APPENDIX A

STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

FOR THE GROUNDFISH RESOURCES

OF THE BERING SEA/ALEUTIAN ISLANDS REGIONS

Compiled by

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

With Contributions by

S. deBlois, M. Dorn, L. Fritz, J. Fujioka, S. Hare, T. Honkalehto,
J. Ianelli, D. Ito, S. Lowe, C. Lunsford, D. Nichol, R. Rueter, T. Sample,
M. Sigler, P. Spencer, G. Thompson, G. Walters, T. Wilderbuer,
G. Williams, N. Williamson, and D. Witherell

November 2000

North Pacific Fishery Management Council
605 West 4th Ave., Suite 306
Anchorage, AK 99501

Stock Assessment and Fishery Evaluation Report
for the Groundfish Resources
of the Bering Sea/Aleutian Islands Region

Table of Contents

SUMMARY

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

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. In 2000, first drafts of assessments were not produced because the September Plan Team meeting was cancelled.

Members of the Plan Team who compiled this SAFE report were Michael Sigler (acting chair), David Witherell (plan coordinator), Kristin Mabrey, Brenda Norcross, Andrew Smoker, Grant Thompson, Ivan Vining, Farron Wallace, 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:* $B/B_{MSY} > 1$

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

$F_{ABC} \leq \mu_H$, 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 × OFL

OVERVIEW OF "STOCK ASSESSMENT" SECTION

Summary and Use of Terms

Plan Team recommendations for 2001 ABCs are summarized in Tables 4-7. The sum of the recommended ABCs for 2001 is 2,959,385 t, about 700,000 t above the 2000 Council-approved total of 2,260,000 t and about 950,000 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 1999 ABCs correspond to the values approved by the Council. The figures listed as 2000 ABCs correspond to the Plan Team's recommendations for next year.

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 2000 numbers at age estimated in the assessment. This vector is then projected forward to the beginning of 2001 using the schedules of natural mortality and selectivity described in the assessment and the best available estimate of total (year-end) catch for 2000. 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 2001, 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 2001 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 2001 and 2002, 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 2001 is estimated to be below ½ $B_{35\%}$, the stock is below its MSST. If spawning biomass for 2001 is estimated to be above $B_{35\%}$, the stock is above its MSST.

(2) If spawning biomass for 2001 is estimated to be above ½ $B_{35\%}$ 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 2011 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 2003 is below ½ $B_{35\%}$, the stock is approaching an overfished condition.

(2) If the mean spawning biomass for 2003 is above $B_{35\%}$, the stock is not approaching an overfished condition.

(3) If the mean spawning biomass for 2003 is above ½ $B_{35\%}$ but below $B_{35\%}$, the determination depends on the mean spawning biomass for 2013. If the mean spawning biomass for 2013 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.

Environmental Conditions

The EBS bottom temperature during the 1999 trawl survey was the coldest temperature ever recorded for EBS trawl survey. The mean bottom temperature was 0.81^{o}C versus the average of 2.54^{o}C, from 1982-1998. The trawl survey biomass estimates changed, sometimes extensively, between the 1998 and 1999 survey, for several species. Pollock and Pacific cod trawl survey biomass estimates increased by 61% and 9%, respectively. Flatfish species estimates tended to decrease, with yellowfin sole decreasing by 44%, arrowtooth flounder by 29%, rock sole by 22%, flathead sole by 43% and other flatfish (not including Alaska plaice) by 6%. Alaska plaice was the only flatfish species to show an increase (21%). These changes in biomass estimates may have been due to changes in behavior and/or distribution of these groundfish species. The Plan Team believes monitoring for possible effects should be done during the 2000 EBS trawl survey.

Conditions were much closer to 'normal' in 2000, particularly in the middle domain. The mean bottom temp was 2.17 ^{o}C, only slightly below the long-term mean. This seemed to affect pollock more than any other species. In 1999, almost all the pollock were congregated on the outer shelf in the warmest water available, whereas in 2000, they were spread out all over as we normally expect. Most of the flatfish were up in abundance slightly to moderately, though not as much as we expected from our low catchability hypothesis from the cold year. Cold water remains north of St. Matthew.

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.

The Teams discussed research needs, and agreed that the list developed by the Plan Teams and Scientific and Statistical Committee was fairly comprehensive. Several research needs were identified during the Plan Team deliberations, and these are included in the summary section for each species.

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 2001 are those recommended by the Plan Team. Catch data are current through 10/28/2000.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
EBS	1999	7,040,000	1,720,000	992,000	992,000	988,674
	2000	7,700,000	1,680,000	1,139,000	1,139,000	1,112,100
	2001	10,060,000	2,350,000	1,842,000	n/a	n/a
AI	1999	106,000	31,700	23,800	2,000	1,010
	2000	106,000	31,700	23,800	2,000	1,228
	2001	106,000	31,700	23,800	n/a	n/a
Bogoslof	1999	403,000	21,000	15,300	1,000	21
	2000	475,000	95,000	71,300	1,000	28
	2001	300,000	60,200	45,200	n/a	n/a

Eastern Bering Sea:

This year's pollock chapter features new data from the 2000 fishery and bottom trawl and echo-integration trawl surveys. The 2000 bottom trawl survey estimated a biomass of 5,140,000 t, an increase of 44% relative to the 1999 estimate and following a 61% increase from 1998 to 1999. The 2000 echo-integration trawl survey estimated a biomass of 3,005,000 t, a decrease of 7% relative to the 1999 estimate and following an increase of 27% from the 1997 estimate, the last year an echo-integration trawl survey was conducted in this region. Ten alternative models are presented in the chapter, all of which follow the statistical age-structured approach that was used last year to set ABC for 2000. All but one of these ten models estimate 2000 age 3+ biomass to fall between 10,200,000 t and 11,200,000 t (the other model gives a value of 6,900,000 t).

Of the ten models presented, the Plan Team based its recommendations for 2001 on Model 1, which assumes a Ricker stock-recruitment relationship and uses the commercial fishery selectivity pattern from 1999 to make projections of future catch and stock size. This model is most similar to the model used by the Plan Team last year to recommend the 2000 ABC, except that the selectivity estimates are based only on estimates from 1999 since the establishment of cooperatives and new regulations may be best reflected in the most recent year of fishery data. In addition this year’s model runs all include the fishery CPUE data from 1965-1976.

The predicted strength of the 1996 year class is larger than observed for the 2000 bottom trawl and EIT surveys. This discrepancy likely is due to the model trying to match the substantial increase in trawl survey biomass estimate by overestimating the 1996 year class strength, out-of-line with what’s implied by the age compositions. Some contradiction apparently exists between the observed biomass estimate and the observed age compositions. However this contradiction does not appear to lead to substantial bias in the abundance estimates.

Abundance estimates from 1993 to 1999 increased sharply in this year’s assessment. For example the estimate of 1999 age 3+ biomass is 7,513,000 t for last year’s assessment and 10,772,000 t for this year’s assessment, a 43% increase. The change in estimated abundance is the main reason the Tier 3b recommendation for 2001 is substantially larger than the Tier 3b recommendation for 2000. The change in estimated abundance appears reasonable. From 1998-1999 survey biomass increased 61% and from 1999-2000 increased 44%. The increased abundance estimate from 1998-1999 essentially was ignored by the model, but after two year's of increases in a row, the model mimics this consistent increase.

Last year, 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 2,125,000 t, 0.71, and 1.18, respectively, compared to 1,790,000 t, 0.50, and 0.80, respectively, from last year's assessment. Projected spawning biomass for 2001 is 2,761,000 t (at time of spawning, fishing at F_{MSY}), placing EBS walleye pollock in sub-tier "a" of Tier 1. The maximum permissible value of F_{MSY} under Tier 1a is 0.71, the harmonic mean of the probability density function for F_{MSY}. A fishing mortality rate of 0.71 translates into a 2001 catch of 2,125,000 t, which would be the maximum permissible ABC under Tier 1a (compared to 1,200,000 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 3. The Tier 3 reference points $B_{40\%}$ and $F_{40\%}$ are estimated at values of 2,426,000 t and 0.49, respectively, similar to 2,340,000 t and 0.48 from last year's assessment. The projected spawning biomass for 2001, 3,066,000 t (at time of spawning, fishing at $F_{40\%}$), is above $B_{40\%}$, so the maximum permissible value of F_{ABC} that would be allowed under Tier 3 is not adjusted downward. The 2001 catch associated with a fishing mortality rate of 0.49 is 1,842,000 t, a 13% reduction from the maximum permissible level under Tier 1. The Plan Team wishes to emphasize that use of the Tier 3b formula to recommend an ABC is not intended to change EBS walleye pollock's classification as a Tier 1 stock. While the Plan Team feels that the Tier 1 reference points are reliably estimated given current model structure, it concurs with the senior assessment author that some issues surrounding model specification remain to be addressed. In other words, alternative model structures should be explored to determine if the current model structure adequately captures the degree of uncertainty surrounding reference points such as F_{MSY}. Some alternative model structures might focus on use of the stock-recruitment relationship and the effect of regime shifts thereupon. The Plan Team notes that the MSY estimate from Model 5 is 38% greater than the estimate from Model 2, and that the F_{MSY} estimate from Model 5 is 130% greater than the estimate from Model 2.

The Plan Team recommends a 2001 ABC of 1,842,000 t. Although this ABC is a 62% increase from the 1,139,000 t ABC approved for 2000, the Plan Team recommends the increased 2001 ABC for the following reasons:

1) The model to estimate abundance and the method to recommend 2001 ABC are the same as those used for the 1999 and 2000 ABC values.

2) Abundance has substantially increased and so a substantial increase in ABC appears reasonable. A broad distribution of ages in the population are average strength or better (Figure 1.31), not only the strong 1996 year class. The catch will come from multiple year classes, not a single predominant year class as occurred for some harvests in the past. Spawning biomass is projected to stay above 35% of unfished biomass if harvesting in future years continues based on an $F_{40\%}$ policy, except for a slight dip below $B_{35\%}$ in 2003. Even if biomass equals the lower confidence bound for abundance of 5,000,000 t, a 1,840,000 t catch would result in an exploitation rate of about 30%, which the senior assessment author says is considered a reasonable maximum exploitation rate for gadid stocks.

3) Increased pollock abundance potentially provides additional prey to pollock predators. Even with the increased ABC, additional pollock is likely to be available as prey compared to three years ago when pollock

abundance was substantially less. In addition other measures are in place to provide pollock as prey to higher trophic levels.

The OFL fishing mortality rate under Tier 3a is approximately 0.80, corresponding to $F_{35\%}$. A fishing mortality rate of 0.80 translates into a 2001 OFL of 2,359,000 t. The EBS walleye pollock stock is not 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. The 1997 estimate previously was 106,000 t, but was revised this year to 94,000 t due to discrepancies found in strata definitions. The 1997 stock assessment concluded that the model which had been used to recommend ABC for 1997 was no longer reliable due to the confounding effect of immigration from other areas, and the SSC determined that Aleutian pollock qualified for management under Tier 5. The recommended 1998, 1999, and 2000 ABC was 23,800 t, computed as the product of the 1997 survey biomass estimate and 75% of the natural mortality rate (0.3). The recommended 1998, 1999, and 2000 OFL was 31,700 t, computed as the product of the 1997 survey biomass estimate and the natural mortality rate. Anticipating that the SSC will continue to find that Aleutian pollock qualify for management under Tier 5, the Plan Team recommends retaining the 2000 survey biomass estimate as the best available estimate of biomass in 2000, which keeps 2001 ABC and OFL at their respective 2000 levels. 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 2000 hydroacoustic survey of the Bogoslof region resulted in a biomass estimate of 301,000 t. Last year, the Plan Team and SSC recommended that Bogoslof pollock be placed in Tier 5. The placement of Bogoslof pollock in Tier 5 classify it similarly with Aleutian pollock, a stock which generally has about the same quality of assessment information. The Plan Team's recommendations of 2001 ABC and OFL are based on the hydroacoustic survey estimate for the entire spawning aggregation (301,000 t), rather than the biomass observed in Area 518 alone. Because the hydroacoustic survey is attempting to measure the biomass of a discrete spawning aggregation, the Plan Team believes that it is appropriate to use the entire biomass estimate rather than the proportion of the estimate that happened to reside in Area 518 at the precise time of the survey. In SAFE reports previous to last year, ABC calculations were made by projecting the hydroacoustic biomass estimate forward to account for natural mortality, but not growth or recruitment. In contrast, growth and recruitment have been assumed to balance natural mortality for all other BSAI stocks lacking an age- or length-structured assessment model. The Plan Team recommends that the assumptions of zero growth and zero recruitment be discontinued for Bogoslof pollock, and recommends instead that projected biomass be set equal to the most recent survey biomass estimate. The Plan Team's recommendation for the maximum permissible 2001 ABC is 45,200 t (= 301,000 t × M × 0.75), which is the Plan Team's recommended ABC and for 2001 OFL is 60,200 t (= 301,000 t × M). As a Tier 5 stock, it is not possible to determine whether Bogoslof pollock is overfished or whether it is approaching an overfished condition.

The Plan Team received the pollock assessment later than usual because the senior assessment author was busy with preparation of the SEIS and Biological Opinion.

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 2001 are those recommended by the Plan Team. Catch data are current through 10/28/2000.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
BSAI	1999	1,210,000	264,000	177,000	177,000	170,456
	2000	1,300,000	240,000	193,000	193,000	173,995
	2001	1,320,000	248,000	188,000	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 528,000 t, a 9% decrease from last year's estimate and the lowest observed value for the survey. The Aleutian Islands were surveyed in 2000; the biomass increased 63% from 1997. Estimates of abundance are somewhat higher for the 2000 assessment compared to the 1999 assessment. For example, estimated 2001 spawning biomass for the BSAI stock is 369,000 t, up about 10% from last year's F_{ABC} projection for 2001. 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 389,000 t, 0.29, and 0.35, respectively. Fishing at a rate of 0.29 is projected to result in a 2001 spawning biomass of 369,000 t, and solves the equation for the maximum permissible value of F_{ABC} under tier 3. Because projected biomass for 2001 is less than $B_{40\%}$, Pacific cod qualify for management under sub-tier "b" of tier 3. Fishing at an instantaneous rate of 0.29 is projected to result in a 2001 catch of 214,000 t, which is the maximum permissible ABC under Amendment 56. However, the Plan Team concurs with the chapter authors' recommendation to set 2001 ABC at 188,000 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 each of the last four years 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 not only on the basis of these decision-theoretic concerns, but also 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 have been well below average. A 2001 catch of 188,000 t would represent a decrease of 2% over the 2000 ABC of 193,000 t, the same direction as the 9% decrease in the trawl survey biomass estimate. Spawning biomass projected for 2001 is 38% of it's unfished level. Spawning biomass is projected to decline through 2004. ABC reaches a minimum of 150,000 t in 2003. A 2001 catch of 188,000 t corresponds to a fishing mortality rate of 0.28, below the value of 0.29 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 assessment author was unable to redo the Bayesian meta-analysis because of lack of time caused by preparation of the SEIS and Biological Opinion.

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 2001 are those recommended by the Plan Team. Catch data are current through 10/28/2000.

Area	Year	Age 2+ Bio.	OFL	ABC	TAC	Catch
BSAI	1999	3,180,000	308,000	212,000	207,980	69,233
	2000	2,820,000	226,000	191,000	123,262	76,714
	2001	2,380,000	209,000	176,000	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 1,580,000 t, an increase of 21% from last year's survey, but still a 32% decline from 1998. The sharp decrease in 1999 was attributed in part to cold water which might have decreased availability. However, both the 1999 and 2000 trawl survey lower estimates may be due to the survey being performed earlier, when a significant portion of the stock is still at the spawning grounds in shallow water. Extra tows were done outside the normal trawling area (in shallow waters) and concentrations of yellowfin sole were encountered. An AI trawl survey was also performed and caught yellowfin sole in only two tows, of less than 20 kg each. The biomass estimate for the AI is not included in the model due to the relatively low catch.

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 502,000 t, 0.11, and 0.13, respectively. Given that the projected 2001 spawning biomass of 742,000 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 $F_{40\%}$ (=0.11) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2001 ABC of 176,000 t.

The Plan Team's OFL was determined from the Tier 3a formula, where an $F_{35\%}$ value of 0.13 gives a 2001 OFL of 209,000 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.

Recommendations for next year's assessment

The extensive drop in yellowfin sole biomass from the trawl survey may be due to a change in availability, due to spawning occurring later the last two years and/or the survey being earlier; spawning occurs inshore in an area outside the survey sampling frame. The Plan Team recommends that the authors explore model sensitivity to catchability prior in the model. Also, the Plan Team recommends further investigation of spatial and temporal distribution of the spawning stock.

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 2001 are those recommended by the Plan Team. Catch data are current through 10/28/00.

Area	Year	Age 1+ Bio.	OFL	ABC	TAC	Catch
BSAI	1999	177,000	29,700	14,200	9,000	5,852
	2000	233,000	42,000	9,300	9,300	6,927
	2001	210,000	31,000	8,400	n/a	n/a

The stock assessment document was not complete for Greenland turbot at the November Plan Team meeting because the senior assessment author was involved in the preparation of the SEIS and Biological Opinion. However, the Plan team did hear a brief presentation form the stock assessment author. The current assessment is a straightforward update of last year's assessment, incorporating new catch and survey information.

The SSC has determined that 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 81,200 t, 0.26, and 0.32, respectively. Projected spawning biomass for 2001 is 136,000 t, placing Greenland turbot in sub-tier "a" of Tier 3. The Plan Team notes that the ratio of spawning biomass to $B_{40\%}$ has changed slightly since last year's assessment. The maximum permissible value of F_{ABC} under Tier 3a is 0.26. A fishing mortality rate of 0.26 translates into a 2001 catch of 27,400 t, which would be the maximum permissible ABC under Amendment 56. The Plan Team concurs with the authors' recommendation to set the 2001 ABC at a value substantially less than the maximum permissible, using $F_{ABC} = 0.25 \times max\ F_{ABC}$, which results in a 2001 ABC of 8,400 t. The Plan Team believes that a 2001 ABC well below the maximum permissible value is warranted for the following reasons: 1) estimated age 1+ biomass has trended downward continually since 1972; 2) the 7 most recent age 1 recruitments constitute 7 of the lowest 8 values in the entire time series; and 3) if the maximum permissible ABC of 27,400 t were actually caught, this would constitute the highest catch since 1983, even though spawning biomass in 2001 is projected to be less than half of what it was in 1983.

The OFL fishing mortality rate is computed under Tier 3a, $F_{OFL} = F_{35\%} = 0.32$, and translates into a 2001 OFL of 31,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Recommendations for next year's assessment

1) Longline catches have represented an increasing share of the reported Greenland turbot catches in recent years. Because killer whales can remove substantial amounts of catch from longlines, the Plan Team recommends that the authors analyze observer data to estimate how much unreported mortality occurs due to killer whale depredation, and include this estimate of unreported mortality in the assessment model. 2) Shelf and slope trawl surveys and longline surveys are currently used to index Greenland turbot abundance in the assessment model. The Plan Team recommends that the authors weight the survey likelihood components by the respective annual sampling variances. The Plan Team also recommends that the authors include longline survey data from all available years in the model.

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 9/16/00.

Area	Year	Age 1+ Bio.	OFL	ABC	TAC	Catch
BSAI	1999	819,000	219,000	140,000	134,354	11,376
	2000	785,000	160,000	131,000	131,000	12,818
	2001	701,000	157,000	130,000	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 340,000 t, a 29% increase relative to last year's estimate and similar to the 1998 trawl survey. The 2000 AI trawl survey resulted in a biomass estimate of 93,500 t, which represents 22% of the BS/AI arrowtooth flounder combined biomass estimate from the trawl surveys. The biomass estimate for the AI is not included in the model due to the low relative catch.

Reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, 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 183,000 t, 0.24 and 0.29, respectively. Given that the projected 2001 spawning biomass of 458,000 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 $F_{40\%}$ (=0.24) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2000 ABC of 130,000 t.

The OFL fishing mortality rate is computed under Tier 3a, $F_{OFL} = F_{35\%} = 0.29$, and translates into a 2000 OFL of 157,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

The effort in the fishery increased this year due to a developing market in Japan for arrowtooth flounder, though still a low exploitation rate (< 0.02). The arrowtooth flounder stock continues to decline, as does several other flatfish stocks, due to the low recruitment in the last decade.

Recommendations for next year's assessment

Survey data indicate that more than half of each year's sample consists of females (yearly estimates range between 55% and 75%), which is consistent with findings for this species in the Gulf of Alaska. However, attempts to reflect this in last year's stock assessment proved unsuccessful due to constraints of the modeling software used. Authors are encouraged to use more flexible software to develop a model that reflects the unequal sex ratio observed by the survey. The authors noted that they had intended to make this change in this assessment, but SEIS took precedence.

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 2001 are those recommended by the Plan Team. Catch data are current through 10/28/2000.

Area	Year	Age 2+ Bio.	OFL	ABC	TAC	Catch
BSAI	1999	2,320,000	444,000	309,000	120,000	41,088
	2000	2,070,000	273,000	230,000	134,760	49,494
	2001	1,940,000	271,000	228,000	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 2,130,000 t, a 26% increase relative to last year's estimate, and very similar to the 1998 trawl survey estimate. An Aleutian Island trawl survey was also performed and resulted in a biomass estimate of 46,000 t, which represents only 2% of the BS/AI rock sole combined biomass estimate from the trawl surveys. The biomass estimate for the AI is not included in the model due to the low relative catch.

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 285,000 t, 0.16, and 0.19, respectively. Given that the projected 2001 spawning biomass of 676,000 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 2001 ABC of 230,000 t.

The Plan Team's OFL was determined from the Tier 3a formula, where an $F_{35\%}$ value of 0.19 gives a 2001 OFL of 273,000 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.

Flathead Sole

Status and catch specifications (t) of **flathead sole** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2001 are those recommended by the Plan Team. Catch data are current through 10/28/2000.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
BSAI	1999	710,000	118,000	77,300	77,300	17,777
	2000	660,000	90,000	73,500	52,652	19,640
	2001	618,000	102,000	84,000	n/a	n/a

The present assessment includes significant changes from last year's assessment, including use of AD Model Builder as a modeling platform and incorporation of new catch and survey information. This model included a new, simpler selectivity function that yielded a slightly lower, though smoother, curve. The new AD Model Builder estimates tested favorably against the previously used Synthesis model. Furthermore, there was an Aleutian Island trawl survey in 2000 and those data and estimates are combined here with the EBS data. This year's EBS bottom trawl survey resulted in a biomass estimate of 399,000 t, a 1% 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 134,000 t, 0.30, and 0.38, respectively. Given that the projected 2001 spawning biomass of 268,000 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 $F_{40\%}$ (=0.30) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2001 ABC of 84,000 t.

The Plan Team's OFL was determined from the Tier 3a formula, where an $F_{35\%}$ value of 0.38 gives a 2001 OFL of 102,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Recommendations: The Plan Team commends the author for implementing AD Model Builder. We acknowledge that there is a good long-term data set for flathead sole that aids the modeling process. This new model is age-structured and must be adapted to be length-based because only length data, not age data, are available for flathead sole. Flatfish are known to change size at age, as is currently happening for rock sole. The Plan Team further notes that while the abundance is still above $B_{40\%}$, the biomass of flathead sole, like that of other flatfishes, appears to be decreasing. The most recent year in which otoliths were aged for flathead sole was 1995. We recommend that flathead sole otoliths be collected and processed at least every three years to validate the length at age relationship because growth rates have been changing for flatfish in general.

Last year the SSC suggested that was an apparent Ricker function between spawners and recruits. The author investigated the relationship. The Plan Team noted that there is a strong chronological pattern to these data. It looks like autocorrelation and the strongest relationship appears to be a decrease in biomass over time. This is likely due to a lack good recruitment in recent years. The Plan Team suggests investigation 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 (age 1+ biomass is shown for 1999 and 2000, age 2+ for 2001). The OFL and ABC for 2001 are those recommended by the Plan Team. Catch data are current through 10/28/00.

	Year	Age 2+ Bio.	OFL	ABC	TAC	Catch
BSAI	1999	618,000	248,000	154,000	154,000	15,184
	2000	829,000	141,000	117,000	83,813	15,596
	2001	865,000	147,000	122,000	n/a	n/a

The present assessment is a straightforward update of last year's assessment, assessment, including use of AD Model Builder as a modeling platform for Alaska plaice only. The new model further was improved by using individual c.v.'s of surveys to weight surveys each year as a replacement for the average c.v. values used previously. The assessment also incorporates new catch and survey information. This year's EBS bottom trawl survey resulted in biomass estimates of 444,000 t for Alaska plaice and 80,000 t for the remaining species in the "other flatfish" complex. The other "other flatfish" are Dover sole (1%), rex sole (21%), longhead dab (17%), Sakhalin sole (<1%), starry flounder (58%), butter sole (2%) and English sole (<1%). This represents a decrease of 19% in Alaska plaice and an increase of 15% of "other flatfish" relative to last year's estimates. Note that last year, plaice increased and "others" decreased. The Plan Team again notes that Alaska plaice does not follow the same interannual trends as the other major flatfish species. However, like the other flatfishes, the population of Alaska plaice appears to be gradually declining and there has been no apparent strong recruitment recently.

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 111,000 t (Alaska plaice only), 0.29, and 0.36, respectively. Given that the projected 2001 spawning biomass (Alaska plaice only) of 217,000 t exceeds B40%, the Plan Team's ABC and OFL recommendations for 2001 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 FABC at the $F_{40\%}$ level (=0.29), which is the maximum allowable under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2001 ABC of 122,000 t for Alaska plaice. For the remaining species in the flatfish complex, the Plan Team recommends FABC at the $F_{40\%}$ level (=0.30), which is the maximum allowable under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2001 ABC of 18,000 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 (=0.35) gives a 2001 OFL of 147,000 t. For the "other flatfish" species, the Plan Team recommends an $F_{35\%}$ value (=0.38) giving a 2001 OFL of 22,000 t. Model projections indicate that this stock complex is neither overfished nor approaching an overfished condition.

The Plan Team recommends the author continue to analyze Alaska plaice separately from the other less abundance species.

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 2001 are those recommended by the Plan Team. Catch data are current through 10/28/2000.

Area	Year	Age 4+ Bio.	OFL	ABC	TAC	Catch
EBS	1999	17,000	2,090	1,340	1,340	628
	2000	18,000	1,750	1,470	1,470	742
	2001	20,000	1,910	1,560	n/a	n/a
AI	1999	26,000	2,890	1,860	1,380	629
	2000	33,000	3,090	2,430	2,430	1,020
	2001	38,000	3,070	2,500	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 decreased 10% in numbers and 8% in weight from 1999 to 2000. These decreases follow increases from 1998 to 1999 in the survey abundance index of 10% in numbers and 5% in weight and in the fishery abundance index of 7% in weight, so that relative abundance in 2000 is similar to 1998. Fishery abundance data for 2000 were not analyzed because the fishery remains open. Exploitable and spawning biomass are projected to increase 3 and 4%, respectively, from 2000 to 2001. Alaska sablefish abundance now appears low and stable. This confirms the conclusion from last year's assessment that the abundance trend has changed from low and slowly decreasing to low and stable. Abundance is projected to continue to increase slowly; the rate of the increase depends on the actual strength of the above-average 1997 and 1998 year classes.

A simple Bayesian analysis was completed by examining the effect of uncertainty in natural mortality and survey catchability on parameter estimation. A decision analysis was completed using the posterior probability from the Bayesian analysis to determine what catch levels likely will decrease abundance. The decision analysis indicates that a yield of 16,800 mt will maintain spawning biomass. The Team commends that assessment author for providing this analysis, and recommended that analysis of uncertainty and risk-assessment be continued..

The maximum permissible yield from an adjusted $F_{40\%}$ strategy is 16,900 mt. Based on these results, the Plan Team recommends a 2001 ABC of 16,900 mt for the combined stock, similar to the 2000 ABC of 17,300 mt (2% decrease).

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 213,000 t (combined across the EBS, AI, and GOA), 0.12, and 0.15, respectively. Projected spawning biomass (combined areas) for 2000 is 178,000 t, placing sablefish in sub-tier "b" of Tier 3. The maximum permissible value of F_{ABC} under Tier 3b is computed as follows:

$F_{ABC} \le F_{40\%} \times(B_{2000} / B_{40\%}$-0.05)/(1-0.05) = 0.12×(178,000/213,000-0.05)/0.95 = 0.10

A fishing mortality rate of 0.10 translates into a 2001 catch (combined areas) of 16,900 t, which would be the maximum permissible ABC under Amendment 56, and is the Plan Team's recommended 2000 ABC. A 5-year exponential weighting of longline survey relative abundance may be used to apportion the combined 2000 ABC among regions, resulting in the following values: EBS--1,560 t, AI--2,500 t, and GOA--12,840 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)= 0.15×(178,000/213,000-0.05)/0.95 = 0.12

A fishing mortality rate of 0.14 translates into a 2001 OFL (combined areas) of 20,700 t. Using the survey-based apportionment scheme described above, 2001 OFL also may be apportioned among regions and results in the following values: EBS–1,910 t, AI–3,070 t, and GOA–15,720 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

The senior assessment author planned to incorporate information on juvenile sablefish abundance in this year's assessment, but was unable to do so because of the time needed to prepare the SEIS. This information should increase the accuracy of abundance projections, and the Plan Team encourages the authors to incorporate it in next year's assessment.

Pacific ocean perch (POP)

Status and catch specifications (t) of **Pacific ocean perch** 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 2000 are those recommended by the Plan Team. Catch data are current through 9/30/00.

Pacific Ocean Perch

Area	Year	Age 9+ Bio.	OFL	ABC	TAC	Catch
EBS	1999	45,500	3,600	1,900	1,400	381
	2000	45,700	3,100	2,600	2,600	451
	2001	41,000	2,040	1,730	n/a	n/a
AI	1999	236,000	19,100	13,500	13,500	11,880
	2000	192,000	14,400	12,300	12,300	8,576
	2001	191,000	11,800	10,200	n/a	n/a

Eastern Bering Sea

The present assessment is a straightforward update of last year's assessment, incorporating new catch 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 21,500 t, 0.049, and 0.058, respectively. Projected spawning biomass for 2001 is 18,100 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:

$F_{ABC} \leq F_{40\%} \times(B_{2001}/B_{40\%}-0.05)/(1-0.05) = 0.049\times(18{,}100/21{,}500-0.05)/0.95 = 0.040$

Projected harvesting at a fishing mortality rate of 0.040 gives a 2001 catch of 1,730 t, which is the Plan Team's recommended ABC (last year's ABC was set using a higher fishing mortality rate, 0.054, in part because last year's $B_{40\%}$ estimate of 26,200 t was higher than this year's estimate of 21,500 t).

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

$F_{OFL} = F_{35\%}\times(B_{2001}/B_{40\%}-0.05)/(1-0.05)= 0.058\times(18{,}100/21{,}500-0.05)/0.95 = 0.048$

Projected harvesting at a fishing mortality rate of 0.048 gives a 2001 catch of 2,040 t, which is the Plan Team's recommended OFL. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Aleutians:

The present assessment is a straightforward update of last year's assessment, incorporating new catch information and age composition data. Reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{30\%}$ 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 89,100 t, 0.062, and 0.073, respectively. Projected spawning biomass for 2001 is 84,900 t, placing true POP in the Aleutians in sub-tier "b" of Tier 3. The maximum F_{ABC} value allowed under Tier 3b is computed as follows:

$F_{ABC} \leq F_{40\%} \times(B_{2001}/B_{40\%}-0.05)/(1-0.05) = 0.062\times(84{,}900/89{,}100-0.05)/0.95 = 0.059$

Projected harvesting at a fishing mortality rate of 0.059 gives a 2001 catch of 10,200 t, which is the Plan Team's recommended ABC. The ABC is apportioned among AI subareas based on survey distribution as follows: Western AI = 46.5%, Central AI = 25.1% , and Eastern = 28.4%, corresponding to 4,749 t (W), 2,563 t (C), and 2,900 t (E).

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

$F_{OFL} = F_{35\%}\times(B_{2001}/B_{40\%}-0.05)/(1-0.05)= 0.073\times(84{,}900/89{,}100-0.05)/0.95 = 0.069$

Projected harvesting at a fishing mortality rate of 0.069 gives a 2001 catch of 11,800 t, which is the Plan Team's recommended OFL. 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 2001 are those recommended by the Plan Team.

Area	Year	Biomass	OFL	ABC	TAC	Catch
Northern Rockfish						
BSAI	2001	150,000	9,020	6,760	n/a	n/a
Rougheye Rockfish						
BSAI	2001	14,000	349	262	n/a	n/a
Shortraker Rougheye						
BSAI	2001	34,000	1,020	766	n/a	n/a

For several years, the Plan Team had recommended that separate chapters be prepared for *S. alutus* and the combined "other red rockfish". It was felt that separate chapters would improve the clarity of the assessment and facilitate better understanding of the methodology used and the results obtained. The Team had also recommended that the authors examine the possibility of specifying area-specific OFLs, ABCs, and TACs for the shortraker/rougheye complex and a combined-area OFL, ABC, and TAC for the northern/sharpchin complex. The Team had further recommended that future assessments include catch and survey data by individual species to determine if differential harvest rates exist. The Plan Team commends the authors for addressing all of these recommendations in the current assessment and chapter appendix.

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, 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 that 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 northern rockfish in the Bering Sea in 2000. Establishing ABCs on a species by species basis would help prevent overfishing.

There are also immediate economic and management issues to be addressed by splitting out the other red rockfish category. Quite simply, the low abundance of rockfish in the EBS would be very constraining to the fleet. The low OFL calculated for the 2001 EBS other red rockfish complex (180 mt) could greatly impact the 2001 fisheries. Note that the 2000 catch was 228 mt even though it was on bycatch status all year. Other target fisheries could be shut down, or prohibited to retention, to prevent the OFL from being exceeded.

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 2001 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:

	BS	AI
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 2001 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.

The author noted that he had intended to present this analysis of breaking out the species complex at the September Plan Team meeting. This meeting was cancelled due to the SEIS preparation. Hence, the Team discussion of this important measure was limited to only the November meeting.

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 2001 are those recommended by the Plan Team. Catch data are current through 10/28/00.

Area	Year	Biomass	OFL	ABC	TAC	Catch
EBS	1999	7,030	492	369	369	141
	2000	7,030	492	369	369	235
	2001	6,880	482	361	n/a	n/a
AI	1999	13,000	913	685	685	659
	2000	13,000	913	685	685	583
	2001	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. Last year, 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 2001 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 2001 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 and this raised some concerns about the potential for localized overfishing. For example, the catch in 2000 of Dusky rockfish in the EAI was 171 mt, whereas the estimated biomass was 522 mt. The Plan Team recommends that the author continue with this analysis of exploitation rates for individual species in this complex.

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 2000 are current through 10/28/00.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
AI	1999	595,000	148,000	73,300	66,400	53,643
	2000	565,000	119,000	70,800	70,800	42,394
	2001	553,000	138,000	58,700	n/a	n/a

Because of other priorities (SEIS preparation), a complete Atka mackerel chapter was not available for the Plan Team's review at it's November 2000 meeting. Only figures and tables were available, and these were handed out at the presentation. The limited materials made Plan Team consideration more difficult.

New catch data, survey biomass estimates, 1999 fishery and 2000 survey age data were incorporated into the model. The SSC has determined that this stock 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 154,000 t, 0.35, and 0.42, respectively. Projected spawning biomass for 2001 is 159,000 t, placing Atka mackerel in sub-tier "a" of Tier 3. The maximum F_{ABC} value allowable under Tier 3a is $F_{40\%}$ (0.35). Projected harvesting at a fishing mortality rate of 0.35 gives a 2001 catch of 128,000 t, which is the maximum permissible value of ABC under Tier 3a. The assessment authors recommend setting F_{ABC} at a value of 0.19 would give a 2001 catch of 58,700 t. The F_{ABC} value was computed from the $F_{40\%}$ value by adjusting the $F_{40\%}$ value based on the c.v. of the survey biomasses, which results in a 44% downward adjustment of F.

The Plan Team, by a vote of 4-2 with 2 abstentions, agreed with the author's motivation for developing the adjustment of the $F_{40\%}$,rate. Stock size continues to decline, current biomass is about 40% of the peak estimated in the early 1990's. The 5 surveys from 1986 through 2000 are highly variable, the biomass estimates for a 95% confidence interval are very large in several cases ranging from zero to more than double the estimate. Atka mackerel are difficult to survey, applying the model's estimate of $F_{40\%}$ to the model's estimate of next year's biomass does not address the substantial uncertainty surrounding these biomass estimates. The adjustment method incorporates a measure of uncertainty regarding the survey estimates into the harvest strategy.

The Team commends the authors for attempting to incorporate data variability into the assessment. Nevertheless, the authors adjustment is a very simple approach. For example, it only considers one part of the data variability in the trawl survey. The Team recommends that the authors develop a more sophisticated method of incorporating variability into the assessment. The Team does not wish this approach to become the standard approach for recommending ABC.

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 58,700 t, this formula gives the following subarea-specific ABCs: Eastern Bering Sea and Eastern Aleutians = 6,600 t (11.2%), Central Aleutians = 28,500 t (48.5%), Western Aleutians = 23,600 t (40.2%). The Plan Team discussed other possible weighting schemes including a 3 survey, unweighted average.

The Plan Team's OFL was determined from the Tier 3a formula, where an $F_{35\%}$ value of 0.42 gives a 2001 OFL of 138,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

The Plan Team expressed the following concerns. The 2000 survey found very little Atka mackerel in the Eastern Aleutian District. Previous survey biomass estimates ranged from about 45,000 to 208,000 t. The 2000 survey estimate for that district was 922 t. Catch rates from commercial and research fishing just prior to the survey indicated abundant Atka mackerel. Using the previous year's percentages for ABC apportionments to demonstrate the impact of that estimate, apportionments to that district are cut by about half when the low biomass value estimated for the Eastern Aleutian District is incorporated into the method for distributing the ABC. The low biomass estimate is counterintuitive. When combined with the previously mentioned large confidence intervals associated with the 5 surveys occurring between 1986 and 2000, the estimate promotes concerns that current survey methods, while appropriate for estimating groundfish biomass, 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, etc.) in recent years. The OFL and ABC for 2001 are those recommended by the Plan Team. Catch data are current through 10/28/00.

Squid

Area	Year	Biomass	OFL	ABC	TAC	Catch
BSAI	1999	n/a	2,620	1,970	1,970	401
	2000	n/a	2,620	1,970	1,970	333
	2001	n/a	2,620	1,970	n/a	n/a

Other Species

Area	Year	Survey Bio.	OFL	ABC	TAC	Catch
BSAI	1999	643,000	122,100	32,860	32,860	18,677
	2000	611,000	71,500	31,360	31,360	20,696
	2001	567,000	113,000	26,500	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 2001 therefore is 1,970 t, which is the Plan Team's recommended value.

The "other species" assessment is an update of last year's assessment, incorporating new catch and survey biomass information. For the 2000 fishing year the SSC disagreed with the Plan Team for the ABC for other species. Using a Tier 5 ABC determination process and a 10 year 'stair step' strategy the SSC recommended the 2000 other species ABC as 31,600.

The assessment author noted that enough parameters can be estimated to suggest that the ABC and OFL for the other species assemblage could be set using the criteria in Tier 5, however the values derived would increase the potential annual catch over 3-fold. The Plan Team concurs with the author that there is no compelling reason to alter the method of computing the ABC and is concerned that more information regarding the large number species comprising this complex is necessary before exploitation is encouraged by an increased ABC. Therefore, the Plan Team recommends a 2001 ABC equal to the average catch, which is 26,500 t.

The Plan Team recommends that the authors consider breaking out some species from the “other species” complex to reduce the potential for over-harvesting species such as sharks and skates.

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
FINFISHES			
Salmon	Walleye pollock	Sculpins	Eulachon
Pacific halibut	Pacific cod	Sharks	Capelin
Pacific herring	Yellowfin sole	Skates	Sandlance
Steelhead trout	Greenland turbot	Smelt	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		
INVERTEBRATES			
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, 1954-2000.							
Year	Pollock	Pacific Cod	Sable Fish	Pacific Ocean Perch Complex	Other Rock Fish	Yellow Fin Sole	Greenland Turbot
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/d	889,589	134,647	646	609	135	67,307	5,205
2000/e	1,002,916	123,515	677	684	229	72,644	5,600

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	1,202,386
2000	11,149	34,663	48,608	239	326	18,078	1,319,328

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, 1999.
e/ Data through November 1, 2000. 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, 1962-2000.

Year	Pollock	Pacific Cod	Sable Fish	Pacific Ocean Perch Complex	Other Rock Fish	Greenland Turbot	Yellow 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/c	965	27,714	565	17,619	630	422	13
2000/d	1,164	32,187	930	13,686	547	994	12

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	104,581
2000	481	110	1,071	42,138	7	1,825	95,152

a/ Arrowtooth flounder included in Greenland turbot catch statistics.
b/ Includes POP shortraker, rougheye, northern and sharpchin rockfish.
c/ Data through December 31, 1999.
c/ Data through October 21, 2000. 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 2001. “Biomass” corresponds to projected January 2001 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	10,060,000	2,350,000	1,842,000	0.80	0.49
Walleye pollock	AI	106,000	31,700	23,800	0.20	0.15
Walleye pollock	Bogoslof	300,000	60,200	45,200	0.20	0.15
Pacific cod	BSAI	1,320,000	248,000	188,000	0.32	0.28
Yellowfin sole	BSAI	2,380,000	209,000	176,000	0.13	0.11
Greenland turbot	BSAI	210,000	31,000	8,400	0.32	0.064
Arrowtooth flounder	BSAI	701,000	157,000	130,000	0.29	0.24
Rock sole	BSAI	1,940,000	271,000	228,000	0.19	0.16
Flathead sole	BSAI	618,000	102,000	84,000	0.38	0.30
Other flatfish	BSAI	865,000	147,000	122,000	0.36 [a]	0.29 [a]
Sablefish	EBS	20,000	1,910	1,560	0.12	0.10
Sablefish	AI	38,000	3,070	2,500	0.12	0.10
Pacific ocean perch	EBS	41,000	2,040	1,730	0.048	0.040
Pacific ocean perch	AI	191,000	11,800	10,200	0.069	0.059
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	0.023 [b]
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	553,000	138,000	58,700	0.42	0.19
Squid	BSAI	n/a	2,620	1,970	n/a	n/a
Other species	BSAI	567,000	113,000	26,500	0.12	0.044
TOTAL		20,127,780	3,891,112	2,959,385		

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-- Total allowable catch (TAC) and acceptable biological catch (ABC) for 2000 (as established by the Council) and 2001 (as recommended by the Plan Team) for groundfish in the eastern Bering Sea (EBS), Aleutian Islands (AI), and Bogoslof district. Figures are in metric tons.

Species or Species Complex	Area	2000 TAC (Council)	2000 ABC (Council)	2001 ABC (Plan Team)
Walleye pollock	EBS	1,139,000	1,139,000	1,842,000
Walleye pollock	AI	2,000	23,800	23,800
Walleye pollock	Bogoslof	1,000	22,300	45,200
Pacific cod	BSAI	193,000	193,000	188,000
Yellowfin sole	BSAI	123,262	191,000	176,000
Greenland turbot	BSAI	9,300	9,300	8,400
Arrowtooth flounder	BSAI	131,000	131,000	130,000
Rock sole	BSAI	134,760	230,000	228,000
Flathead sole	BSAI	52,652	73,500	84,000
Other flatfish	BSAI	83,813	117,000	122,000
Sablefish	EBS	1,470	1,470	1,560
Sablefish	AI	2,430	2,430	2,500
Pacific ocean perch	EBS	2,600	2,600	1,730
Pacific ocean perch	AI	12,300	12,300	10,200
Other red rockfish *	EBS	*	*	194
Sharpchin/northern *	AI	*	*	5,150
Shortraker/rougheye *	AI	*	*	885
Other rockfish	EBS	369	369	361
Other rockfish	AI	685	685	676
Atka mackerel	BSAI	70,800	70,800	58,700
Squid	BSAI	1,970	1,970	1,970
Other species	BSAI	31,360	31,360	26,500

* Note that the Plan Team has recommended separating the other red rockfish into single species units for 2001, and thus are not included together in this table.

Table 6-- Summary of stock abundance (biomass), harvest strategy (rate), 2001 recommended acceptable biological catch (ABC), and stock condition for groundfish in the eastern Bering Sea (EBS), Aleutian Islands (AI), and Bogoslof district. "Biomass" corresponds to projected January 2001 abundance for the age+ range reported in the summary section. Biomass and ABC are in metric tons, reported to three significant digits. Fishing mortality rates are reported to two significant digits. "Relative biomass" is based on the long-term average, and "trend" is based on the short-term projection.

Species or Species Complex	Area	Biomass	Rate	ABC	Relative biomass, trend
Walleye pollock	EBS	10,060,000	$F_{40\%}$	1,842,000	High, stable
Walleye pollock	AI	106,000	$0.75M$	23,800	Low, stable
Walleye pollock	Bogoslof	300,000	$0.75M$	45,200	Low, stable
Pacific cod	BSAI	1,320,000	F_{cod} [b]	188,000	Average, declining
Yellowfin sole	BSAI	2,380,000	$F_{40\%}$	176,000	High, stable
Greenland turbot	BSAI	210,000	$0.25F_{40\%}$	8,400	Low, declining
Arrowtooth flounder	BSAI	701,000	$F_{40\%}$	130,000	High, declining
Rock sole	BSAI	1,940,000	$F_{40\%}$	228,000	High, declining
Flathead sole	BSAI	618,000	$F_{40\%}$	84,000	High, declining
Other flatfish	BSAI	865,000	$F_{40\%}$ [c]	122,000	High, declining
Sablefish	EBS	20,000	$F_{40\%}$ [a]	1,560	Low, stable
Sablefish	AI	38,000	$F_{40\%}$ [a]	2,500	Low, stable
Pacific ocean perch	EBS	41,000	$F_{40\%}$ [a]	1,730	Low, stable
Pacific ocean perch	AI	191,000	$F_{40\%}$ [a]	10,200	Average, stable
Northern rockfish	BSAI	150,000	$0.75M$	6,760	Not available
Rougheye rockfish	BSAI	14,000	$0.75M$	262	Not available
Shortraker rockfish	BSAI	34,000	$0.75M$	766	Not available
Other rockfish	EBS	6,880	$0.75M$ [c]	361	Not available
Other rockfish	AI	12,900	$0.75M$ [c]	676	Not available
Atka mackerel	BSAI	553,000	F_{mac} [d]	58,700	Average, declining
Squid	BSAI	n/a	$0.75F_{his}$ [e]	1,970	Not available
Other species	BSAI	567,000	F_{his} [e]	26,500	Not available
Total	BSAI	20,127,780		2,959,385	

a/ Adjusted on the basis of the relationship between projected spawning biomass and $B_{40\%}$.
b/ Species-specific harvest strategy used only for Pacific cod
c/ Proxy values used for some species.
d/ Species-specific harvest strategy used only for Atka mackerel.
e/ Fishing mortality rate implied by setting ABC equal to historic average catch.

Table 7-- 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 2001 harvest season.

Species or Species Complex	Area	Tier	*max* F_{ABC}	F_{ABC}	*max* ABC	ABC	% Red.
Walleye pollock	EBS	1a	0.71	0.49	2,125,000	1,842,000	13
Walleye pollock	AI	5	0.15	0.15	23,800	23,800	
Walleye pollock	Bogoslof	5	0.15	0.15	45,200	45,200	
Pacific cod	BSAI	3b	0.29	0.28	214,000	188,000	12
Yellowfin sole	BSAI	3a	0.11	0.11	176,000	176,000	
Greenland turbot	BSAI	3a	0.26	0.064	27,000	8,400	69
Arrowtooth flounder	BSAI	3a	0.24	0.24	130,000	130,000	
Rock sole	BSAI	3a	0.16	0.16	228,000	228,000	
Flathead sole	BSAI	3a	0.30	0.30	84,000	84,000	
Other flatfish	BSAI	3a	0.29	0.29	122,000	122,000	
Sablefish	EBS	3b	0.10	0.10	1,560	1,560	
Sablefish	AI	3b	0.10	0.10	2,500	2,500	
Pacific ocean perch	EBS	3b	0.040	0.040	1,730	1,730	
Pacific ocean perch	AI	3b	0.059	0.059	10,200	10,200	
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	3a	0.35	0.19	128,000	58,700	54
Squid	BSAI	6	n/a	n/a	1,970	1,970	
Other species	BSAI	5	0.16	0.048	85,000	26,500	69
Total					3,414,785	2,959,385	8