

**APPENDIX A**

**STOCK ASSESSMENT AND FISHERY EVALUATION REPORT**

**FOR THE GROUND FISH 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

K. Aydin, S. Barbeaux, J. Boldt, D. Chen, D. Courtney, J. DiCosimo, M. Dorn, J. Fujioka,  
S. Gaichas, K. Goldman, J. Hoff, T. Honkalehto, J. Ianelli, R. Lauth, Y. Lee, S. Lowe,  
C. Lunsford, B. Matta, M. Nelson, D. Nichol, R. Reuter, T. Sample, M. Sigler, P. Spencer,  
T. TenBrink, G. Thompson, C. Tribuzio, G. Walters, T. Wilderbuer, G. Williams,  
N. Williamson, H. Zenger

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**605 West 4th Ave., Suite 306**  
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**Stock Assessment and Fishery Evaluation Report  
for the Groundfish Resources  
of the Bering Sea/Aleutian Islands Region**

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## **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 (BSAI) 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 BSAI groundfish fisheries is compiled by the BSAI Groundfish 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 December meeting of the Council. Each stock or stock complex is represented in the report by a chapter containing the latest stock assessment. New or revised stock assessment models are generally previewed at its September Plan Team meeting, and considered by the Plan Team at its November meeting for setting specifications for the following fishing year.

Members of the Plan Team who compiled this SAFE report were Loh-lee Low (chair), Jane DiCosimo (BSAI FMP coordinator), Kerim Aydin, David Carlile, William Clark, Lowell Fritz, Brenda Norcross, Michael Sigler, Andrew Smoker, Grant Thompson, and Ivan Vining.

## **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.

Five categories of finfishes and invertebrates have been designated for management purposes (see below). They are prohibited species (species which must be returned to the sea when caught), target species

(species for which an individual TAC is established), other species (species for which an aggregate TAC is established), forage fish, and non-specified species (all species not included in one of the other categories). This SAFE report describes the status of the stocks in the target species and “other species” categories only. For finfish, the species categories other than non-specified species are populated as follow:

Prohibited Species	Target Species	Other Species	Forage Fish
Salmon	Walleye pollock	Sculpins	Eulachon
Pacific halibut	Pacific cod	Sharks	Capelin
Pacific herring	Sablefish	Skates	Sandlance
Steelhead trout	Yellowfin sole		Myctophids
	Greenland turbot		Bathylagids
	Arrowtooth flounder		Sandfish
	Rock sole		Pholids
	Flathead Sole		Stichaeids
	Alaska plaice		Gonostomatids
	Other flatfish		
	Pacific ocean perch		
	Northern rockfish		
	Shortraker and rougheye rockfish		
	Other rockfish		
	Atka mackerel		

For invertebrates, the species categories other than non-specified species are populated as follow:

Prohibited Species	Target Species	Other Species	Forage Fish
King crab	Squid	Octopus	
Tanner crab			

### 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, and total catches rose to 2.2 million t in 1972. Walleye pollock is now the principal fishery, with recent catches approximately 1.4-1.5 million t in 2001-2004. After the Magnuson Fishery Conservation and Management Act was adopted in 1976, catch restrictions and other management measures were placed on the fishery and all-species catches have since varied from one to two million t.

Catches in the Aleutian region have always been much smaller than those in the EBS. Target species have also been different (Table 3). Pacific ocean perch (POP) was the initial target species. As POP abundance declined, the fishery diversified to other species. During the early years of exploitation, overall catches of Aleutian groundfish reached a peak of 112,000 t in 1965. Atka mackerel is the largest fishery (51,700 t in 2003) in the AI, followed by Pacific cod (32,500 t in 2003). Total catches from the Aleutians in recent years have been about 100,000 t annually, after peaking at 191,000 t in 1996. Total 2004 BSAI catches through November 13 were 1.99 million t. Table 4 provides total EBS and AI catches, 1954 through November 13, 2004.

## 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 TACs equals OY for the BSAI groundfish complex, which is currently constrained by the 2.0 million t cap.

Fifteen percent (15%) of the total TACs is set aside as a reserve (except for pollock, squid, and hook-and-line and pot gear allocation of sablefish), which may be released during the season by the NMFS Regional Administrator. The ITAC, or initial TAC, for each species or complex is the remainder of the TAC after the subtraction of the reserve. Except as noted above, one half of the reserve, or 7.5 percent, is designated as a Community Development Quota (CDQ) reserve for use by CDQ participants. The reserve is released to directed fishing later in the fishing year. Ten percent of the pollock TAC is allocated as a directed fishing allowance for CDQ participants.

## Definition of Acceptable Biological Catch and the Overfishing Level

Amendment 56 defined ABC and OFL for the BSAI groundfish fisheries. The 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 described following the next paragraph.

**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  $\alpha$  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:  $\alpha < B/B_{MSY} \leq 1$

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

- 1c) Stock status:  $F_{ABC} \leq \mu_H \times (B/B_{MSY} - \alpha)/(1 - \alpha)$   
 $B/B_{MSY} \leq \alpha$   
 $F_{OFL} = 0$   
 $F_{ABC} = 0$
- 2) Information available: Reliable point estimates of B,  $B_{MSY}$ ,  $F_{MSY}$ ,  $F_{35\%}$ , and  $F_{40\%}$ .
- 2a) Stock status:  $B/B_{MSY} > 1$   
 $F_{OFL} = F_{MSY}$   
 $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%})$
- 2b) Stock status:  $\alpha < B/B_{MSY} \leq 1$   
 $F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)$   
 $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
- 2c) Stock status:  $B/B_{MSY} \leq \alpha$   
 $F_{OFL} = 0$   
 $F_{ABC} = 0$
- 3) Information available: Reliable point estimates of B,  $B_{40\%}$ ,  $F_{35\%}$ , and  $F_{40\%}$ .
- 3a) Stock status:  $B/B_{40\%} > 1$   
 $F_{OFL} = F_{35\%}$   
 $F_{ABC} \leq F_{40\%}$
- 3b) Stock status:  $\alpha < B/B_{40\%} \leq 1$   
 $F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$   
 $F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$
- 3c) Stock status:  $B/B_{40\%} \leq \alpha$   
 $F_{OFL} = 0$   
 $F_{ABC} = 0$
- 4) Information available: Reliable point estimates of B,  $F_{35\%}$ , and  $F_{40\%}$ .  
 $F_{OFL} = F_{35\%}$   
 $F_{ABC} \leq F_{40\%}$
- 5) Information available: Reliable point estimates of B and natural mortality rate M.  
 $F_{OFL} = M$   
 $F_{ABC} \leq 0.75 \times M$
- 6) Information available: Reliable catch history from 1978 through 1995.  
OFL = the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information  
 $ABC \leq 0.75 \times OFL$

## OVERVIEW OF “STOCK ASSESSMENT” SECTION

### Summary and Use of Terms

Plan Team recommendations for 2005 ABCs are summarized in Tables 5 and 6. The sum of the recommended ABCs for 2005 is about 3,100,000 t, approximately 560,000 t below the sum of the 2004 ABCs. This is about 1.1 million t above the 2 million t TAC cap employed by the Council as a conservation measure. Overall, the status of the stocks continues to appear relatively favorable, although some stocks are declining due to poor recruitment in recent years. Total biomass for 2005 (17.5 million t) is down about 12% since last year. 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. For EBS walleye pollock, the fishing mortality rate consists of the ratio between catch (in biomass) and age 3+ biomass at the start of the year.
- 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.
- 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 or when a stock-specific ABC is apportioned among areas on a percentage basis, in which case four significant digits may be used if necessary to avoid rounding error. Fishing mortality rates are reported to two significant digits.
- 5) The figures listed as last year’s ABCs correspond to the values approved by the Council. The figures listed as future ABCs correspond to the Plan Team’s recommendations.

### **Projection Scenarios and Status Determination**

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

For each scenario, the projections begin with the vector of 2004 numbers at age estimated in the assessment. This vector is then projected forward to the beginning of 2005 using the schedules of natural mortality and selectivity described in the assessment and the best available estimate of total (year-end) catch for 2004. 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 2005, 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 2005 recommended in the assessment to the  $\max F_{ABC}$  for 2005. (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 average  $F$  from the period 1999-2003. (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 2005 and 2006,  $F$  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 2005:

- (1) If spawning biomass for 2005 is estimated to be below  $\frac{1}{2} B_{35\%}$ , the stock is below its MSST. If spawning biomass for 2005 is estimated to be above  $B_{35\%}$ , the stock is above its MSST.
- (2) If spawning biomass for 2005 is estimated to be above  $\frac{1}{2} B_{35\%}$  but below  $B_{35\%}$ , the stock's status relative to MSST is determined by referring to harvest scenario #6. If the mean spawning biomass for 2015 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 2007 is below  $\frac{1}{2} B_{35\%}$ , the stock is approaching an overfished condition.
- (2) If the mean spawning biomass for 2007 is above  $B_{35\%}$ , the stock is not approaching an overfished condition.
- (3) If the mean spawning biomass for 2007 is above  $\frac{1}{2} B_{35\%}$  but below  $B_{35\%}$ , the determination depends on the mean spawning biomass for 2017. If the mean spawning biomass for 2017

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.

### **Two-Year Ahead ABC and OFL Projections**

In September of this year, preliminary projections of ABC and OFL for 2005 and 2006 were made on the basis of last year's stock assessments. In this SAFE report, the Plan Team has revised most of those projections (Table 1). Such revisions are typically due to the development of new models; collection of new catch, survey, age composition, or size composition data; or use of new methodology for recommending ABC. In the case of nearly all stocks managed under Tier 3 (Aleutian Islands walleye pollock is an exception), 2005 and 2006 projections are based on the output for Scenarios 1 or 2 (ABC) and 6 (OFL) of the standard projection model. For Aleutian Islands walleye pollock, the Plan Team's ABC recommendations for 2005 and 2006 do not correspond to any of the standard scenarios, but the OFL recommendations follow the projections under Scenario 6. For the one stock managed under Tier 1, EBS walleye pollock, the Plan Team's recommended 2005 ABC and OFL do not appear in the assessment chapter's projection table, because the standard projection model does not include an option for stocks managed under Tier 1. Nevertheless, the EBS pollock chapter's projections for 2006 under Scenarios 1 and 6 were used to recommend 2006 ABC and OFL, because no better estimates were available. As a precautionary measure, the standard projection model estimates 2005 catch at levels that are likely higher than the catch that will actually be achieved in 2005, meaning that the 2006 ABC and OFL projections for all Tier 1-3 stocks are likely to be biased downward. In the case of stocks managed under Tiers 4-6, 2006 projections are set equal to the Plan Team's recommended values for 2005. It should be emphasized that the ABC and OFL values recommended in next year's SAFE report are likely to differ from this year's projections for 2006, for the same reasons that the projections in this SAFE report differ from the projections made in September.

### **Uncertainty / Ecosystem Considerations / Research**

Statistical uncertainty is addressed in the individual assessments, and to some degree is addressed by the tiers used to establish ABCs. In three cases, statistical uncertainty or natural variability in the stock led the Plan Team to recommend 2005 ABC values lower than the maximum permissible level: In the case of Aleutian pollock, the Plan Team's recommended ABC is 46% below the maximum permissible level; in the case of Pacific cod, the Plan Team's recommended ABC is 9% below the maximum permissible level; and in the case of Greenland turbot, the Plan Team's recommended ABC is 75% below the maximum permissible level.

Ecosystem considerations are also addressed in the stock assessment chapters. In several assessments (walleye pollock, yellowfin sole, arrowtooth flounder, northern rock sole, flathead sole), attempts are made to estimate relationships between bottom trawl survey catchability and bottom temperature. In some assessments (Pacific cod, rock sole, flathead sole, Alaska plaice), potential effects of a possible 1989 regime shift on the stock-recruitment relationship are investigated (the yellowfin sole included a similar analysis for the 1978 regime shift). In the Pacific cod assessment, correlations between recruitment and annual values of the Pacific Decadal Oscillation are computed. In the Atka mackerel assessment, many new results based on ecosystem models are presented. Although the Team was unable to identify any cases where these or other ecosystem considerations suggested a need to adjust ABC, the Team encourages further development of ecosystem considerations. A review of ecosystem status and trends is provided in the Ecosystem Considerations chapter.

## Walleye Pollock

Status and catch specifications (t) of **pollock** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/06/04.

<u>Area</u>	<u>Year</u>	<u>Age 3+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
EBS	2003	11,100,000	3,530,000	2,330,000	1,491,760	1,490,095
	2004	11,000,000	2,740,000	2,560,000	1,492,000	1,480,021
	2005	8,410,000	2,100,000	1,960,000	n/a	n/a
	2006	n/a	1,480,000	1,420,000	n/a	n/a
AI	2003	175,000	52,600	39,400	1,000	1,653
	2004	175,000	52,600	39,400	1,000	1,150
	2005	344,000	99,300	43,200	n/a	n/a
	2006	n/a	69,100	43,200	n/a	n/a
Bogoslof	2003	227,000	45,300	4,070	50	24
	2004	198,000	39,600	2,570	50	0
	2005	198,000	39,600	*29,700	n/a	n/a
	2006	n/a	39,600	*29,700	n/a	n/a

\* The approach used by the Plan Team for recommending Bogoslof ABC in 2005-2006 differs from the approach used by the SSC and Council in 2003-2004.

### *Eastern Bering Sea:*

The present assessment is a straightforward update of last year's assessment, incorporating new data from the 2004 EIT and bottom trawl surveys and from the 2003 fishery. The 2004 EIT survey estimated a biomass of 3,310,000 t, a decrease of 8% relative to the 2002 estimate. The 2004 bottom trawl survey estimated a biomass of 3,750,000 t, a decrease of 54% relative to the all-time high estimate obtained in 2003 but within the range of the 1999-2002 estimates. The estimates of average weight at age from the fishery were also revised.

Six alternative models are presented in the chapter, all of which follow the statistical age-structured approach that has been used for the last several years. All of these models give point estimates of 2005 spawning biomass in the range 2,580,000 t to 3,310,000 t. One of the models (Model 4) explicitly addressed the possibility that an environmental covariate (summer bottom temperature) had an effect on trawl survey catchability, but failed to find a statistically significant relationship. Concurring with the assessment authors, the Plan Team based its recommendations for 2005 on the reference model (Model 1), which is identical to last year's model. The current assessment provides estimates of the biomass time series that are slightly lower than those provided in last year's assessment (Figure 1.32).

The SSC has 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 qualify 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, although some Plan Team members expressed concern regarding the usefulness of MSY-based reference points in cases where environmental regime shifts can have major impacts on the productivity of the stock. The updated estimate of  $B_{MSY}$  from the present assessment is 2,230,000 t, compared to 2,470,000 t from last year's

assessment. The projected spawning biomass for 2005 is 2,870,000 t, placing EBS walleye pollock in sub-tier “a” of Tier 1. As in last year’s assessment, the maximum permissible ABC harvest rate was based on the ratio between MSY and the equilibrium age 3+ biomass corresponding to MSY. The harmonic mean of this ratio from this year’s assessment is 0.233, identical to the value obtained in last year’s assessment. This ratio is multiplied by the geometric mean of the projected age 3+ biomass for 2005 (8,410,000 t) to obtain the maximum permissible ABC for 2005, which is 1,960,000 t. This ABC is about 3% higher than the 2005 yield corresponding to an  $F_{40\%}$  strategy, which is 1,900,000 t. In each of the last three years, the senior assessment author, Plan Team, and SSC all recommended setting ABC at the maximum permissible value. This year, the assessment authors recommend setting ABC at the  $F_{40\%}$  level rather than at the maximum permissible value. However, the Plan Team does not find any compelling reason to depart from the approach used to recommend ABC for the last three years, and so recommends setting the 2005 ABC at the maximum permissible level of 1,960,000 t. At the same time, the Plan Team notes that the 2001, 2002, and 2003 year classes are all estimated to be well below average and that ABC recommendations for the near future are expected to be substantially lower than the 2005 recommendation.

Given that TAC will necessarily be set below the recommended ABC, the assessment also provides alternative harvest scenarios, including the seven standard scenarios analyzed in all age-structured assessments and two constant catch scenarios (1,300,000 t and 1,500,000 t).

The OFL harvest ratio under Tier 1a is 0.250, the arithmetic mean of the ratio between MSY and the equilibrium age 3+ biomass corresponding to MSY. The product of this ratio and the geometric mean of the projected age 3+ biomass for 2005 (8,410,000 t) gives the OFL for 2005, which is 2,100,000 t. The walleye pollock stock in the EBS is not overfished and is not approaching an overfished condition.

#### *Aleutian Islands:*

For many years, the Aleutian Islands pollock stock has lacked an age-structured model and the SSC has determined that the stock qualified for management under Tier 5. In last year’s assessment, preliminary explorations of several age-structured models were provided, all of which focused on the portion of the stock to the west of 174°W. In this year’s assessment, five alternative age-structured models were developed and evaluated. The chapter focuses on two of those models, one of which (Model 1) uses data only from the portion of the stock to the west of 174°W, and the other of which (Model 1B) includes survey data from the entire Aleutian Islands management area. The authors recommend use of Model 1. However, the Plan Team recommends use of Model 1B, largely because the time series of survey biomass estimates for the entire Aleutian Islands management area tends to show greater year-to-year consistency than the time series for the portion west of 174°W. For example, the 2002 and 2004 estimates for the entire Aleutian Islands management area are 175,283 t and 130,451 t, respectively, whereas the corresponding estimates for the portion west of 174°W are 121,915 t and 19,201 t, respectively.

If the SSC determines that the Aleutian pollock stock now qualifies for management under Tier 3 using Model 1B, the estimates of 2005 spawning biomass,  $B_{40\%}$ , and  $F_{40\%}$  would be 131,000 t, 77,000 t, and 0.35, respectively. The maximum permissible 2005 ABC would be 80,500 t. Although the Plan Team feels that Model 1B makes better use of the available information than Model 1, the assessment authors feel that considerable uncertainty exists as to the value of the trawl survey catchability coefficient, a conclusion with which the Plan Team concurs. For this reason, the Plan Team recommends setting 2005 ABC at a value below the maximum permissible level. Because the fishery for pollock in the Aleutian Islands has been closed for several years, using recent average fishing mortality to project ABC is not an option. Instead, the Plan Team recommends setting 2005 ABC at the equilibrium level associated with an  $F_{40\%}$  harvest rate, which is 43,200 t. If the SSC determines that the Aleutian pollock stock qualifies for management only under Tier 5, the Plan Team recommends computing the maximum permissible ABC

for 2005 as the product of the most recent survey biomass estimate (130,451 t) and 75% of the natural mortality rate (0.30), giving a value of 29,400 t.

If the SSC determines that the Aleutian pollock stock now qualifies for management under Tier 3 using Model 1B, the 2005 OFL would be 99,300 t. According to Model 1B, the stock is not overfished and is not approaching an overfished condition. If the SSC determines that the Aleutian pollock stock qualifies for management only under Tier 5, the 2005 OFL would be 39,100 t. As a Tier 5 stock, it would not be possible to determine whether Aleutian pollock is overfished or whether it is approaching an overfished condition.

#### *Bogoslof:*

The 2003 hydroacoustic survey of the Bogoslof region resulted in a biomass estimate of 198,000 t. There was no survey of the Bogoslof region this year. Last year, the SSC determined that Bogoslof pollock qualified for management under Tier 5. The maximum permissible ABC under Tier 5 is 75% of the product of the natural mortality rate (0.20) and biomass, giving a value of 29,700 t, which is the Plan Team's recommendation for 2005 ABC. For several years, the Plan Team has recommended setting ABC for this stock at the maximum permissible level while the SSC has used a much more conservative approach. If the formula used by the SSC is applied, the resulting fishing mortality rate is 0.014, giving a 2005 ABC of 2,570 t. The overfishing level under Tier 5 is the product of the natural mortality rate and biomass, giving an OFL of 39,600 t for 2004. As a Tier 5 stock, it is not possible to determine whether Bogoslof pollock is overfished or whether it is approaching an overfished condition.

## **Pacific Cod**

Status and catch specifications (t) of **Pacific cod** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/06/04.

<u>Area</u>	<u>Year</u>	<u>Age 3+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2003	1,680,000	324,000	223,000	207,500	209,114
	2004	1,660,000	350,000	223,000	215,500	195,529
	2005	1,290,000	265,000	206,000	n/a	n/a
	2006	n/a	226,000	195,000	n/a	n/a

The present assessment is a substantial revision of last year's assessment, incorporating recent age and growth data and slope survey length data. This year's EBS shelf bottom trawl survey resulted in a biomass estimate of 597,000 t, down 1% from the 2003 estimate and near the minimum for the time series (534,000 t). The Aleutian Islands and EBS slope also were surveyed in 2004. Model estimates of abundance are much lower than last year's assessment due to the added age, growth, and length data. Estimated 2005 spawning biomass for the BSAI stock is 295,000 t, down about 32% from last year's estimate for 2004 and down about 21% from last year's  $F_{40\%}$  projection for 2005. The added data have reduced some of the uncertainties in the Pacific cod assessment. The Plan Team recommends that the revised model (Model 2) results be used for estimating ABC.

The SSC has determined that reliable estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  exist for this stock, and that this stock therefore qualifies for management under tier 3. The updated point estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  from the present assessment are 304,000 t, 0.36 and 0.43, respectively. Pacific cod qualify for management under sub-tier "b" of tier 3 because projected biomass for 2005 is about 3% below  $B_{40\%}$ .

Fishing at an instantaneous rate of 0.35 is projected to result in a 2005 catch of 227,000 t, which is the maximum permissible ABC under Amendment 56. The ABC for 2005 recommended by the authors is 206,000 t based on an alternative approach that considers the tradeoff between average yield and variability in yield. This ABC results in a 2005  $F_{ABC}$  of 0.31 and is about 8% from last year's estimate for 2004 and down about 8% from last year's  $F_{ABC}$  projection for 2005.

The Plan Team concurs with the authors' recommendation to set 2005 ABC at 206,000 t, 9% below the maximum permissible ABC of 227,000 t.

The Plan Team's recommended OFL was determined from the tier 3b formula, where fishing at a rate of 0.42 gives a 2005 value of 265,000 t, down about 24% from last year's estimate for 2004. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

## Sablefish

Status and catch specifications (t) of **sablefish** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/06/04.

<u>Area</u>	<u>Year</u>	<u>Age 4+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
EBS	2003	31,000	4,290	2,900	2,900	1,066
	2004	32,000	4,020	3,000	2,900	977
	2005	34,000	2,950	2,440	n/a	n/a
	2006	n/a	2,690	2,310	n/a	n/a
AI	2003	39,000	4,590	3,100	3,100	1,081
	2004	39,000	4,620	3,450	3,100	918
	2005	34,000	3,170	2,620	n/a	n/a
	2006	n/a	2,880	2,480	n/a	n/a

The present assessment is a straightforward update of last year's assessment, incorporating recent age, length and abundance data from the sablefish longline survey and fishery. The survey abundance index decreased 5% from 2003 to 2004 and follows an 8% decrease from 2002 to 2003. These decreases follow recent increases, so that relative abundance in 2004 is 4% higher than in 2000. The fishery abundance index decreased 12% from 2002 to 2003 (2004 data are not available yet). The decrease follows recent increases, so that relative abundance in 2003 is 6% lower than in 2000.

Spawning biomass is projected to decrease slightly (2%) from 2004 to 2005. Sablefish abundance is moderate; projected 2005 spawning biomass is 37% of unfished biomass. Abundance has increased from a low of 33% of unfished biomass during 1998 to 2000. The 1997 year class is an important part of the total biomass and is projected to account for 23% of 2005 spawning biomass. The 2000 year class also appears above average, although more years of data are needed to confirm its strength.

The SSC has determined that reliable estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  existed for this stock, and that this stock therefore qualifies for management under tier 3. The updated point estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  from this assessment are 223,000 t (combined across the EBS, AI, and GOA), 0.112, and 0.136, respectively. Projected spawning biomass (combined areas) for 2005 is 204,000 t (92% of  $B_{40\%}$ ), placing sablefish in sub-tier "b" of Tier 3. The maximum permissible value of  $F_{ABC}$  under Tier 3b is 0.10. A fishing mortality rate of 0.10 translates into a 2005 catch (combined areas) of 21,000 t, which would be

the maximum permissible ABC under Amendment 56 and is the Plan Teams recommended 2005 ABC. A 5-year exponential weighting of longline survey relative abundance may be used to apportion the combined 2005 ABC among regions, resulting in the following values: EBS: 2,440 t, AI: 2,620 t, and GOA: 15,940 t.

The OFL fishing mortality rate under Tier 3b is 0.12. A fishing mortality rate of 0.12 translates into a 2005 OFL (combined areas) of 25,400 t. Using the survey-based apportionment scheme described above, 2005 OFL also may be apportioned among regions and results in the following values: EBS: 2,950 t, AI: 3,170 t, and GOA: 19,280 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

The Plan Team’s recommended 2005 ABC represents a decrease of 9% from the 2004 ABC of 23,000 t and is similar to the 2003 ABC of 20,900 t. Spawning biomass is projected to decrease from 2004 to 2005 by about 2%.

The risk that maximum permissible yield will reduce spawning biomass below the replacement level is low. During the next three years, the probability of spawning biomass falling below the estimated threshold of  $B_{18\%}$  is nil. The probability of falling below  $B_{30\%}$  in three years is small (6%). The long-term probability depends on future recruitment, but will be updated each year as new data becomes available.

## 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 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/06/04.

<u>Area</u>	<u>Year</u>	<u>Age 2+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2003	1,550,000	136,000	114,000	83,750	74,418
	2004	1,560,000	135,000	114,000	86,075	73,931
	2005	1,560,000	148,000	124,000	n/a	n/a
	2006	n/a	133,000	114,000	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 2,530,000 t, an increase of 13% from last year’s survey. It was noted by the Plan Team that the ages from the 2003 EBS bottom trawl survey had the lowest estimates of 7 year old and younger fish in the entire time series of the trawl survey. In last year’s assessment, the authors allowed their estimate of survey catchability to differ from 1.0 by including a linear temperature effect; however this year the temperature effect was modeled exponentially.

Reliable estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  exist for this stock, thereby qualifying yellowfin sole for management under Tier 3. The updated point estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  from the present assessment are 388,000 t, 0.11, and 0.14, respectively. Given that the projected 2005 spawning biomass of 494,000 t exceeds  $B_{40\%}$ , the Plan Team’s ABC and OFL recommendations for 2005 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 2005 ABC of 124,000 t.

The Plan Team's OFL was determined from the Tier 3a formula, where an  $F_{35\%}$  value of 0.14 gives a 2005 OFL of 148,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

In response to SSC recommendations, the authors analyzed stock-recruitment data to consider assessment of yellowfin sole under Tier 1. The authors fit a Ricker stock-recruitment curve using two different time-series of data (1954-1999 and 1978-1999) inside the model. However, the assessment authors and Plan Team were concerned about the reliability of the stock-recruitment fit because the estimated stock-recruitment parameters changed substantially when using different time-series. The Plan Team also had concerns about the current estimates of the stock-recruitment relationship. The Plan Team therefore concluded that management of this stock under Tier 1 is not advisable at this time.

## 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 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/06/04.

<u>Year</u>	<u>Area</u>	<u>Age 1+</u>	<u>OFL</u>	<u>Subarea</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
2003	BSAI	112,000	17,800		5,880	4,000	3,017
				EBS	3,920	2,680	2,368
				AI	1,960	1,320	649
2004	BSAI	132,000	19,300		4,740	3,500	2,215
				EBS	3,162	2,700	1,805
				AI	1,578	800	410
2005	BSAI	98,300	19,200		3,930		
				EBS	2,720	n/a	n/a
				AI	1,210	n/a	n/a
2006	BSAI	n/a	11,100		3,600		
				EBS	2,500	n/a	n/a
				AI	1,100	n/a	n/a

This year's model is a straightforward update of last year's assessment. This year's model incorporated new catch and length frequency data from the fishery. It also included an updated aggregated longline survey index. Biomass and length composition data were also included from the EBS slope and shelf surveys. Reliable estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  exist for this stock. Updated point estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  from the present assessment are 51,600 t, 0.39, and 0.50, respectively. Projected spawning biomass for 2005 is 55,600 t. Greenland turbot therefore qualify for management under Tier 3a. The maximum permissible value of  $F_{ABC}$  under this tier translates into a 2005 catch of 15,500 t.

The Plan Team and authors acknowledged large uncertainties in the assessment. Additional slope trawl surveys will improve measurement of abundance trend and estimates of biomass. The Team discussed the possibility that the area of the survey does not adequately encompass the juvenile distribution raising questions about the reliability of recruitment estimates from the model. Because of these uncertainties the Plan Team agrees with the authors' recommendation to set the 2005 ABC at a value less than the maximum permissible. Using  $F_{ABC} = 5$ -year average results in a 2005 ABC of 3,930 t corresponding to a full selection fishing mortality rate of 0.07. The OFL fishing mortality rate is computed under Tier 3a,  $F_{OFL} = F_{35\%} = 0.50$ , and translates into a 2005 OFL of 19,200 t.

## 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 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/06/04.

<u>Area</u>	<u>Year</u>	<u>Age 1+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2003	597,000	139,000	112,000	12,000	12,834
	2004	696,000	142,000	115,000	12,000	17,953
	2005	684,000	132,000	108,000	n/a	n/a
	2006	n/a	103,000	88,400	n/a	n/a

The present assessment is a straightforward update of last year's assessment, incorporating new data from the EBS shelf and slope trawl surveys, the 2003 and 2004 fisheries. The assessment adds an ecosystem component by representing catchability of the EBS shelf trawl survey as an exponential function of average bottom temperature during the EBS shelf trawl survey. This year's EBS shelf bottom trawl survey resulted in a biomass estimate of 547,000 t. This year an EBS slope trawl survey was conducted resulting in a biomass estimate of 68,600 t for the EBS slope. When the EBS shelf and slope trawl survey results are combined the biomass estimate is 616,000 t for the EBS, which is the highest estimate for the EBS since the start of the surveys. Also, the Aleutian Islands trawl survey biomass estimate of 135,000 t, is the highest for the Aleutian Islands.

More female arrowtooth flounder are caught than males. As in last year's assessment, the model was evaluated using a range of male natural mortality rates between 0.28 and 0.35. The authors felt most comfortable with the model run in which the male natural mortality rate was fixed at 0.32. As in past assessments, the female natural mortality rate was fixed at 0.20.

The SSC has determined that reliable estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  exist for this stock, thereby qualifying arrowtooth flounder for management under Tier 3. The updated point estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  from the present assessment are 235,000 t, 0.26, and 0.33, respectively. Given that the projected 2005 spawning biomass of 505,000 t exceeds  $B_{40\%}$ , the Plan Team's ABC and OFL recommendations for 2005 were calculated under sub-tier "a" of Tier 3. The Plan Team recommends setting  $F_{ABC}$  at the  $F_{40\%}$  (0.26) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the  $F_{40\%}$  level gives a 2005 ABC of 108,000 t.

The OFL fishing mortality rate under Tier 3a is  $F_{35\%}$  (0.33), translating into a 2005 OFL of 132,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Currently, the arrowtooth flounder fishery is not a directed fishery in the BSAI. It was noted by the authors that arrowtooth flounder continue to have a fairly high discard rate (>50%).

## Northern 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 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/06/04.

<u>Area</u>	<u>Year</u>	<u>Age 2+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2003	877,000	132,000	110,000	44,000	35,832
	2004	1,160,000	166,000	139,000	37,925	47,729
	2005	1,380,000	157,000	132,000	n/a	n/a
	2006	n/a	129,000	111,000	n/a	n/a

The present assessment is a straightforward update of last year's assessment. The authors changed the name of this chapter from "Rock Sole" to "Northern Rock Sole." This change reflects the fact that two species of rock sole, northern (*Lepidopsetta polyxystra*) and southern (*Lepidopsetta bilineata*) inhabit the Bering Sea. Northern rock sole are dominant, although approximately 2% of the commercial catch may be southern rock sole. Commercial catch data include both species. The northern rock sole chapter is in some ways analogous -to the arrowtooth flounder and flathead sole chapters, where the assessment focuses on a single dominant species even though small catches of a morphologically similar species (Kamchatka flounder in the case of arrowtooth flounder, Bering flounder in the case of flathead sole) are included in the fishery data and counted against the TAC.

Changes to input data in this analysis include addition of 2003 rock sole (both northern and southern) fishery age composition, 2003 northern rock sole survey age composition, and the 2004 northern rock sole trawl survey biomass point estimate and standard error. Aleutian Islands survey biomass estimates (about 3% of the combined EBS and AI survey biomass estimates) were not used in the assessment. Catch data from 2003 were updated and a preliminary 2004 catch estimate was included.

A natural mortality estimate of 0.16 was found to give a better fit to the data than the value of 0.18 used previously. The model's estimate of survey catchability was influenced by a prior distribution based on results from a trawl herding experiment. Model results indicate that survey catchability of northern rock sole does not vary with bottom temperature.

This year's EBS bottom trawl survey resulted in a biomass estimate of 1,380,000 t, an 18% increase relative to last year's estimate of 1,170,000 t. Nevertheless, the rock sole stock is expected to decline, as are several other flatfish stocks, due to low recruitment in the last decade.

Reliable estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  exist for this stock, thereby qualifying the stock for management under Tier 3. The updated point estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  from the present assessment are 205,000 t, 0.15, and 0.18, respectively. Given that the projected 2005 spawning biomass of 429,000t exceeds  $B_{40\%}$ , the Plan Team's ABC and OFL recommendations for 2005 were calculated under sub-tier "a" of Tier 3. The Plan Team recommends setting  $F_{ABC}$  at the  $F_{40\%}$  (0.15) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the  $F_{40\%}$  level gives a 2005 ABC of 132,000 t.

The Plan Team's OFL was determined from the Tier 3a formula, where an  $F_{35\%}$  value of 0.18 gives a 2005 OFL of 157,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

This is a stable fishery that is lightly exploited, partly because it is usually constrained by Pacific halibut bycatch. However, the 2004 fishery was different in that it was not limited by Pacific halibut bycatch. The catch of rock sole in 2004 exceeded the TAC by 26%. This is not a biological concern, however, because the TAC was set much lower than the ABC.

## 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 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/06/04.

<u>Area</u>	<u>Year</u>	<u>Age 3+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2003	550,000	81,000	66,000	20,000	14,053
	2004	505,000	75,200	61,900	19,000	17,307
	2005	560,000	70,200	58,500	n/a	n/a
	2006	n/a	56,100	48,400	n/a	n/a

The present assessment is a straightforward update of last year's assessment. The present assessment includes updated catch, survey biomass, length composition, and age composition data. The growth schedule, maturity schedule, and age-to-length conversion matrix were re-estimated. This year's EBS shelf survey biomass estimate of 617,000 t was about 16% higher than last year's survey biomass estimate of 530,000 t. Prior to this increase, survey biomass had been relatively stable over the period 2001-2003 compared to the decrease observed from 1998-2000. This year's assessment again examined the relationship between bottom temperature the trawl survey catchability coefficient. This addition had an effect on survey biomass estimates since 1998, during which time temperature fluctuations were relatively large.

The SSC has determined that reliable estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  exist for this stock, thereby qualifying the stock for management under Tier 3. The updated point estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  from the present assessment are 113,800, 0.30, and 0.37, respectively. Given that the projected 2005 spawning biomass of 198,000 t exceeds  $B_{40\%}$ , the Plan Team's ABC and OFL recommendations for 2005 were calculated under sub-tier "a" of Tier 3. The Plan Team recommends setting FABC 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 2005 ABC of 58,500 t. The Plan Team's OFL was determined from the Tier 3a formula, where an  $F_{35\%}$  value of 0.37 gives a 2005 OFL of 70,200 t.

Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

At the request of the SSC, the authors evaluated stock productivity and  $F_{MSY}$  by fitting stock-recruitment (S-R) models within the assessment model. Ricker and Beverton-Holt S-R models were evaluated for post-1976 data and for post-1988 data, the second data series start at 1989 corresponding to the time of a potential regime shift. While a Ricker S-R model fit the post-1976 data reasonably well, it was unclear whether this was due to, or in spite of, a 1989 regime shift. The range of spawning biomass data for the post-1988 period does not bracket the  $B_{MSY}$  values estimated by either the post-1976 or post-1988 Ricker S-R models, indicating that the post-1988 model might also be inadequate to estimate MSY and related parameters. Because of these problems, the Plan Team agrees with the authors in recommending that the results of the S-R models not be used for managing flathead sole at the present time.

## Alaska Plaice

Status and catch specifications (t) of **Alaska plaice** 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 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/06/04.

<u>Area</u>	<u>Year</u>	<u>Age 3+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2003	1,080,000	165,000	137,000	10,000	9,896
	2004	1,060,000	258,000	203,000	9,250	7,570
	2005	913,000	237,000	189,000	n/a	n/a
	2006	n/a	115,000	109,000	n/a	n/a

Note: Biomass for 2003 represents age 1+.

The present assessment is a straightforward update of last year's assessment. The present assessment includes updated catch, survey biomass, length composition, and age composition data. The growth schedule, maturity schedule, and age-to-length conversion matrix were re-estimated. This year's EBS shelf survey biomass estimate of 488,000 t was about 4% higher than last year's survey biomass estimate of 467,000 t. The estimated age at 50% selection increased in this year's assessment from 10.3 years to 10.9 years. Survey catchability of Alaska plaice does not appear to be affected by temperature. Recruitment of Alaska plaice appears to have been relatively stable since the late 1970s.

Reliable estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  exist for this stock complex, thereby qualifying the stock for management under Tier 3a. The updated point estimates are  $B_{40\%} = 118,000$  t,  $F_{40\%} = 0.76$ , and  $F_{35\%} = 1.06$ . The reference fishing mortality rates for this stock are fairly high relative to natural mortality (0.25) because the age at 50% selection (10.9 years) is more than 2 years greater than the age at 50% maturity (8.5 years). Given that the projected 2005 spawning biomass of 203,000 t exceeds  $B_{40\%}$ , the Plan Team's ABC and OFL recommendations for 2005 were calculated under sub-tier "a" of Tier 3. Projected harvesting at the  $F_{40\%}$  level gives a 2005 ABC of 189,000 t. The Plan Team's OFL was determined from the Tier 3a formula, which gives a 2005 OFL of 237,000 t. Model projections indicate that this species is neither overfished nor approaching an overfished condition.

The authors also analyzed stock-recruitment data to consider assessment of Alaska plaice under Tier 1. The authors fit both Ricker and Beverton-Holt stock recruitment curves using two different time series of data. The full time series (1979 – 2001) and the portion of the time series since the possible 1989 regime shift (1989-2001) were examined. Neither stock-recruitment curve fit the data well. Both curves imply that Alaska plaice is highly unproductive and that even a small fishery could not be maintained. Although the stock size may be decreasing somewhat, the authors and the Plan Team do not feel that the estimates of productivity implied by these stock-recruitment relationships are accurate, and therefore conclude that management of Alaska plaice under Tier 1 is not advisable at this time.

## Other Flatfish Complex

Status and catch specifications (t) of **other flatfish** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/06/04.

<u>Area</u>	<u>Year</u>	<u>Age 1+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2003	107,000	21,400	16,000	3,000	2,818
	2004	90,300	18,100	13,500	2,775	4,874
	2005	143,000	28,500	21,400	n/a	n/a
	2006	n/a	28,500	21,400	n/a	n/a

With the removal of Alaska plaice from this category in 2002, the species currently collected in the “other flatfish” category in the Eastern Bering Sea survey are arctic flounder, butter sole, curlfin sole, deepsea sole, Dover sole, English sole, longhead dab, Pacific sand dab, petrale sole, rex sole, roughscale sole, sand sole, slender sole, starry flounder, and Sakhalin sole. The species currently collected in the “other flatfish” category in the Aleutian Islands survey are Dover sole, rex sole, starry flounder, butter sole and English sole. Starry flounder, rex sole and butter sole comprise the majority of the species landed; a negligible amount of other species is landed. Of those, starry flounder and rex sole comprised 95% of the other flatfish catch in 2004.

Because of insufficient data, age-structured modeling of these species is not feasible at present. This year’s assessment incorporates 2002 and 2003 total catch and discard data, a preliminary 2004 catch estimate, and 2004 trawl survey information. The 2004 EBS and AI bottom trawl surveys resulted in a combined BSAI biomass estimate of 143,000 t. Both the EBS and AI surveys showed substantial increases from their previous biomass estimates (EBS up 41% from 2003 and AI up 70% from 2002).

Since the removal of Alaska plaice from this category, “other flatfish” has been managed as a Tier 5 species complex with an assumed natural mortality rate of 0.20. Projected harvesting at the 0.75M level gives a 2005 catch of 21,400 t, which is the maximum permissible value under Tier 5 and the Plan Team’s recommended ABC. Under Tier 5,  $F_{OFL}$  is equal to  $M$ , giving a 2005 OFL of 28,500 t. It is not possible to determine whether the “other flatfish” complex is overfished or approaching an overfished condition because it is not managed under Tiers 1-3.

The fishery for “other flatfish” is usually closed prior to attainment of TAC due to bycatch of Pacific halibut, a prohibited species. However, the 2004 fishery was different in that it was not limited by Pacific halibut bycatch. The catch of “other flatfish” in 2004 exceeded the TAC by 68%. This is not a biological concern, however, because the TAC was set much lower than the ABC.

## Pacific Ocean Perch (POP)

Status and catch specifications (t) of **Pacific ocean perch**. Biomass corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/06/04.

<u>Year</u>	<u>Area</u>	<u>Age 3+ Bio</u>	<u>OFL</u>	<u>Subarea</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
2003	BSAI	375,000	17,900		15,100	14,100	14,645
				EBS	2,410	1,410	1,196
				Eastern AI	3,500	3,500	3,934
				Central AI	3,340	3,340	3,120
				Western AI	5,850	5,850	6,395
2004	BSAI	349,000	15,800		13,300	12,220	11,883
				EBS	2,128	1,048	718
				Eastern AI	3,059	3,059	2,536
				Central AI	2,926	2,926	3,143
				Western AI	5,187	5,187	5,486
2005	BSAI	379,000	17,300		14,600		
				EBS	2,920	n/a	n/a
				Eastern AI	3,210	n/a	n/a
				Central AI	3,165	n/a	n/a
				Western AI	5,305	n/a	n/a
2006	BSAI	n/a	17,400		14,600		
				EBS	2,920	n/a	n/a
				Eastern AI	3,210	n/a	n/a
				Central AI	3,165	n/a	n/a

Overall this assessment is a straightforward update of last year, adding the most recent survey and age composition data. This year's Aleutian Islands bottom trawl survey resulted in a biomass estimate of 579,000 t, a 23% increase over the 2002 estimate and the second highest estimate for the time series. This year's EBS slope bottom trawl survey resulted in a biomass estimate of 112,000 t, up about 47% from the 2002 estimate.

The SSC has determined that reliable estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  exist for this stock, thereby qualifying Pacific ocean perch for management under Tier 3. The current estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  are 142,000 t, 0.048, and 0.058 respectively. Given the projected spawning biomass of 133,000 t is below  $B_{40\%}$ , the Plan Team's ABC and OFL recommendations were calculated under sub-tier "b". The Plan Team recommends setting  $F_{ABC}$  at the adjusted  $F_{40\%}$  (0.045) and  $F_{OFL}$  at the adjusted  $F_{35\%}$  of 0.054. This gives an ABC of 14,600 t, which is the authors' and Plan Team's recommendation. The team concurs with the authors' recommendation that ABCs be set regionally based on the proportions in combined survey biomass as follows: BS = 2,920 t, Eastern Aleutians (Area 541) = 3,210 t, Central Aleutians (Area 542) = 3,165 t, Western Aleutians (Area 543) = 5,305 t. The OFL is computed under Tier 3b as 17,300 t. The OFL for BSAI is not regionally apportioned.

The authors presented an Appendix containing the results of an SSC-recommended analysis of an  $F_{40\%}$  policy for POP, examining the possibility that older females contribute disproportionately (per unit biomass) to recruitment. The results include an index of viable larvae that reflects differences in larval survival based upon spawner age. The stock-recruitment analysis using viable larvae as an index of stock

reproductive capacity produced results similar to those obtained from using spawning stock biomass, indicating that age truncation is not evident in the data. The Plan Team commended the analysis but suggested that the authors continue this line of investigation, possibly within the context of a larger “Management Strategy Evaluation.”

Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

## Northern Rockfish

Status and catch specifications (t) of **Northern rockfish**. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2005 and 2006 are those recommended by the Plan Team. Catch is reported through 11/06/04.

<u>Year</u>	<u>Area</u>	<u>Age 3+ Bio.</u>	<u>OFL</u>	<u>Subarea</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
2003	BSAI	156,000	9,468		7,100		
				BS		121	72
				AI		5,879	4,582
2004	BSAI	142,000	8,140		6,880	5,000	4,683
2005	BSAI	200,000	9,810		8,260	n/a	na
2006	BSAI	n/a	9,480		8,040	n/a	n/a

For the most part, the methodology in this year’s assessment was the same as last year, with new data on fisheries catch, survey estimates for 2004, and age composition for 2000 and 2003. The combined BS and AI survey biomass for 2004 was 192,000 t, up 9% from 176,000 t in 2002.

Difficulties with fitting the model led the authors to present alternative model runs, both with and without constraints on survey catchability  $q$ . The authors and Plan Team noted that the model with the unconstrained  $q$  led to a near doubling of the biomass estimate between 2004 and 2005, which the authors attributed in part to difficulties in modelling incoming year classes at late ages (age 10+). In all models, the increase in biomass estimates from 2004 to 2005 was due to the recruitment of a strong 1994 year class. The authors and Plan Team recommended use of the more conservative, constrained- $q$  alternative. For future assessments, the authors plan to explore the possibility of reducing the recruitment age of the model below age 10, to mitigate changes in ABC and OFL that result from fish entering the model at older ages. The Plan Team recommends setting a combined BSAI OFL and ABC due to the difficulty of managing low quotas (<50 t) which would result from subregional splitting.

The SSC has determined that this stock qualifies for management under Tier 3 due to the availability of reliable estimates for  $B_{40\%}$  (45,900 t),  $F_{40\%}$  (0.048), and  $F_{35\%}$  (0.058). Since the female spawning biomass of 66,600 is greater than  $B_{40\%}$ , sub-tier "a" would be applicable, with  $F_{ABC} = F_{40\%}$  and  $F_{OFL} = F_{35\%}$ . Under Tier 3a, the maximum permissible ABC would be 8,260 t, which is the authors’ and Plan Team’s recommendation for the 2005 ABC. Under Tier 3a, the 2005 OFL would be 9,810 t for the Bering Sea/Aleutian Islands combined.

Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

## Shortraker/Rougheye Rockfish

Status and catch specifications (t) of **shortraker/rougheye** 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 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/06/04.

<u>Species or complex</u>	<u>Year</u>	<u>Area</u>	<u>Survey Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>Subarea</u>	<u>TAC</u>	<u>Catch</u>
shortraker/rougheye	2003	BSAI	45,200	1,290	967			
						EBS	137	112
						AI	830	298
shortraker	2004	BSAI	23,400	701	526		526	240
	2005	BSAI	26,500	794	596		n/a	n/a
	2006	BSAI	n/a	794	596		n/a	n/a
rougheye	2004	BSAI	10,400	259	195		195	203
	2005	BSAI	11,900	298	223		n/a	n/a
	2006	BSAI	n/a	298	223		n/a	n/a

The assessment methodology used here is a straightforward update of last year. The SSC has previously determined that reliable estimates of biomass and natural mortality exist for shortraker and rougheye rockfish, qualifying the species for management under Tier 5. Last year, the assessment authors developed a Kalman filter approach to estimate biomass and possibly lead to management under a higher Tier. This year, the model was updated with 2004 survey data, but the authors noted that confidence intervals for population parameters were uninformative for making projections. The Plan Team concurs with the authors' recommendation that the primary use of the model is to provide smoothed estimates of survey biomass. At the present time, the Plan Team recommends that the SSC retain Tier 5 management for these stocks. The Plan Team recommends setting  $F_{ABC}$  at the maximum permissible level under Tier 5, which is 75% of  $M$ . Accepted values for  $M$  for these stocks are: rougheye rockfish--0.025, shortraker rockfish--0.030, resulting in  $F_{ABC}$  values of 0.019 and 0.023 for rougheye and shortraker respectively.

In 2001, the Plan Team, SSC, AP, and Council recommended separating shortraker and rougheye rockfish species and setting BSAI area-wide ABCs and TACs for 2002. However, NMFS was unable to implement those recommendations because of the difficulty of species identification, and instead set separate BS and AI TACs for the combined shortraker/rougheye rockfishes category. In 2004, the NMFS Regional Office and Observer Program developed a catch accounting program that separates shortraker and rougheye rockfishes. With this improvement, concerns over management of small OFLs led to recombining regions into a BSAI-wide quota for each species. For 2005, the authors presented separate BS and AI recommendations. However, the Plan Team recommends retaining BSAI-wide ABCs and OFLs for each species.

The authors investigated the possibility of using Bering Sea slope survey data but noted low biomass and high variance from these surveys. The Plan Team noted that not including the surveys was a conservative option, and so recommended the continued use of Bering Sea shelf and Aleutian Islands surveys only.

The biomass estimates for 2005 are 26,500 t for shortraker and 11,900 t for rougheye, leading to an BSAI OFLs of 794 t for shortraker and 298 t for rougheye, and ABCs of 596 t for shortraker and 223 t for rougheye. It is not possible to determine whether these species are overfished or whether they are approaching an overfished condition because they are managed under Tier 5.

### Other Rockfish Complex

Status and catch specifications (t) of <b>other rockfish</b> (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 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/06/04.							
<u>Year</u>	<u>Area</u>	<u>Subarea</u>	<u>Survey Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
2003	BSAI						
		BS	18,300	1,280	960	960	324
		AI	12,100	846	634	634	401
2004	BSAI						
		BS	18,300	1,280	960	960	308
		AI	12,100	846	634	634	333
2005	BSAI		26,600	1,870			
		BS	15,400		810	n/a	n/a
		AI	11,200		590	n/a	n/a
2006	BSAI		n/a	1,870			
		BS	n/a		810	n/a	n/a
		AI	n/a		590	n/a	n/a

The BSAI “other rockfish” assessment considers the 8 species that have been caught at least once during AFSC research surveys or appeared in more than 1% of observed fishery hauls between 1990 and 2001. This year’s assessment includes new survey data for the Aleutian Islands, southern Bering Sea, and eastern Bering Sea slope; updated catches in the EBS and AI; and updated length frequency data. The authors followed recommendations made by the Plan Team in 2004 for their 2005 proposed ABCs and OFLs. For 2005, the authors recommended separating thornyheads (*Sebastolobus* spp.) from the remaining 7 rockfish species within the “other rockfish” complex for the purposes of setting ABCs and OFLs. This recommendation was based on the fact that thornyheads are the most abundant and valuable species in the complex and inhabit deeper regions of the shelf and slope than the others.

The Plan Team commended the authors for providing separate ABC and OFL recommendations for thornyheads (primarily shortspine thornyheads) and the remaining “other rockfish” species. The Tier 5 ABCs and OFLs for thornyheads were based on biomass estimates that the Plan Team and the author considered reliable. However, biomass estimates for the remaining “other rockfish” did not appear to be reliable. The actual catches of the remaining “other rockfish” species have been much larger (by a factor of 6) than the OFLs would have been had this species group been managed under Tier 5 in 1992-2002. This, combined with the fact that the Aleutian Island area survey biomass estimates for this group have generally increased for the last 13 years, suggested that the biomass estimates for this group are unreliable. Using Tier 6 criteria for the remaining “other rockfish” resulted in an OFL that was similar to catches for 1999-2002. As with Tier 5, the Plan Team considered the Tier 6 OFL for this subgroup to

be inappropriate (i.e., it seemed unlikely that biomass would keep increasing for 13 years if catches had equaled or exceeded OFL on average). Therefore, the Plan Team recommends against splitting thornyheads from the “other rockfish” complex at this time.

For 2005, the Plan Team recommends that ABC and OFL be set for the entire “other rockfish” complex including thornyheads. The Plan Team recommends setting  $F_{ABC}$  at the maximum value allowable under Tier 5, which is 75% of  $M$  (0.07), or 0.053. Multiplying this rate by the best estimates of “other rockfish” biomass yields 2005 ABCs of 809 t in the EBS and 590 t in the AI. The Plan Team recommended that OFL be set for the entire BSAI area, which under Tier 5 is calculated by multiplying the best estimate of total biomass for the area by  $M$  (0.07), which yields an OFL of 1,870 t.

Using trawl survey data collected since 1991, the authors developed a Schaefer surplus production model for shortspine thornyheads, the principal “other rockfish” species. The Plan Team commends the authors for their efforts, but suggests that biomass dynamic modeling for this stock is not appropriate at this time given the limited number of survey data points available (6) and the number of parameters to estimate (4). As such, the Plan Team did not use the model results or projections to recommend ABCs or OFLs for the “other rockfish” complex. Once age data become available for thornyheads, the Plan Team would welcome an age-based modeling approach for this stock.

The Plan Team encourages the authors to explore alternative methods for computing average survey biomass. Currently, equal weights are given to each of the survey biomass estimates back through 1991. One alternative is to consider giving more recent survey results more weight than older data. In addition, the authors are encouraged to continue exploration of the use of the Kalman filter to estimate current and past biomass.

## 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 2005 and 2006 are those recommended by the Plan Team. Catch data for 2004 are current through 11/06/04.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
BSAI	2003	358,000	99,700	51,000	60,000	50,238
	2004	286,000	78,500	66,700	63,000	60,454
	2005	486,000	147,000	124,000	n/a	n/a
	2006	n/a	94,300	89,200	n/a	n/a

The present assessment is an updated and slightly revised form of last year’s assessment that utilized the AMAK model in the NMFS Stock Assessment Toolbox. New data include catch updates, the 2004 Aleutian Island bottom trawl survey results (biomass estimate and length frequency), 2003 fishery age composition, and 2002 Aleutian Islands survey age composition. Relative to past model formulations, the authors explored three changes: allowance for within-year mortality to the month that the survey occurs (July) to compute modeled survey abundance, use of a lognormal distribution to describe error in survey biomass estimates instead of a normal distribution, and allowing the model to estimate survey catchability ( $q$ ) within the constraints of a prior. The authors recommended, and the Plan Team accepted, the model formulation that included all of the proposed changes (Model 4).

The SSC has determined that reliable estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  exist for this stock, thereby qualifying Atka mackerel for management under Tier 3. The current estimates of  $B_{40\%}$ ,  $F_{40\%}$ , and  $F_{35\%}$  are 96,900 t, 0.52, and 0.64, respectively. Projected spawning biomass for 2005 is 151,000 t, placing Atka mackerel in sub-tier “a” of Tier 3. The assessment authors recommend setting  $F_{ABC}$  at the maximum permissible level, which would give a 2005 ABC of 124,000 t. The Plan Team agrees with the authors’ recommendation.

The recommended 2005 ABC is 86% higher than the 2004 ABC. This increase is based primarily on new age data that improved the estimate of the size of the 1999 year class. Incorporating this new information doubled the estimated size of the 1999 year class from last year’s assessment, and suggests that it is the largest year class on record. Last year, female spawning biomass was projected to be 86,000 t in 2004; this year, the 2004 estimate increased to 137,000 t and it is projected to increase to 151,000 t in 2005. Changes in model formulation and adding new data also increased the estimated sizes of all other year classes in the time series, but particularly those spawned recently (e.g., the 1999 and 2000 year classes).

The OFL was determined from the Tier 3a formula, where an  $F_{35\%}$  value of 0.64 gives a 2005 OFL of 146,900 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

To apportion ABCs among areas, the authors used a weighted average of the 4 most recent survey estimates of the biomass distribution, where the greatest weight is assigned to the 2004 survey. When applied to the recommended ABC of 124,000 t, this formula gives the following subarea-specific ABCs: Eastern Bering Sea and Eastern Aleutians = 24,550 t (19.8%), Central Aleutians = 52,830 t (42.6%), and Western Aleutians = 46,620 t (37.6%).

The Plan Team noted several ABC considerations listed by the author. Some of these considerations are positive (model is conservative relative to survey biomass estimates; age data reveal continued presence of a relatively strong 1998 year class along with the very large 1999 and above average 2000 year classes), while others are negative (spawning biomass is projected to drop below  $B_{40\%}$  for 2007-2010 under an  $F_{40\%}$  strategy; trawl survey biomass estimates have sometimes been highly variable).

The authors presented an expanded analysis of Atka mackerel predators and prey, highlighting the major components of predation on Atka mackerel, primarily Pacific cod and Steller sea lions. The Plan Team was encouraged that the analysis allowed for a more informed discussion of predator/prey interactions, and suggested that such additions would be welcome in other assessments. Specific to Atka mackerel, the Plan Team noted that, since projections associated with the recommended ABC indicate an increase in the availability Atka mackerel to all predators, the author’s recommended levels would not decrease the effectiveness of Steller sea lion mitigation measures already in place. The Plan Team noted that the construction of an age-structured Atka mackerel/Pacific cod predation model could inform future stock assessments, especially given the limited scope of the Aleutian component of the current BSAI Pacific cod assessment.

## Squid and Other Species Complex

Status and catch specifications (t) of **squid and other species** (sharks, skates, sculpins, octopus) 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 2005 and 2006 are those recommended by the Plan Team. Catch data are current through 11/08/04.

### Squid

<u>Area</u>	<u>Year</u>	<u>Biomass</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2003	n/a	2,620	1,970	1,970	1,274
	2004	n/a	2,620	1,970	1,275	1,016
	2005	n/a	2,620	1,970	n/a	n/a
	2006	n/a	2,620	1,970	n/a	n/a

### Other species

<u>Area</u>	<u>Year</u>	<u>Survey Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2003	695,000	81,100	43,300	32,309	27,597
	2004	73,0280	81,150	46,810	27,205	27,266
	2005: sharks	17,700	1,590	1,200	n/a	n/a
	2005: skates	478,000	47,800	35,800	n/a	n/a
	2005: sculpins	206,000	39,200	29,400	n/a	n/a
	2005: octopus	6,320	3,160	2,370	n/a	n/a
	2005: Total	708,020	91,750	68,770	n/a	n/a
	2006: sharks	17,700	1,590	1,200	n/a	n/a
	2006: skates	478,000	47,800	35,800	n/a	n/a
	2006: sculpins	206,000	39,200	29,400	n/a	n/a
	2006: octopus	6,320	3,160	2,370	n/a	n/a
	2006: Total	708,020	91,750	68,770	n/a	n/a

The SSC has determined that a reliable catch history from 1978 through 1995 exists for squid, thereby qualifying this stock complex for management under Tier 6. Under Tier 6, OFL is set equal to the average catch unless an alternative value is established by the SSC on the basis of the best available scientific information, and ABC is constrained to be no greater than 75% of OFL. Therefore, the Plan Team's recommend 2005 OFL, based on average squid catch from 1978 through 1995, is 2,620 t. The maximum permissible value of ABC for 2005 is 1,970 t, which is the Plan Team's recommended value. It is not possible to determine whether the squid complex is overfished or whether it is approaching an overfished condition because it is managed under Tier 6.

The SSC has determined that reliable estimates of the natural mortality rate and biomass exist for all major components of the "other species" complex, thereby qualifying this complex for management under Tier 5. The Plan Team agrees that Tier 5 is the appropriate classification for all four component species groups. The Plan Team recommends that the natural mortality rates for sharks, skates, sculpins and octopus be estimated at values of 0.09, 0.10, 0.19 and 0.50, respectively, and that biomass be estimated

by summing the average biomass estimates from the surveys that have occurred over the last 10 years in the EBS shelf trawl survey, the EBS slope trawl survey, and the AI trawl survey.

The Plan team agrees with the authors' recommendation for setting group-specific ABCs. The Plan Team's recommended 2005 ABCs for the four groups constituting the "other species" complex are: sharks–1,200 t, skates–35,800 t, sculpins–29,400 t, and octopus–2,370 t, which are the maximum permissible values under Tier 5. However, the Plan Team recognizes that the current structure of the FMP will not allow group-specific ABCs to be set for 2005. The Plan Team therefore recommends that the "other species" complex be placed on bycatch-only status. The Plan Team agrees with the authors' recommendation to discontinue setting a complex-level "other species" ABC as soon as possible and encourages the development of a plan amendment to do so. This FMP amendment should focus on short-term management goals pertaining to the "other species" complex and should not await completion of a more general amendment addressing long-term management goals for all non-target groundfish species.

The Plan Team also agrees with the authors' recommendation for setting group-specific OFLs and the author's recommendation that use of the complex-level "other species" OFL be discontinued. The Plan Team's recommended 2005 OFLs for the four groups constituting the "other species" complex are: sharks–1,590 t, skates–47,800 t, sculpins–39,200 t, and octopus–3,160 t, which are the values under obtained under the Tier 5 formula. It is not possible to determine whether the "other species" complex is overfished or whether it is approaching an overfished condition because it is not managed under Tiers 1-3.

## Pacific Halibut Discard Mortality Rates for 2005 CDQ fisheries (Appendix A)

Pacific halibut discard mortality rates (DMRs) in the Alaskan groundfish fisheries are estimated from viability data collected by the NMFS Observer Program. Analysis by staff of the International Pacific Halibut Commission (IPHC) results in recommendations to the North Pacific Fishery Management Council for managing halibut bycatch for the 200f Community Development Quota (CDQ) fisheries (Appendix A).

CDQ trawl effort in 2003 was focused on pollock, Atka mackerel, and yellowfin sole. IPHC staff calculated the mean DMR for these targets using all available data, and recommend that the 2005 CDQ trawl fisheries be managed using these mean DMRs. The 2005 DMR for bottom trawl pollock is recommended to remain the same as was used in 2004. The remaining targets that occur in 2005 should be managed using the open access 2004-2006 long-term means.

CDQ longline fishing in 2003 was directed primarily at cod and resulted in a DMR of 0.09. As with the CDQ trawl fisheries, we calculated a mean DMR for the cod fishery of 0.10 and recommend that this be used in 2005. As with trawls, too few halibut were examined to provide meaningful results for the other targets. Longline targets other than cod should use the open access long-term mean DMRs.

The pot fishery DMR for sablefish CDQ fishing was 0.22 in 2003, lower than in past years. Again, the long-term mean DMR was calculated to be 0.33 and this value is recommended to be used for 2005. Pot fishery targets other than cod that occur in 2005 should use the open access long-term mean DMR until data from those fisheries can be collected and analyzed, and DMRs identified. The IPHC recommendations are included in the following summary table.

**Summary of recommended Pacific halibut discard mortality rates (DMRs) for calculating bycatch mortality in the 2005 CDQ groundfish fisheries off Alaska.**

	Used in 2004	Recommendation for 2005
<i>CDQ Trawl</i>		
Atka mackerel	85	85
Bottom pollock	85	85
Flathead sole	67	67
Pelagic pollock	89	90
Rockfish	74	74
Yellowfin sole	82	84
<i>CDQ Longline</i>		
Pacific cod	11	10
Turbot	7	15
<i>CDQ Pot</i>		
Pacific cod	5	8
Sablefish	36	33

**Table 1. BSAI Plan Team November 2004 Groundfish OFL and ABC Recommendations for the 2005-2006 Fisheries**

Species	Area	2004			Recommended 2005				Recommended 2006		
		OFL	ABC	TAC	Catch**	OFL	ABC	TAC	OFL	ABC	TAC
Pollock	EBS	2,740,000	2,560,000	1,492,000	1,248,817	2,100,000	1,960,000		1,480,000	1,420,000	
	Aleutian Islands	52,600	39,400	1,000	1,128	99,300	43,200		69,100	43,200	
	Bogoslof District	39,600	2,570	50	0	39,600	29,700		39,600	29,700	
Pacific cod	BSAI	350,000	223,000	215,500	166,776	265,000	206,000		226,000	195,000	
Sablefish	BS	4,020	3,000	2,900	748	2,950	2,440		2,890	2,310	
	AI	4,620	3,460	3,100	912	3,170	2,620		2,880	2,480	
Yellowfin sole	BSAI	135,000	114,000	86,075	68,822	148,000	124,000		133,000	114,000	
Greenland turbot	Total	19,200	4,740	3,500	2,136	19,200	3,930		11,100	3,600	
	BS	—	3,162	2,700	1,730	—	2,720		—	2,500	
	AI	—	1,578	800	406	—	1,210		—	1,100	
Arrowtooth flounder	BSAI	142,000	115,000	12,000	17,130	132,000	108,000		103,000	88,400	
Rock sole	BSAI	166,000	139,000	41,000	47,875	157,000	132,000		129,000	111,000	
Flathead sole	BSAI	75,200	61,900	19,000	16,611	70,200	58,500		56,100	48,400	
Alaska plaice	BSAI	258,000	203,000	10,000	7,624	237,000	189,000		115,000	109,000	
Other flatfish	BSAI	18,100	13,500	3,000	4,669	28,500	21,400		28,500	21,400	
Pacific Ocean perch	BSAI	15,800	13,300	12,580	11,032	17,300	14,600		17,408	14,600	
	BS	—	2,128	1,408	701	—	2,920		—	2,920	
	AI total	—	11,172	11,172	10,331	—	11,680		—	11,680	
	MVAI	—	5,187	5,187	4,998	—	5,305		—	5,305	
	CAI	—	2,926	2,926	2,970	—	3,165		—	3,165	
Northern rockfish	EAI	—	3,059	3,059	2,363	—	3,210		—	3,210	
	BSAI	8,140	6,880	5,000	4,166	9,810	8,260		9,480	8,040	
Shoctraker rockfish	BSAI	701	526	526	207	794	596		794	596	
Rougheye rockfish	BSAI	259	195	195	189	298	223		298	223	
Other rockfish	BSAI	—	—	—	—	1,870	1,400		1,870	1,400	
	BS	1,280	960	460	304	—	810		—	810	
	AI	846	634	634	309	—	590		—	590	
Atka mackerel	Total	78,500	66,700	63,000	54,789	147,000	124,000		94,300	89,200	
	MVAI	—	24,360	20,660	17,341	—	46,620		—	33,540	
	CAI	—	31,100	31,100	27,832	—	52,830		—	38,000	
	EAI/BS	—	11,240	11,240	9,616	—	24,550		—	17,660	
Squid	BSAI	2,620	1,970	1,275	814	2,620	1,970		2,620	1,970	
Other species	BSAI	81,150	46,810	27,205	21,795	91,750	68,770		91,750	68,770	
Sharks	BSAI	**	**	**	**	1,590	1,200		1,590	1,200	
Skates	BSAI	**	**	**	**	47,800	35,800		47,800	35,800	
Sculpins	BSAI	**	**	**	**	39,200	29,400		39,200	29,400	
Octopus	BSAI	**	**	**	**	3,160	2,370		3,160	2,370	
<b>Total</b>	<b>BSAI</b>	<b>4,193,736</b>	<b>3,620,535</b>	<b>2,000,000</b>	<b>1,676,853</b>	<b>3,573,362</b>	<b>3,100,609</b>		<b>2,614,490</b>	<b>2,373,289</b>	

Table 2. Groundfish catches (metric tons) in the eastern Bering Sea, 1954-2004.

Year	Pacific		Sable	W. low	Greenland	Arrow	Rock	Other	Pacific		Pacific	Northern	Shortraker	Rougheye	Other	Atka	Other	
	Pollock	Cod	Fish	Fin Sok	Turbot	Flounder <sup>a</sup>	Sok/c	Flat Fish	Alaska Phike	Ocean Complex <sup>b</sup>	Ocean Perch	Rockfish	Rockfish	Rockfish	Fish	Mackerel	Squid	Species
1954				12,562														
1955				14,690														
1956				24,697														
1957				24,145														
1958	6,924	171	6	44,153														147
1959	32,793	2,864	289	185,321														380
1960			1,861	456,103	36,843					6,100								
1961			15,627	553,742	57,348					47,000								
1962			25,989	420,703	58,226					19,900								
1963			13,706	85,810	31,965			35,643		24,500								
1964	174,792	13,408	3,545	111,177	33,729			30,604		25,900								736
1965	230,551	14,719	4,838	53,810	9,747			11,686		16,800								2,218
1966	261,678	18,200	9,505	102,353	13,042			24,864		20,200								2,239
1967	550,362	32,064	11,698	162,228	23,869			32,109		19,600								4,378
1968	702,181	57,902	4,374	84,189	35,232			29,647		31,500								22,038
1969	862,789	50,351	16,009	167,134	36,029			34,749		14,500								10,439
1970	1,256,565	70,094	11,737	133,079	19,691	12,598		64,690		9,900								15,295
1971	1,743,763	43,054	15,106	160,399	40,464	18,792		92,452		9,800								13,496
1972	1,874,534	42,905	12,738	47,856	64,510	13,123		76,813		5,700								10,893
1973	1,758,919	53,386	5,957	78,240	55,280	9,217		43,919		3,700								55,826
1974	1,588,390	62,462	4,238	42,235	69,634	21,473		37,357		14,000								60,263
1975	1,356,736	51,551	2,766	64,690	64,819	20,832		20,393		8,600								54,945
1976	1,177,822	50,481	2,923	56,221	60,523	17,806		21,746		14,900								26,143
1977	978,370	33,335	2,718	38,373	27,708	9,454		14,393		2,654								35,902
1978	979,431	42,543	1,192	138,433	37,423	8,338		21,040		2,221					311		4,926	61,537
1979	913,881	33,761	1,376	99,017	34,998	7,921		19,724		1,723					2,614	831	6,886	38,767
1980	958,279	45,861	2,206	87,391	48,856	13,761		20,406		1,097					1,985	4,286	4,040	34,633
1981	973,505	51,996	2,604	97,301	52,921	13,473		23,428		1,222					3,955	4,040	4,040	34,633
1982	955,964	55,040	3,184	95,712	45,805	9,103		23,809		224					3,027	4,182	35,651	
1983	982,363	83,212	2,695	108,385	43,443	10,216		30,454		221					276	328	3,838	18,200
1984	1,098,783	110,944	2,329	159,526	21,317	7,980		44,286		1,569					320	141	3,470	15,465
1985	1,179,759	132,736	2,348	227,107	14,698	7,288		71,179		784					176	57	2,824	8,308
1986	1,188,449	130,555	3,518	208,597	7,710	6,761		76,328		560					92	4	1,611	11,303
1987	1,237,597	144,539	4,178	181,429	6,533	4,380		30,372		920					102	12	848	10,471
1988	1,228,000	192,726	3,193	223,156	6,064	5,477		137,418		1,047					474	12	108	8,569
1989	1,230,000	164,800	1,252	153,165	4,061	3,024		63,452		2,017					341	428	414	12,206
1990	1,353,000	162,927	2,329	80,584	7,267	2,773		22,568		5,639					192	3,126	300	4,993
1991	1,268,360	165,444	1,128	94,755	3,704	12,748	46,681	30,401		4,744					384	480	460	5,698
1992	1,384,376	163,240	538	146,942	1,875	11,080	51,720	34,757		3,309					396	2,265	544	16,283
1993	1,301,574	133,156	669	105,809	6,330	7,930	63,942	28,812		3,763					675	2,610	819	29,993
1994	1,362,694	174,151	699	144,544	7,211	13,043	60,276	29,720		1,907					190	201	597	21,413
1995	1,264,578	228,496	929	124,746	5,855	8,282	54,672	34,861		1,210					261	190	502	23,430
1996	1,189,296	209,201	629	129,509	4,699	13,280	46,775	35,390		2,635					629	340	364	20,928
1997	1,115,268	209,475	547	166,681	6,589	8,580	67,349	42,374		1,060					364	780	1,080	19,717
1998	1,101,428	160,681	386	101,310	8,303	14,985	33,221	39,940		1,124					161	171	1,438	20,997
1999	889,589	134,647	646	67,307	5,205	9,827	39,934	33,042		609					203	901	891	23,156
2000	1,132,736	151,372	742	84,057	5,888	12,071	49,186	36,813		704					135	2,008	393	17,045
2001	1,387,452	142,452	863	63,563	4,252	12,836	28,949	27,693		1,148					239	239	375	23,098
2002	1,481,815	166,552	1,143	74,956	3,150	10,821	40,700	30,229		858					296	264	1,761	23,148
2003	1,489,997	176,639	969	79,961	2,515	12,292	35,003	16,929	9,964	1,341					401	572	1,334	26,639
2004/d	1,480,398	172,295	983	74,776	1,811	17,276	47,802	22,234	7,867			717	116	119	328	5,368	1,198	26,205
															314	7,052	1,003	26,275

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69.

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

b/ Inc lides POP shortraker, rouzheve, northern and sharochik.

d/ Data through November 13, 2004.

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

Table 3. Groundfish catches (metric tons) in the Aleutian Islands, 1954-2004.																						
Year	Pollock	Pacific		Willow		Arrow		Other		Pacific		Pacific		Northern	Shortfin	Rougheye	Other		Other	Total		
		Cod	Sable	Flr	Greenland	Tooth	Rock	Flat	Alaska	Ocean	Ocean	Northern	Shortfin				Rock	Arctic			Squid	Species
			Fish	Sole	Turbot	Flounder/a	Sole	Fish	Halibut	Complex	Porch	Rockfish	Rockfish			Rockfish	Fish	Mackerel		Species	Species)	
1954																					0	
1955																					0	
1956																					0	
1957																					0	
1958																					0	
1959																					0	
1960																					0	
1961																					0	
1962																					200	
1963			664			7						200									21,471	
1964			241	1,541		504						90,300								66	92,632	
1965			451	1,249		300						109,100								768	111,868	
1966			154	1,341		63						85,900								131	87,389	
1967			293	1,652		394						55,900									8,542	66,781
1968			289	1,673		213						44,900									8,948	56,023
1969			200	1,673		228						38,800									3,088	44,009
1970			283	1,248		285	274					66,900						949			10,671	80,610
1971			2,078	2,936		1,730	381					21,800									2,973	32,118
1972			435	3,531		12,874	1,323					33,200						5,907			22,447	79,717
1973			977	2,902		8,666	3,705					11,800						1,712			4,244	34,006
1974			1,379	2,477		8,788	3,195					22,400						1,377			9,724	49,340
1975			2,838	1,747		2,970	784					16,600						13,326			8,288	46,553
1976			4,100	1,639		2,067	1,370					14,000						13,126			7,073	43,465
1977		7,625	3,262	1,897		2,453	2,035					8,080						3,043	20,975	1,808	16,110	67,348
1978		6,282	3,295	821		4,766	1,782					5,286						921	23,418	2,085	12,436	61,092
1979		9,304	5,393	782		6,411	6,436					5,487						4,517	21,279	2,252	12,934	75,195
1980		38,156	5,788	274		3,697	4,603					4,700						430	15,533	2,332	13,028	108,531
1981		55,516	10,462	533		4,400	3,640					3,622						328	16,661	1,763	7,274	104,199
1982		57,978	1,526	955		6,317	2,415					1,014						2,114	19,546	1,201	5,167	98,233
1983		39,026	9,955	673		4,115	3,753					280						1,045	11,585	510	3,675	94,617
1984		81,834	22,216	999		1,803	1,472					631						56	35,998	343	1,670	147,022
1985		38,730	12,690	1,448		33	87					308						99	37,836	9	2,050	113,310
1986		46,641	10,332	3,028		2,154	142					286						169	31,978	20	1,309	96,239
1987		38,730	13,307	3,834		3,066	199					1,004						147	30,049	23	1,155	81,364
1988		43,000	5,165	3,415		1,044	406					1,979						278	21,636	3	437	77,383
1989		156,000	4,118	3,248		4,761	198					2,706						481	14,868	6	108	186,494
1990		73,000	8,081	2,116		2,353	1,459					14,650						864	21,725	11	627	124,886
1991		78,104	6,714	2,071	1,380	3,174	938	88				2,545						549	22,238	30	91	117,942
1992		54,036	42,889	1,546	4	895	900	236	68			10,277						3,689	46,831	61	3,081	164,513
1993		57,184	34,234	2,078	0	2,138	1,348	318	39			13,375						495	65,805	85	2,540	179,639
1994		38,708	22,421	1,771	0	3,168	1,334	308	55			16,939						301	69,401	86	1,102	175,614
1995		64,925	16,534	1,119	6	2,338	1,001	336	47			14,734						220	81,214	95	1,273	183,862
1996		28,933	31,389	720	654	1,677	1,330	371	61			20,443						278	103,087	87	1,720	190,730
1997		26,872	25,166	779	234	1,077	1,071	271	39			15,687						307	65,668	323	1,555	139,049
1998		23,821	34,964	995	5	821	694	446	54			13,729						385	56,195	25	2,448	134,182
1999		965	27,714	565	13	422	746	577	53			17,619						630	51,636	9	1,633	102,382
2000		1,244	39,684	1,048	13	1,086	1,157	480	113			14,893						601	46,990	8	3,010	110,327
2001		824	34,207	1,074	15	1,060	1,220	526	97			15,387						610	61,296	5	4,029	120,530
2002		1,177	30,801	1,118	29	485	1,032	1,165	130			14,996						551	44,722	10	1,980	98,216
2003		1,653	32,455	1,119	0	993	987	972	81			18,306						411	51,742	26	1,411	110,166
2004/c		1,140	28,847	941	9	410	801	815	20				11,165	4,567	121	181	335	53,402	14	1,842	104,620	

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1964-69.

c/ Data through November 13, 2004.

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

b/ Includes POP shortfin, rougheye, northern and shamchuro fish until 2004.

Table 4. Groundfish catches (metric tons) in the Bering Sea and Aleutian Islands, 1954-2004.

Year	Pacific		Yellow	Greenland	Arrow	Other	Alaska	Pacific	Pacific	Other	Other	Other	Other	Other	Other	Other		
	Pollock	Cod	Sable Fish	Fin Sole	Turbot	Tooth Flounder/a	Rock Sole/c	Fat Fish	Alaska Phice	Ocean Perch Complex/b	Ocean Perch	Northern Rockfish	Shortraker Rockfish	Rougheye Rockfish	Rock Fish	Atka Macrarel	Squid	Other Species
1954	0	0	0	12,562	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	14,690	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	24,697	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	0	0	24,145	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	6,924	171	6	44,153	0	0	0	0	0	0	0	0	0	0	0	0	0	147
1959	32,793	2,864	289	185,321	0	0	0	0	0	0	0	0	0	0	0	0	0	380
1960	0	0	1,861	456,103	36,843	0	0	0	0	6,100	0	0	0	0	0	0	0	0
1961	0	0	15,627	553,742	57,348	0	0	0	0	47,000	0	0	0	0	0	0	0	0
1962	0	0	25,989	420,703	58,226	0	0	0	0	20,100	0	0	0	0	0	0	0	0
1963	0	0	14,370	85,810	31,572	0	0	35,643	0	45,300	0	0	0	0	0	0	0	0
1964	174,792	13,649	5,086	111,177	34,233	0	0	30,604	0	116,200	0	0	0	0	0	0	0	802
1965	290,551	15,170	6,087	53,810	10,047	0	0	11,686	0	125,900	0	0	0	0	0	0	0	2,986
1966	261,678	18,354	10,846	102,353	13,105	0	0	24,864	0	106,100	0	0	0	0	0	0	0	2,370
1967	590,362	32,357	13,350	162,228	24,263	0	0	32,109	0	75,300	0	0	0	0	0	0	0	12,920
1968	702,181	58,191	6,047	84,189	35,445	0	0	29,647	0	76,400	0	0	0	0	0	0	0	31,006
1969	862,789	50,571	17,682	167,134	36,257	0	0	34,749	0	53,300	0	0	0	0	0	0	0	13,547
1970	1,256,565	70,377	12,985	133,079	19,976	12,872	0	64,690	0	76,800	0	0	0	0	0	949	0	25,966
1971	1,743,763	45,132	18,042	160,399	42,214	19,373	0	92,452	0	31,600	0	0	0	0	0	0	0	16,469
1972	1,874,534	43,340	16,289	47,856	77,384	14,446	0	76,813	0	38,900	0	0	0	0	0	5,907	0	33,340
1973	1,738,919	54,363	8,859	78,240	63,946	12,922	0	43,919	0	15,300	0	0	0	0	0	1,712	0	60,070
1974	1,388,390	63,841	6,735	42,235	78,442	24,668	0	37,357	0	36,400	0	0	0	0	0	1,377	0	69,987
1975	1,356,736	54,389	4,513	64,690	67,789	21,616	0	20,393	0	25,200	0	0	0	0	0	13,326	0	63,133
1976	1,177,822	54,671	4,382	56,221	62,390	19,176	0	21,746	0	28,900	0	0	0	0	0	13,126	0	33,196
1977	985,995	36,597	4,615	58,373	30,161	11,489	0	14,393	0	10,734	0	0	0	0	3,354	20,975	6,734	52,072
1978	985,713	45,838	2,013	138,433	42,189	10,140	0	21,040	0	7,207	0	0	0	0	3,535	24,249	8,971	73,973
1979	923,385	39,354	2,158	99,017	41,409	14,357	0	19,724	0	7,210	0	0	0	0	6,625	23,264	6,538	51,701
1980	1,016,435	51,649	2,480	87,391	52,553	18,364	0	20,406	0	5,797	0	0	0	0	879	20,488	6,372	47,661
1981	1,029,021	62,438	3,137	97,301	57,321	17,113	0	23,428	0	4,844	0	0	0	0	684	19,688	5,945	42,925
1982	1,013,942	56,566	4,139	95,712	52,122	11,518	0	23,809	0	1,288	0	0	0	0	2,390	19,874	5,039	23,367
1983	1,041,389	93,167	3,368	108,385	47,538	13,969	0	30,454	0	501	0	0	0	0	1,265	11,726	3,980	19,140
1984	1,180,617	133,160	3,328	159,526	28,130	9,452	0	44,286	0	2,200	0	0	0	0	232	36,055	3,167	10,178
1985	1,238,489	145,426	3,796	227,107	14,731	7,375	0	71,179	0	1,092	0	0	0	0	191	37,860	1,620	13,553
1986	1,235,090	140,887	6,546	208,597	9,864	6,903	0	76,328	0	846	0	0	0	0	271	31,990	868	11,980
1987	1,266,317	157,746	8,012	181,429	9,599	4,539	0	90,372	0	1,934	0	0	0	0	621	30,061	131	9,724
1988	1,271,000	197,891	6,608	223,156	7,108	5,883	0	137,418	0	3,026	0	0	0	0	619	22,084	417	12,643
1989	1,386,000	168,918	4,500	153,165	8,822	3,222	0	63,452	0	4,723	0	0	0	0	673	17,994	306	5,101
1990	1,426,000	171,008	4,445	80,384	9,630	4,232	0	22,568	0	20,289	0	0	0	0	1,248	22,205	471	6,325
1991	1,346,464	172,138	3,199	96,135	6,878	13,686	46,681	30,489	0	7,289	0	0	0	0	945	24,523	574	16,376
1992	1,438,412	206,129	2,104	146,946	2,770	11,980	519,56	34,825	0	13,386	0	0	0	0	4,364	49,441	880	33,074
1993	1,338,738	167,390	2,747	105,809	8,468	9,298	64,260	28,871	0	17,138	0	0	0	0	685	66,006	682	23,953
1994	1,421,402	196,572	2,470	144,544	10,379	14,377	60,584	29,775	0	18,866	0	0	0	0	562	69,391	588	24,532
1995	1,329,303	245,090	2,048	124,752	8,193	9,283	55,028	34,908	0	15,944	0	0	0	0	849	81,554	439	22,201
1996	1,218,229	240,390	1,349	130,163	6,376	14,610	47,146	33,451	0	23,078	0	0	0	0	642	103,867	1,167	21,437
1997	1,142,140	234,641	1,326	166,915	7,666	9,651	67,520	42,413	0	16,747	0	0	0	0	468	65,839	1,761	22,552
1998	1,125,249	195,645	1,181	101,315	9,124	15,679	33,667	39,994	0	14,863	0	0	0	0	388	57,096	916	25,604
1999	890,554	162,361	1,211	67,320	5,627	10,573	40,511	33,095	0	18,228	0	0	0	0	765	53,644	402	18,678
2000	1,133,980	191,056	1,790	84,070	6,974	13,228	49,666	36,926	0	15,397	0	0	0	0	840	47,229	383	26,108
2001	1,388,276	176,639	1,937	63,578	5,312	14,056	29,475	27,790	0	16,735	0	0	0	0	906	61,560	1,766	27,177
2002	1,482,992	197,353	2,261	74,985	3,635	11,853	41,865	30,379	0	15,834	0	0	0	0	952	45,294	1,344	28,619
2003	1,491,630	209,114	2,088	79,961	3,508	13,279	35,975	17,010	9,964	19,647	0	0	0	0	739	57,110	1,234	27,716
2004/d	1,481,548	201,140	1,924	74,785	2,221	18,077	48,617	22,304	7,867		11,882	4,683	240	203	649	60,454	1,017	28,117

a/ Arrowtooth flounder included in Greenland turbot catch statistics, 1960-69.

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

c/ Rocks ole prior to 1991 is included in other fatfish catch statistics.

d/ Data through November 13, 2004.

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

Table 5. Summary of stock abundance (biomass), overfishing level (OFL), acceptable biological catch (ABC), the fishing mortality rate corresponding to ABC ( $F_{ABC}$ ), and the fishing mortality rate corresponding to OFL ( $F_{OFL}$ ) for the eastern Bering Sea (EBS), Aleutian Islands (AI), and Bogoslof district as projected for 2005. "Biomass" corresponds to projected January 2005 abundance for the age+ range reported in the summary section. Stock-specific biomass, OFL, and ABC are in metric tons, reported to three significant digits (four significant digits are used when a stock-specific ABC is apportioned among areas on a percentage basis). Fishing mortality rates are reported to two significant digits.

Species or Complex	Area	Biomass	OFL	ABC	$F_{OFL}$	$F_{ABC}$
Walleye pollock	EBS	8,410,000	2,100,000	1,960,000	0.25	0.23
Walleye pollock	AI	344,000	99,300	43,200	0.21	0.20
Walleye pollock	Bogoslof	198,000	39,600	29,700	0.20	0.15
Pacific cod	BSAI	1,290,000	265,000	206,000	0.43	0.31
Sablefish	EBS	34,000	2,950	2,440	0.12	0.10
Sablefish	AI	34,000	3,170	2,620	0.12	0.10
Yellowfin sole	BSAI	1,560,000	148,000	124,000	0.14	0.11
Greenland turbot	BSAI	98,300	19,200	3,930	0.50	0.07
	EBS			2,720		
	AI			1,210		
Arrowtooth flounder	BSAI	684,000	132,000	108,000	0.33	0.26
Rock sole	BSAI	1,380,000	157,000	132,000	0.18	0.15
Flathead sole	BSAI	560,000	70,200	58,500	0.37	0.30
Alaska plaice	BSAI	913,000	237,000	189,000	1.06	0.76
Other flatfish	BSAI	143,000	28,500	21,400	0.20	0.15
Pacific ocean perch	BSAI	382,000	17,300	14,600	0.058	0.045
	EBS			2,920		
	Area 541			3,210		
	Area 542			3,165		
	Area 543			5,305		
Northern rockfish	BSAI	200,000	9,810	8,260	0.058	0.048 <sup>a</sup>
Shortraker rockfish	BSAI	26,500	794	596	0.030	0.023 <sup>a</sup>
Rougheye rockfish	BSAI	11,900	298	223	0.025	0.019 <sup>a</sup>
Other rockfish	BSAI	26,600	1,870	1,400	0.070	.053
	EBS	15,400		810		
	AI	11,200		590		
Atka mackerel	AI	486,000	147,000	124,000	0.64	0.52
	Area 541			24,550		
	Area 542			52,830		
	Area 543			46,620		
Squids	BSAI	n/a	2,620	1,970	n/a	n/a
Sharks	BSAI	17,700	1,590	1,200	0.09	0.068
Skates	BSAI	478,000	47,800	35,800	0.10	0.075
Sculpins	BSAI	206,000	39,200	29,400	0.19	0.143
Octopus	BSAI	6,320	3,160	2,370	0.50	0.375
<b>TOTAL</b>		<b>17,489,320</b>	<b>3,573,362</b>	<b>3,100,609</b>		

a/ previously combined into other red rockfish complex

b/ based on natural mortality rate for shortspine thornyhead

Table 6. Summary of BSAI groundfish tier designations under Amendment 56, maximum permissible ABC fishing mortality rate ( $\max F_{ABC}$ ), the Plan Team’s recommended tier designation, 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. Stock-specific  $\max ABC$  and ABC are in metric tons, reported to three significant digits (four significant digits are used when a stock-specific ABC is apportioned among areas on a percentage basis). 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 2005 fishing year.

Species or Complex	Area	Tier	$\max F_{ABC}$	$F_{ABC}$	$\max ABC$	ABC	% Red.
Walleye pollock	EBS	1a	0.23	0.23	1,960,000	1,960,000	
Walleye pollock	AI	3a	0.35	0.20	80,500	43,200	46
Walleye pollock	Bogoslof	5	0.15	0.15	29,700	29,700	
Pacific cod	BSAI	3b	0.35	0.31	227,000	206,000	9
Sablefish	BS	3b	0.11	0.10	2,440	2,440	
Sablefish	AI	3b	0.11	0.10	2,620	2,620	
Yellowfin sole	BSAI	3a	0.11	0.11	124,000	124,000	
Greenland turbot	BSAI	3a	0.39	0.07	15,500	3,930	75
	EBS					2,720	
	AI					1,210	
Arrowtooth flounder	BSAI	3a	0.26	0.26	108,000	108,000	
Rock sole	BSAI	3a	0.15	0.15	132,000	132,000	
Flathead sole	BSAI	3a	0.30	0.30	58,500	58,500	
Alaska plaice	BSAI	3a	0.76	0.76	189,000	189,000	
Other flatfish	BSAI	5	0.15	0.15	21,400	21,400	
Pacific ocean perch	BSAI	3b	0.045	0.045	14,600	14,600	
	EBS					2,920	
	Area 541					3,210	
	Area 542					3,165	
	Area 543					5,305	
Northern rockfish	BSAI	3a	0.048	0.048	8,260	8,260	
Shorthead rockfish	BSAI	5	0.023	0.023	596	596	
Rougheye rockfish	BSAI	5	0.019	0.019	223	223	
Other rockfish	BSAI	5	.053	.053	1,400	1,400	
	EBS					810	
	AI					590	
Atka mackerel	BSAI	3a	0.52	0.52	124,000	124,000	
	Area 541					24,550	
	Area 542					52,830	
	Area 543					46,620	
Squid	BSAI	6	n/a	n/a	1,970	1,970	
Sharks	BSAI	5	0.068	0.068	1,200	1,200	
Skates	BSAI	5	0.075	0.075	35,800	35,800	
Sculpins	BSAI	5	0.143	0.143	29,400	29,400	
Octopi	BSAI	5	0.375	0.375	2,370	2,370	
<b>Total</b>					<b>3,170,479</b>	<b>3,100,609</b>	

Figure 1

# BSAI Statistical and Reporting Areas

