concern, the Team recommends that TAC's for these species be apportioned among BS and AI areas. Apportionments of the full ABC based on average (1991-2000) survey biomass would be:

	<u>BS</u>	<u>AI</u>
Northern	19 mt (0.3%)	6,741 mt (99.7%)
Rougheye	32 mt (10.9%)	230 mt (89.1%)
Shortraker	84 mt (11.0%)	682 mt (89.0%)

To prevent topping off of northern rockfish, rougheye, and shortraker rockfish, these species may be prohibited to retention in the EBS at the beginning of the year. Another possibility would be to reduce maximum retainable bycatch levels from the current 15%. However, the Team notes that this change takes proposed and final rulemaking, so these changes would not be in place for the start of the fishing year.

The Plan Team's OFL was determined from the Tier 5 formula, where setting $F_{OFL}=M$ for each species gives 2002 OFL's:

Northern Rockfish (BSAI)	9,020 mt
Rougheye Rockfish (BSAI)	349 mt
Shortraker Rockfish (BSAI)	1,020 mt

As Tier 5 stocks, it is not possible to determine whether any species in the EBS "other red rockfish" complex is overfished or whether it is approaching an overfished condition.

Other rockfish complex

Status and catch specifications (t) of **other rockfish** (primarily thornyheads) in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2002 are those recommended by the Plan Team. Catch data are current through 10/27/01.

<u>Area</u>	<u>Year</u>	<u>Survey Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
EBS	2000	7,030	492	369	369	232
	2001	6,880	482	361	361	293
	2002	6,880	482	361	n/a	n/a
AI	2000	13,000	913	685	685	563
	2001	12,900	901	676	676	605
	2002	12,900	901	676	n/a	n/a

The present assessment is updated and expanded from last year's assessment. Traditionally, the biomass estimates (split according to management area) from all bottom trawl surveys (EBS shelf/slope and Aleutians) are averaged over all years to obtain the best estimates of biomass for the species in this complex. Summed over the species in the complex, this procedure produces a biomass estimate of 6,880 t in the EBS and a biomass estimate of 12,900 t in the Aleutians. The great majority of this biomass is comprised of thornyhead rockfish. In 2000, the SSC determined that a reliable estimate of the natural mortality rate (M) existed for the species in this subcomplex, and that "other rockfish" in the EBS and Aleutians therefore qualified for management under Tier 5 of the BSAI Groundfish FMP. The accepted estimate of M for these species in both areas is 0.07. The Plan Team recommends setting F_{ABC} at the maximum value allowable under Tier 5, which

is 75% of M , or 0.053. Multiplying this rate by the best estimate of complex-wide biomass gives a 2002 ABC of 361 t in the EBS and 676 t in the Aleutians.

The Plan Team’s OFLs were determined from the Tier 5 formula, where setting $F_{OFL}=M$ gives a 2002 OFL of 482 t in the EBS and 901 t in the Aleutians. As a Tier 5 stock complex, it is not possible to determine whether the “other rockfish” complex is overfished or whether it is approaching an overfished condition.

The assessment authors provided catch and survey data for individual species within this complex. Notably, about 90% of this complex is composed of shortspine thornyheads according to survey data. However, the commercial fishery in the AI takes mostly dusky rockfish. The author notes that the surveys do not adequately sample the other rockfish habitats. The team feels that the survey biomass estimates for thornyhead rockfish and dusky rockfish in particular, probably greatly underestimate true population biomass. A tier 6 classification was discussed, but not adopted. The Plan Team recommends that the author continue to examine and assess biomass for individual species in this complex, and compare these with commercial catches.

The assessment authors also noted that the other species complex has listed over 27 species, as identified by fishery observers. Some of these species may have been mis-identified by observers, or the BSAI is simply outside of the normal range for some rockfish in this category. The authors propose criteria to reduce the numbers of species from this complex list of species: at least one fish had to be observed in research surveys since 1990, or has occurred in at least 1% of commercial fishery trawl hauls that contained other rockfish. The following 7 species met this criteria: dark dusky, light dusky, harlequin, red banded, redstripe, yelloweye, and shortspine thornyhead rockfish. The team requested that the assessment author continue to explore the occurrence and distribution of the very rare species in fishery catches, and discuss literature on the known range of these species.

Atka mackerel

Status and catch specifications (t) of **Atka mackerel** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2001 are those recommended by the Plan Team. Catch data for 2001 are current through 10/27/01.

<u>Area</u>	<u>Year</u>	<u>Age 3+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
AI	2000	565,000	119,000	70,800	70,800	47,229
	2001	553,000	138,000	58,700	58,700	56,521
	2002	439,700	82,300	49,000	n/a	n/a

New catch data, and 2000 fishery age data were incorporated into the model. Because the 2002 estimated female spawning biomass (118,000 t) is below $B_{40\%}$, this stock is qualified for management under Tier 3b of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 125,000 t, 0.32, and 0.37, respectively. The projected 2002 yields at $F_{ABC\ adj}$ and F_{ABC} are 71,300 t and 49,000 t respectively. The assessment authors recommend setting F_{ABC} at a value of 0.21 would give a 2002 catch of 49,000 t.

The Plan Team agreed with the author’s recommendation that the 2002 ABC be 49,000 mt. The incorporation of the 2000 fishery age composition data revised the estimate of biomass downward. In the 2001 assessment the 1995 year class appeared be above average but now is showing as average. The 1998

year class is showing potential strength but was not included in the assessment because its appearance in the 2000 survey age composition is the first indication of its magnitude.

To apportion ABCs among areas, the authors used a weighted average of the 4 most recent survey estimates of the distribution of the biomass, which gives the greatest weight to the 2000 survey. When applied to the recommended ABC of 49,000 t, this formula gives the following subarea-specific ABCs: Eastern Bering Sea and Eastern Aleutians = 5,500 t (11.2%), Central Aleutians = 23,800 t (48.5%), Western Aleutians = 19,700 t (40.2%).

The OFL was determined from the Tier 3b formula, where an $F_{35\% adj}$ value of 0.37 gives a 2002 OFL of 82,300 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

The Plan Team expressed concerns that current survey methods are not confidently estimating the abundance of Atka mackerel.

Squid and Other Species Complex

Status and catch specifications (t) of **squid and other species** (sharks, skates, sculpins, octopus.) in recent years. The OFL and ABC for 2002 are those recommended by the Plan Team. Catch data are current through 10/27/01.

Squid

<u>Area</u>	<u>Year</u>	<u>Biomass</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2000	n/a	2,620	1,970	1,970	333
	2001	n/a	2,620	1,970	1,970	1,763
	2002	n/a	2,620	1,970	n/a	n/a

Other Species

<u>Area/BSAI</u>	<u>Year</u>	<u>Survey Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
Shark	2002	n/a	516	387	n/a	n/a
Octopus	2002	n/a	405	304	n/a	n/a
Skates	2002	432,000	43,200	32,400	n/a	n/a
Sculpins	2002	227,000	34,000	25,100	n/a	n/a

The squid assessment is an update of last year's assessment incorporating new catch information. The squid stock is managed under Tier 6, OFL is set equal to the average catch from 1978 through 1995, and ABC is constrained to be no greater than 75% of OFL. The average catch from 1978 through 1995 was 2,620 t. The maximum permissible value of ABC for 2002 therefore is 1,970 t, which is the Plan Team's recommended value.

The assessment author provided information on catch biomass by taxonomic group in this year's assessment. The Plan Team concurs with the author's efforts to begin management of the other species group by taxonomic groups, which better reflects classification by life history characteristics

For sculpins and skates, the Plan Team recommends setting F_{ABC} at the maximum value allowable under Tier 5, which is 75% of M . Tier 5 requires estimates of biomass and natural mortality. Average biomass estimates from 1990 - present were 432,000 mt for skates and 227,00 mt for sculpins. Estimated natural mortality is 0.15 for sculpins and 0.10 for skates. This gives a 2002 ABC of 32,400 mt for skates and 25,100 mt for sculpins. The Plan Team's recommended OFLs were determined from the Tier 5 formula, where setting $F_{OFL} = M$ gives a 2002 OFL of 43,200 mt for skates and 34,000 mt for sculpins.

For sharks and octopus, the Plan Team recommended ABC and OFL based on Tier 6. Tier 6 requires average catch from 1977-1995, but catch estimates are not available until the 1990s. Average catch was 516 mt for sharks and 405 mt for octopus. OFL is set equal to average catch and ABC is set equal to 0.75 of average catch, resulting in ABC of 387 mt for shark and 304 mt for octopus.

Table 1-- Species categories established for management of the Bering Sea/Aleutian Islands groundfish fishery.

Prohibited Species ^a	Target Species ^b	Other Species ^c	Forage Fish
<u>FINFISHES</u>			
Salmon	Walleye pollock	Sculpins	Eulachon
Pacific halibut	Pacific cod	Sharks	Capelin
Pacific herring	Yellowfin sole	Skates	Sandlance
Steelhead trout	Greenland turbot		Myctophids
	Arrowtooth flounder		Bathylagids
	Rock sole		Sandfish
	Flathead sole		Pholids
	Other flatfish		Stichaeids
	Sablefish		Gonostomatids
	Pacific ocean perch		
	Other red rockfish		
	Other rockfish		
	Atka mackerel		
<u>INVERTEBRATES</u>			
King crab	Squid	Octopus	
Tanner crab			

a. Species which must be returned to the sea when caught.

b. Species for which an individual TAC is established.

c. Species for which an aggregate TAC is established.

A nonspecified species category is also established to cover all species not listed above.

Table 2. Groundfish and squid catches (metric tons) in the eastern Bering Sea, 1954-2001.

Year	Pacific Ocean				Other Rock Fish	Yellow Fin Sole	Greenland Turbot
	Pollock	Pacific Cod	Sable Fish	Perch Complex			
1954						12,562	
1955						14,690	
1956						24,697	
1957						24,145	
1958	6,924	171	6			44,153	
1959	32,793	2,864	289			185,321	
1960			1,861	6,100		456,103	36,843
1961			15,627	47,000		553,742	57,348
1962			25,989	19,900		420,703	58,226
1963			13,706	24,500		85,810	31,565
1964	174,792	13,408	3,545	25,900		111,177	33,729
1965	230,551	14,719	4,838	16,800		53,810	9,747
1966	261,678	18,200	9,505	20,200		102,353	13,042
1967	550,362	32,064	11,698	19,600		162,228	23,869
1968	702,181	57,902	4,374	31,500		84,189	35,232
1969	862,789	50,351	16,009	14,500		167,134	36,029
1970	1,256,565	70,094	11,737	9,900		133,079	19,691
1971	1,743,763	43,054	15,106	9,800		160,399	40,464
1972	1,874,534	42,905	12,758	5,700		47,856	64,510
1973	1,758,919	53,386	5,957	3,700		78,240	55,280
1974	1,588,390	62,462	4,258	14,000		42,235	69,654
1975	1,356,736	51,551	2,766	8,600		64,690	64,819
1976	1,177,822	50,481	2,923	14,900		56,221	60,523
1977	978,370	33,335	2,718	2,654	311	58,373	27,708
1978	979,431	42,543	1,192	2,221	2,614	138,433	37,423
1979	913,881	33,761	1,376	1,723	2,108	99,017	34,998
1980	958,279	45,861	2,206	1,097	459	87,391	48,856
1981	973,505	51,996	2,604	1,222	356	97,301	52,921
1982	955,964	55,040	3,184	224	276	95,712	45,805
1983	982,363	83,212	2,695	221	220	108,385	43,443
1984	1,098,783	110,944	2,329	1,569	176	159,526	21,317
1985	1,179,759	132,736	2,348	784	92	227,107	14,698
1986	1,188,449	130,555	3,518	560	102	208,597	7,710
1987	1,237,597	144,539	4,178	930	474	181,429	6,533
1988	1,228,000	192,726	3,193	1,047	341	223,156	6,064
1989	1,230,000	164,800	1,252	2,017	192	153,165	4,061
1990	1,353,000	162,927	2,329	5,639	384	80,584	7,267
1991	1,268,360	165,444	1,128	4,744	396	94,755	3,704
1992	1,384,376	163,240	558	3,309	675	146,942	1,875
1993	1,301,574	133,156	669	3,763	190	105,809	6,330
1994	1,362,694	174,151	699	1,907	261	144,544	7,211
1995	1,264,578	228,496	929	1,210	629	124,746	5,855
1996	1,189,296	209,201	629	2,635	364	129,509	4,699
1997	1,115,268	209,475	547	1,060	161	166,681	6,589
1998	1,101,428	160,681	586	1,134	203	101,310	8,303
1999	889,589	134,647	646	609	135	67,307	5,205
2000/d	1,132,736	151,372	742	704	239	84,057	5,888
2001/e	1,381,598	121,357	842	1,144	293	54,325	4,218

Table 2. (continued)

Year	Arrow Tooth Flounder	Other Flat Fish	Rock Sole/b	Atka Mackerel	Squid	Other Species	Total (All Species)
1954							12,562
1955							14,690
1956							24,697
1957							24,145
1958						147	51,401
1959						380	221,647
1960	a						500,907
1961	a						673,717
1962	a						524,818
1963	a	35,643					191,224
1964	a	30,604				736	393,891
1965	a	11,686				2,218	344,369
1966	a	24,864				2,239	452,081
1967	a	32,109				4,378	836,308
1968	a	29,647				22,058	967,083
1969	a	34,749				10,459	1,192,020
1970	12,598	64,690				15,295	1,593,649
1971	18,792	92,452				13,496	2,137,326
1972	13,123	76,813				10,893	2,149,092
1973	9,217	43,919				55,826	2,064,444
1974	21,473	37,357				60,263	1,900,092
1975	20,832	20,393				54,845	1,645,232
1976	17,806	21,746				26,143	1,428,565
1977	9,454	14,393			4,926	35,902	1,168,144
1978	8,358	21,040		831	6,886	61,537	1,302,509
1979	7,921	19,724		1,985	4,286	38,767	1,159,547
1980	13,761	20,406		4,955	4,040	34,633	1,221,944
1981	13,473	23,428		3,027	4,182	35,651	1,259,666
1982	9,103	23,809		328	3,838	18,200	1,211,483
1983	10,216	30,454		141	3,470	15,465	1,280,285
1984	7,980	44,286		57	2,824	8,508	1,458,299
1985	7,288	71,179		4	1,611	11,503	1,649,109
1986	6,761	76,328		12	848	10,471	1,633,911
1987	4,380	50,372		12	108	8,569	1,639,121
1988	5,477	137,418		428	414	12,206	1,810,470
1989	3,024	63,452		3,126	300	4,993	1,630,382
1990	2,773	22,568		480	460	5,698	1,644,109
1991	12,748	30,401	46,681	2,265	544	16,285	1,647,455
1992	11,080	34,757	51,720	2,610	819	29,993	1,831,954
1993	7,950	28,812	63,942	201	597	21,413	1,674,406
1994	13,043	29,720	60,276	190	502	23,430	1,818,628
1995	8,282	34,861	54,672	340	364	20,928	1,745,890
1996	13,280	35,390	46,775	780	1,080	19,717	1,653,355
1997	8,580	42,374	67,249	171	1,438	20,997	1,640,590
1998	14,985	39,940	33,221	901	891	23,156	1,486,739
1999	9,827	33,042	39,934	2,008	393	17,045	1,200,387
2000	12,071	36,813	49,186	239	375	23,098	1,497,520
2001	12,244	26,590	28,524	265	1,758	19,127	1,652,285

a/ Arrowtooth flounder included in Greenland turbot catch statistics.

b/ Includes POP shortraker, rougheye, northern and sharpchin.

c/ Rocksole prior to 1991 is included in other flatfish catch statistics.

d/ Data through December 31, 2000.

e/ Data through October 27, 2001. Does not include CDQ.

Note: Numbers don't include fish taken for research.

Table 3. Groundfish and squid catches (metric tons) in the Aleutian Islands region, 1962-2001.

Year	Pollock	Pacific Ocean			Other	Greenland	Yellow
		Pacific Cod	Sable Fish	Perch Complex ^b	Rock Fish	Turbot	Fin Sole
1962				200			
1963			664	20,800		7	
1964		241	1,541	90,300		504	
1965		451	1,249	109,100		300	
1966		154	1,341	85,900		63	
1967		293	1,652	55,900		394	
1968		289	1,673	44,900		213	
1969		220	1,673	38,800		228	
1970		283	1,248	66,900		285	
1971		2,078	2,936	21,800		1,750	
1972		435	3,531	33,200		12,874	
1973		977	2,902	11,800		8,666	
1974		1,379	2,477	22,400		8,788	
1975		2,838	1,747	16,600		2,970	
1976		4,190	1,659	14,000		2,067	
1977	7,625	3,262	1,897	8,080	3,043	2,453	
1978	6,282	3,295	821	5,286	921	4,766	
1979	9,504	5,593	782	5,487	4,517	6,411	
1980	58,156	5,788	274	4,700	420	3,697	
1981	55,516	10,462	533	3,622	328	4,400	
1982	57,978	1,526	955	1,014	2,114	6,317	
1983	59,026	9,955	673	280	1,045	4,115	
1984	81,834	22,216	999	631	56	1,803	
1985	58,730	12,690	1,448	308	99	33	
1986	46,641	10,332	3,028	286	169	2,154	
1987	28,720	13,207	3,834	1,004	147	3,066	
1988	43,000	5,165	3,415	1,979	278	1,044	
1989	156,000	4,118	3,248	2,706	481	4,761	
1990	73,000	8,081	2,116	14,650	864	2,353	
1991	78,104	6,714	2,071	2,545	549	3,174	1,380
1992	54,036	42,889	1,546	10,277	3,689	895	4
1993	57,184	34,234	2,078	13,375	495	2,138	0
1994	58,708	22,421	1,771	16,959	301	3,168	0
1995	64,925	16,534	1,119	14,734	220	2,338	6
1996	28,933	31,389	720	20,443	278	1,677	654
1997	26,872	25,166	779	15,687	307	1,077	234
1998	23,821	34,964	595	13,729	385	821	5
1999	965	27,714	565	17,619	630	422	13
2000/c	1,244	39,684	1,048	14,893	601	1,086	13
2001/d	819	33,634	1,033	15,540	605	1,086	15

Table 3. (continued)

Year	Rock Sole	Other Flat Fish	Arrow Tooth Flounder	Atka Mackerel	Squid	Other Species	Total (All Species)
1962							200
1963			a				21,471
1964			a			66	92,652
1965			a			768	111,868
1966			a			131	87,589
1967			a			8,542	66,781
1968			a			8,948	56,023
1969			a			3,088	44,009
1970			274	949		10,671	80,610
1971			581			2,973	32,118
1972			1,323	5,907		22,447	79,717
1973			3,705	1,712		4,244	34,006
1974			3,195	1,377		9,724	49,340
1975			784	13,326		8,288	46,553
1976			1,370	13,126		7,053	43,465
1977			2,035	20,975	1,808	16,170	67,348
1978			1,782	23,418	2,085	12,436	61,092
1979			6,436	21,279	2,252	12,934	75,195
1980			4,603	15,533	2,332	13,028	108,531
1981			3,640	16,661	1,763	7,274	104,199
1982			2,415	19,546	1,201	5,167	98,233
1983			3,753	11,585	510	3,675	94,617
1984			1,472	35,998	343	1,670	147,022
1985			87	37,856	9	2,050	113,310
1986			142	31,978	20	1,509	96,259
1987			159	30,049	23	1,155	81,364
1988			406	21,656	3	437	77,383
1989			198	14,868	6	108	186,494
1990			1,459	21,725	11	627	124,886
1991	n/a	88	938	22,258	30	91	117,942
1992	236	68	900	46,831	61	3,081	164,513
1993	318	59	1,348	65,805	85	2,540	179,659
1994	308	55	1,334	69,401	86	1,102	175,614
1995	356	47	1,001	81,214	95	1,273	183,862
1996	371	61	1,330	103,087	87	1,720	190,750
1997	271	39	1,071	65,668	323	1,555	139,049
1998	446	54	694	56,195	25	2,448	134,182
1999	577	53	746	51,636	9	1,633	102,582
2000	480	113	1,157	46,990	8	3,010	110,327
2001	526	96	1,220	61,234	5	3,851	119,664

a/ Arrowtooth flounder included in Greenland turbot catch statistics.

b/ Includes POP shortraker, rougheye, northern and sharpchin rockfish.

c/ Data through December 31, 2000.

d/ Data through October 27, 2001. Does not include CDQ.

Note: Numbers don't include fish taken for research.

Table 4-- Summary of stock abundance (biomass), overfishing level (OFL), acceptable biological catch (ABC), the fishing mortality rate corresponding to ABC (F_{OFL}), and the fishing mortality rate corresponding to OFL (F_{ABC}) for the eastern Bering Sea (EBS), Aleutian Islands (AI), and Bogoslof district as projected for 2002. "Biomass" corresponds to projected January 2002 abundance for the age+ range reported in the summary section. Biomass, OFL, and ABC are in metric tons, reported to three significant digits. F s are reported to two significant digits.

Species or Species Complex	Area	Biomass	OFL	ABC	F_{OFL}	F_{ABC}
Walleye pollock	EBS	9,800,000	3,530,000	2,110,000	1.20	0.52
Walleye pollock	AI	106,000	31,700	23,800	0.30	0.23
Walleye pollock	Bogoslof	232,000	46,400	4,310	0.20	0.15
Pacific cod	BSAI	1,540,000	294,000	223,000	0.35	0.26
Yellowfin sole	BSAI	1,597,000	136,000	115,000	0.13	0.11
Greenland turbot	BSAI	208,000	36,500	8,100	0.32	0.065
Arrowtooth flounder	BSAI	671,000	137,000	113,000	0.28	0.22
Rock sole	BSAI	1,850,000	268,000	225,000	0.20	0.16
Flathead sole	BSAI	695,000	101,000	82,600	0.38	0.30
Other flatfish	BSAI	1,110,000	172,000	143,000	0.34 ^a	0.28 ^a
Sablefish	EBS	28,000	2,900	1,930	0.14	0.12
Sablefish	AI	39,000	3,850	2,550	0.14	0.12
Pacific ocean perch	BSAI	377,000	17,500	14,800	0.055	0.046 ^b
Northern rockfish	BSAI	150,000	9,020	6,760	0.060	0.045 ^b
Rougheye rockfish	BSAI	14,000	349	262	0.025	0.019 ^b
Shortraker rockfish	BSAI	34,000	1,020	766	0.030 ^c	0.023 ^c
Other rockfish	EBS	6,880	482	361	0.073 ^c	0.054 ^c
Other rockfish	AI	12,900	901	676	0.073 ^c	0.054 ^c
Atka mackerel	BSAI	439,700	82,300	49,000	0.37	0.21
Squid	BSAI	n/a	2,620	1,970	n/a	n/a
Sculpins	BSAI	227,000	34,000	25,100	0.15	0.11
Skates	BSAI	432,000	43,200	32,400	0.10	0.08
Sharks	BSAI	n/a	516	387	n/a	n/a
Octopus	BSAI	n/a	405	304	n/a	n/a
TOTAL		19,569,480	4,951,663	3,185,076		

a/ Alaska plaice rate shown as an example.

b/ previously combined into other red rockfish complex

c/ Weighted average of species-specific rates.

Table 5-- Summary of BSAI groundfish tier designations under Amendment 56, maximum permissible ABC fishing mortality rate ($max F_{ABC}$), the Plan Team's recommended ABC fishing mortality rate (F_{ABC}), the maximum permissible value of ABC ($max ABC$), the Plan Team's recommended ABC, and the percentage reduction (% Red.) between $max ABC$ and the Plan Team's recommended ABC. Insofar as the SSC has final authority for tier designations, the designations shown here represent Plan Team recommendations only. Biomass and ABC are in metric tons, reported to three significant digits. Fishing mortality rates are reported to two significant digits. In cases where $max ABC$ and the Plan Team's recommended ABC are equal, the percentage reduction is left blank. All values pertain to the 2002 harvest season.

Species or Species Complex	Area	Tier	$max F_{ABC}$	F_{ABC}	$max ABC$	ABC	% Red.
Walleye pollock	EBS	1a	0.52	0.52	2,110,000	2,110,000	
Walleye pollock	AI	5	0.23	0.23	23,800	23,800	
Walleye pollock	Bogoslof	5	0.15	0.15	34,800	4,310	87
Pacific cod	BSAI	3b	0.30	0.26	253,000	223,000	12
Yellowfin sole	BSAI	3a	0.11	0.11	115,000	115,000	
Greenland turbot	BSAI	3a	0.26	0.064	32,400	8,100	75
Arrowtooth flounder	BSAI	3a	0.22	0.22	113,000	113,000	
Rock sole	BSAI	3a	0.16	0.16	225,000	225,000	
Flathead sole	BSAI	3a	0.30	0.30	82,600	82,600	
Other flatfish	BSAI	3a	0.28	0.28	143,000	143,000	
Sablefish	BS	3b	0.12	0.09	2,370	1,930	
Sablefish	AI	3b	0.12	0.09	3,140	2,550	
Pacific ocean perch	BSAI	3b	0.046	0.046	14,800	14,800	
Northern rockfish	BSAI	5	0.046	0.046	6,760	6,760	
Rougheye rockfish	BSAI	5	0.022	0.022	262	262	
Shortraker rockfish	BSAI	5	0.023	0.023	766	766	
Other rockfish	EBS	5	0.054	0.054	361	361	
Other rockfish	AI	5	0.054	0.054	676	676	
Atka mackerel	BSAI	3b	0.32	0.21	71,300	49,000	31
Squid	BSAI	6	n/a	n/a	1,970	1,970	
Sculpins	BSAI	5	0.11	0.11	25,100	25,100	
Skates	BSAI	5	0.08	0.08	32,400	32,400	
Sharks	BSAI	6	n/a	n/a	387	387	
Octopus	BSAI	6	n/a	n/a	304	304	
Total						3,185,076	

Insert Figure 1.

