AGENDA D-1(a)
DECEMBER 1985

M E M O R A N D U M

TO: Council, SSC, and AP Members

FROM: Jim H. Branson
Executive Director

DATE: December 4, 1985

SUBJECT: Gulf of Alaska Groundfish Fishery Management Plan

ACTION REQUIRED

Review 1985 status of stocks and adjust 1986 ABCs where necessary.

BACKGROUND

You received a report on the status of the Gulf groundfish resource at the September Council meeting. Since then, new information has become available. The plan team met on November 18-22, 1985 to review the earlier assessment following the receipt of INPFC documents and results of continued analysis on pollock and sablefish. Unfortunately, the additional scientific information was inadequate to more narrowly define ABC for pollock, sablefish, and Pacific ocean perch. For pollock, the plan team is presenting three independent procedures for the determination of ABC. Each procedure produced a different ABC value ranging from 0-100,000 mt. The minimum threshold approach continues to lead to an ABC of zero. Using annual surplus production as a criterion produced an ABC of 100,000 mt. The stock reduction analysis method produced an ABC of 75,600 mt. The plan team recommends the use of the 75,600 mt ABC over the other two estimates.

For both sablefish and Pacific ocean perch, the ABCs are presented as ranges. Attempts failed to more specifically define ABC. Therefore, the plan team suggests that the Council use the midpoint of these ranges as ABC for 1986. A summary table of the team's findings and a worksheet are included here. Further details on the status of stocks and the team's recommendations can be found in the plan team meeting report [item D-1(a)1] and final status of stocks report [item D-1(a)2].

AGENDA D-1(a)1
December 1985

GULF OF ALASKA GROUNDFISH PLAN TEAM MEETING REPORT

November 18-22, 1985
Northwest and Alaska Fisheries Center
Seattle, Washington

The Gulf of Alaska Groundfish Plan Team (PT) met in Seattle on November 18-22, 1985. The principal topics were the review of the continued analysis on pollock and sablefish, a revision to the team's status of stocks document and 1986 ABC recommendations, and the completion of the team's analysis and recommendations in regard to the setting of halibut PSC limits. Other topics included the election of a new chairman, a discussion of a sablefish size limit, and a review of the methodology used last year for addressing the zero-JVP and zero-TALFF problem. The PT also met with the Council's FMP Workgroup to present a fishery economic maximization model and discuss problems meeting the deadlines specified in the groundfish amendment cycle.

In attendance were Plan Team members Jim Balsiger, Joe Terry, and Jeff Fujioka, NWAFC; Ron Berg, NMFS; Fritz Funk and Pete Jackson, ADF&G; Steve Hoag, IPHC; and Steve Davis, NPFMC. Advisors to the team were Miles Alton, Grant Thompson, and Eric Brown, NWAFC; Terry Smith and Ron Rogness, NPFMC; and Will Barber, UAF. Members of the public in attendance were Steve Hughes, Natural Resource Consultants; Paul MacGregor, North Pacific Longline Gillnet Assn.; Steve Dickenson, Japan Deep Sea Trawlers Assn.; Bob Alverson, Mark Lundsten, and Ray Olsen, Fishing Vessel Owners Assn.; and Susan Blanding.

The meeting began with the election of Dr. Jim Balsiger as team chairman. Dr. Balsiger replaces Dr. Gary Stauffer who left the team following a promotion at the NWAFC. Dr. Balsiger was welcomed back to the team having served as its chairman during 1978-1980. Ron Berg was re-elected as vice-chairman for 1986.

I. UPDATE OF STATUS OF STOCKS REPORT AND FINAL ABC RECOMMENDATIONS FOR 1986

Following the September Council Meeting, the PT continued its analysis on the status of the pollock and sablefish stocks in the Gulf of Alaska. In addition to the work performed at the NWAFC, a study on pollock prepared by Steve Hughes of Natural Resource Consultants was also reviewed. As a result of this exercize, the PT discussed three independent procedures for the determination of a pollock ABC for 1986. Each procedure produced a different ABC value ranging from 0-100,000 mt. The stock reduction analysis method, used in managing this fishery in the past, produced an ABC of 75,600 mt. The PT recommends the use of this figure over the other two estimates.

For sablefish, the PT again reviewed 1984 and 1985 survey data for clues that might lead to an ABC estimate. This review did not produce any new ABC information. The ABC range of 12,000-25,000 mt presented to the Council at its last meeting is still the best estimate of ABC. However, given the uncertainties surrounding the upper limit in this range, the PT advises the use of the midpoint or 18,800 mt as the 1986 ABC. The PT recommends that the distribution of this ABC throughout the Gulf be based on the biomass

distribution as indicated in the 1984-85 surveys. A summary of the team's ABC recommendations is provided as Table 1. Details of the determination of these and other ABCs are provided in the PT Status of Stocks report dated November 18, 1985.

II. REVIEW OF THE HALIBUT PSC FRAMEWORK AND RECOMMENDED BYCATCH RATES

Since the September Council meeting, the PT has continued its analysis of domestic bycatch data obtained from state and federal observer programs. Other information studied included material obtained from Natural Resource Consultants and written public comments.

The PT discussed three major issues concerning halibut PSC measures: 1) the appropriate level for the sum of the domestic and joint-venture PSC limits; 2) the allocation of this sum among domestic and joint-venture fisheries; and 3) the applicability of a PSC limit for the domestic fisheries in the absence of an adequate observer program. Details of these three issues and the team's recommended bycatch rates are provided in detail in the accompanying report entitled "Halibut Bycatch Measures for the Gulf of Alaska Groundfish Fishery" dated November 27, 1985. A summary of the PT's recommendations are provided below by issue:

1. The Appropriate Level for the Sum of the Domestic and Joint Venture PSC Limits

The determination of the overall level of the PSC limits is an allocation decision. The Plan Team has provided information that will aid the Council in determining the overall level, but since this determination will depend on how the Council decides to weight the value of halibut that is taken in the halibut and groundfish fisheries, the Plan Team did not recommend a specific allocation. The information provided by the Plan Team includes estimates of the value of halibut to the halibut and groundfish fisheries and estimates of the historical allocations. Table 2 presents both the implied halibut PSC limits for previous years and potential overall PSC levels for 1986 based on historical bycatch and public comments.

2. Allocating the Overall PSC Level Among Domestic and Joint Venture Fisheries

The Plan Team discussed the issue of having a joint venture PSC limit greater than zero when the resulting domestic PSC limit would tend to limit the groundfish catch of the domestic fishery. It was noted that the Council's decision to have separate PSC limits for domestic and joint venture fisheries suggests that such a circumstance might well be acceptable. This is similar to the situation in which the domestic halibut fishery catch has been limited by bycatch in both joint venture and foreign fisheries. Pat Travers is aware of this issue and is expected to have a legal opinion prepared for the Council. Information provided in the Team's halibut bycatch measures report on the relative value of halibut to alternative groundfish fisheries will assist the Council in determining the appropriate PSC limits for joint ventures.

Table 1.--Current status of Gulf of Alaska groundfish resources (mt).

Species	1985 OY	Projected 1985 catch	Stock condition	Current trend in abundance	1986 ABC
Pollock	321,600	275,129	Depressed	Exploitable biomass declining to 420,000 mt in early 1986	ABC = 75,600 mt
Pacific cod	60,000	18,800	Good	Stable	ABC = 136,000
Flounders	33,500	2,300	Good	Assumed stable	Maintain ABC at 141,000
Pacific ocean perch	6,083	1,430	Depressed	Stable	ABC = 6,500 mt; the midpoint of 0 and 13,000 mt
Sablefish	9,480	11,184	Good	Increasing	ABC = 18,800 mt; the midpoint of 12,630 and 25,000 mt
Atka mackerel	5,300	355	Depressed	Depressed; no apparent recruitment in eastern/central area	Unknown; set equal to OY in 1985
Other rockfish	5,000	1,105	Depressed	Unknown	ABC = 2,300 mt
Thornyhead	3,750	110	Unknown	Estimated biomass = 21,000 mt in central and western area	Unknown; MSY = 3,750
Squid	5,000	70	Appears good	Assumed stable	Unknown; set equal to OY in 1985
Other species	22,435	2,645	Probably good	Assumed stable	Unknown; set equal to OY in 1985

Table 2.--Implied halibut PSC limits for previous years and possible overall PSC levels for 1986 based on historical trawl bycatch and public comment.

FMP Prior to Amendment 14--

December 1 - May 31. Foreign on-bottom trawling is prohibited and domestic trawling is only permitted until 29 t and 52 t of halibut are taken in the western and central Gulf, respectively.

June 1 - November 30. Only time/area restrictions and OYs limit bycatch.

Emergency Rules for 1984 and 1985--

Similar to the above except the December 1-May 31 domestic PSC limits were increased to 270 t and 768 t of halibut in the western and central Gulf, respectively. Once a PSC limit is reached, only on-bottom trawling is prohibited.

Overall halibut PSC levels for 1986 based on--

mean annual groundfish trawl halibut bycatch, 1977-1984:	1,561 t
mean annual split between the halibut and groundfish trawl fisheries 1977-1984 (mean annual catch of halibut x 14% overall bycatch rate):	2,700 t

Overall halibut PSC levels for 1986 recommended by:

IPHC and ALFA:	2,000 t
Bob Jacobson:	Set PSC to allow directed halibut catch to remain at the 1985 level.
Deep Sea Fisherman's Union:	Not to exceed 2,500 t
Fishing Vessel Owner's Association:	2,833 t

Note: The recommended overall halibut PSC levels may have in some cases been intended to apply to all groundfish fisheries, not just the domestic and joint venture trawl fisheries.

3. Operational Characteristics of Halibut PSC Measures

The Plan Team had a lengthy discussion of the potential operational characteristics of halibut PSC measures and recommends the following.

Joint Ventures

- Establish an overall joint venture PSC limit.
- Allocate it to individual joint ventures on the basis of expected target catch.
- Use Foreign Vessel Observer Program data to monitor bycatch.
- Count all halibut bycatch of a joint venture against its PSC limit.
- Prohibit further on-bottom trawling by a joint venture that has taken its PSC limit.

Domestic Fisheries

- Establish a domestic on-bottom trawl PSC limit and an expected bycatch rate.
- Monitor bycatch on the basis of the expected bycatch rate for cod and flounder and the reported trawl catch of cod and flounder.
- Adjust the expected bycatch rate inseason if new bycatch rate information becomes available.
- Set PSC limits at zero for small time/areas for which bycatch rates are expected to be unacceptably high.
- Prohibit further on-bottom trawling once it appears that the PSC limit has been taken.

Foreign Fisheries

- The regulations that implement Amendment 14 do not refer to foreign fisheries; therefore, without changing these regulations, the PSC framework cannot be used to control bycatch in foreign fisheries.
- The permit process can be used to control foreign bycatch of halibut just as it was used to control the bycatch of fully utilized species in 1985.

III. OTHER BUSINESS

Discussion of the Term ABC and a Working Definition

An update on the efforts of the NWAFC's ABC Workgroup was presented by Jim Balsiger. This workgroup has been attempting to more clearly define the term "acceptable biological catch"(ABC) as applied in fisheries management. Will

Barber has also been examining this issue. While no firm definition of ABC has yet been developed, efforts will continue to have a working definition available for the rewrite of the Gulf of Alaska Groundfish FMP. The PT did agree that for 1986, ABC is that level of catch which should not be exceeded for biological reasons. The team believes that any harvest below ABC will not constitute overfishing.

Recommendations on Management of 0-JVP and 0-TALFF Species

In December 1984 the Council was presented for the first time with several groundfish species that were fully-utilized by domestic fishermen and processors. Under the FMP, the three species, sablefish, Pacific ocean perch, and other rockfish, were subsequently desiginated as DAP fisheries (OY=DAP) and JVP and TALFF fisheries were set at zero. This DAP designation required a management decision since by regulation any joint venture or foreign fishery which would take any of these species incidentally would be prohibited. For 1985, the Council elected to provide bycatch amounts of the fully-utilized species by subtracting amounts of fish from the equilibrium yield (EY) estimate. This bycatch allocation to joint-ventures and foreign fisheries was only possible because the fully- utilized species OY was set below their EYs for rebuilding purposes. Had this "buffer" not existed, no bycatch allocation would have been possible. As it were, to implement the Council's solution still required an emergency rule. Table 3 shows the bycatch apportionments to JVP and TALFF as approved by the Council for 1985. These apportionments were based on estimated bycatch rates obtained from the foreign observer program. During 1985, all joint-venture and foreign fisheries kept their bycatch below these levels.

For 1986, it is anticipated that zero-JVP and zero-TALFF will again be an issue before the Council. At the time of the PT meeting, there were no estimates available for DAP. The team assumes that the same three species identified as fully-utilized in 1985 will remain fully-utilized in 1986. As for 1985, the Council may want to provide small amounts of fully-utilized species to JVP and TALFF for bycatch purposes. The PT recommends that the same methodology be used as last year, with the exception that bycatch allocations be subtracted from ABC since no groundfish EYs were calculated for 1986. This solution is only viable as long as there is sufficient "buffer" between the fully-utilized species ABCs and OYs. Since these incidentally caught fish come from outside OY, they are treated as a prohibited species and retention is prohibited. Bycatch rates used in estimating domestic and foreign bycatch needs, obtained from the foreign observer program, will be available during the Council meeting.

Sablefish Size Limit

In anticipation of Council discussion, the PT discussed a 22" size limit for sablefish as proposed in both 1984 and 1985 public comments. The team understands the size limit as having two objectives: 1) to increase yield; and 2) to prevent targetting on small fish.

For objective 1, the PT does not believe a strong argument exists to support a size limit on a "yield per recruit" basis. The team has no scientific estimate of hooking mortality with sablefish. However, when estimating hooking mortality at 20-35%, the yield per recruit analysis shows less than a 10% increase in yield. The PT does not believe this to be a significant increase.

Table 3. 1985 Fully-utilized species apportionments in the Gulf of Alaska (mt)

Fully-utilized Species	Area	DAP Directed	DAP Allocated bycatch	1985 OY	JV PSC	Total DAH Removals	Fgn bc	25% inc. if needed ( )	Total Removals	Rebuilding Rate (%)
Sablefish	W	1,586	+ 84 =	1,670	+ 245 =	1,915	+ 140	(175) =	2,055 (2,090)	8 (6)
	C	2,907	+ 153 =	3,060	+ 545 =	3,605	+ 31	(39) =	3,636 (3,644)	11 (11)
Pacific ocean perch	W	1,302	NA =	1,302	+ 53 =	1,355	+ 30	(38) =	1,385 (1,393)	20 (20)
	C	3,906	NA =	3,906	+ 98 =	4,004	+ 16	(20) =	4,020 (4,024)	23 (23)
Rockfish	Gulfwide			5,000			25			

For objective 2, the PT believes that a sablefish size limit is not necessary since concerns of targetting on small fish by trawl and pot gear have already been addressed by allocating sablefish to both of these gear types (Amendment 14).

Status Report on GOA Groundfish FMP Rewrite

The PT met with the Council's GOA Groundfish Workgroup on November 19 to continue the development of the framework FMP. Among the items discussed, the team presented a revised work schedule. The Council originally instructed the team to revise the plan using the annual amendment cycle as shown on the left below:

Original	Event	Workgroup Proposal
January 1986	Council initially reviews draft FMP	March 1986
March	Council reviews & approves draft FMP, RIR, etc., to go to public review.	June
April-May	Public Review	July-September
June	Council gives final approval.	September
July-November	Secretarial Review	October-January
January 1	New FMP takes effect	mid-February 1987

The team and workgroup propose the cycle at the right which would mean a one- to two-month delay in implementing the plan in early 1987. The original schedule is just too tight to allow for adequate analysis and review given such a massive overhaul of the plan.

Next Meeting of the Plan Team

The PT will meet again sometime in February to continue their work in revising the GOA FMP.

Table 1.--Current status of Gulf of Alaska groundfish resources (mt).

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Atka mackerel	5,300	355	Depressed	Depressed; no apparent recruitment in eastern/central area	Unknown; set equal to OY in 1985
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Gulf of Alaska Plan Team Report

Status of Gulf of Alaska Groundfish Stock, 1985

November 18, 1985

STATUS OF GULF OF ALASKA GROUNDFISH STOCKS - 1985

This Plan Team report summarizes the condition of stocks in the Gulf of Alaska. The first section provides an executive summary of management recommendations for each species or species group. This is followed by a summary of the team's review of condition of each and recommendations based on their condition.

The Plan Team (PT) for the Groundfish Fishery Management Plan (FMP) of the Gulf of Alaska met in Seattle on September 9-13, and November 18-22, 1985 to review the status of stocks of the ten species, or species groups, which have a specified OY in the FMP. The PT review and discussions were based on 1985 INPFC documents and presentation by NMFS scientists. In addition, Mr. Steve Hughes of Natural Resource Consultants for Westward Trawlers, Inc. presented at the November meeting a critique of the assessment of the Gulf of Alaska pollock resource.

The PT presented their preliminary review at the September Council Meeting based on the September 13 PT report. This report summarizes the PT final deliberations. The final conclusions differ for only three species categories, pollock, sablefish, and Pacific ocean perch. For these three stocks, the PT established an ABC range based on 2 or more criteria and in each case selected an intermediate or midpoint value as the most appropriate value for ABC.

The following recommendations for harvest levels in 1986 are based on the PT's assessment of the current productivity of fishery resources in the Gulf of Alaska. The establishment of a final harvest level or OY values must also take into account the potential bycatch of fully utilized species, i.e. Pacific ocean perch complex, Atka mackerel, and sablefish.

SUMMARY RECOMMENDATIONS

1. POLLOCK - The biomass is projected to decline to about 420,000 mt for 1986. Evidence from 1984 travel surveys indicates this projection is too low, while past experience with the projection analysis suggests it is too high. The ABC is set by the PT at 75,600 mt based on a 420,000 mt biomass and an 18% optimal harvest rate that would achieve long-term annual surplus production. Any fishery in 1986 should be carried out in such a way as to have the least negative impact on the reproductive potential of the 1986 spawning stock.

2. PACIFIC COD - The ABC is estimated to be about 136,000 mt. In the past, OY has been set well below ABC to control halibut bycatch. The halibut PSC measures included in Amendment 14, if approved, may provide an alternative method of controlling halibut bycatches for those fisheries where observers are present. The 1985 OY is 60,000 mt, with the distribution among the western, central, and eastern areas of 16,560, 33,540, and 9,900 mt, respectively.

3. FLOUNDER - The PT recommends that the Gulf-wide ABC be set at the MSY of 141,081 mt because the stocks are in good condition due to high biomass and relatively low exploitation rates in this fishery.

4. PACIFIC OCEAN PERCH COMPLEX - The PT considers the stock to be depressed. The PT estimates an EY range of 0 - 13,000 mt and sets the 1986 POP ABC at the midpoint of the range or 6,500 mt, apportioned to management areas according to biomass distribution. If the Council wishes to maximize resource rebuilding, OY should be set at a level which allows an incidental catch only.

5. SABLEFISH - The PT considers ABC to be between the lower bound of 12,630 mt (EY for 1983-85) and the maximum upper limit of 25,000 mt.

The biomass in the Gulf of Alaska is estimated to be about 537,000 mt. However, because of the uncertainty of the biomass estimate and the appropriateness of a 25,000 mt harvest level, the PT recommends a midpoint value of 18,800 mt for ABC. There has been a disproportionally large increase of biomass in the central GOA area. Because of this, the PT recommends that ABC be apportioned to management areas according to the geographic distribution of biomass. Based on biomass, the percentage to each management area are: 13.5% for southeast Yak, 11.7% west Yakutat, 61.5% to Central Gulf and 13.3% to Western Gulf.

6. ATKA MACKEREL - There is no new information to indicate that there should be a change in the ABC of 4,678 mt for the Western Management Area. The 1984 survey found significant numbers in the western area only. The biomass estimate for this survey was 36,000 mt, with 500 mt in the central area and no catch in the eastern area. Catches continued at low levels, there is no indication of recruitment from 1968 to 1977 resulted in marked reductions of the Gulf of Alaska Atka mackerel stocks.

7. OTHER ROCKFISH - The PT estimates an ABC of 2,300 mt for the western, central, and a portion of the eastern area. No estimate is available for the whole eastern regulatory area. Because of the extreme longevity of many rockfish species, sustained yield is assumed to be very low.

8. THORNYHEAD ROCKFISH - The PT recommends no change in the current 3,750 mt MSY. There is no new information which would suggest altering the current MSY.

9. SQUID - There is no new information to suggest a change in the current 5,000 mt OY level.

10. OTHER SPECIES - No recommendations were made by the Team for this group. FMP procedures define that OY's for this group be set at 5% of the sum of OY's established for the other OY species categories.

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Atka mackerel	5,300	355	Depressed	Depressed; no apparent recruitment in eastern/central area	Unknown; set equal to OY in 1985
Other rockfish	5,000	1,105	Depressed	Unknown	ABC = 2,300 mt
Thornyhead	3,750	110	Unknown	Estimated biomass = 21,000 mt in central and western area	Unknown; MSY = 3,750
Squid	5,000	70	Appears good	Assumed stable	Unknown; set equal to OY in 1985
Other species	22,435	2,645	Probably good	Assumed stable	Unknown; set equal to OY in 1985

Table 2.--Gulf of Alaska groundfish OY, TALFF and Catch Statistics for 1985, reported and compiled by November 18.

Species	Area	OY	Domestic Landings	JV Catch	Final TALFF	Foreign Catch	Total Catch
Pollock	W		6,497	11,003		13,660	31,160
	C	305,000	2,583	221,301	35,000	6,821	230,705
	E	16,600	tr	0	0	0	tr
	Total	321,600	9,080	232,304	35,000	20,481	261,865
Pacific cod	W	16,560	778	306	7,600	7,324	8,408
	C	33,540	893	1,838	2,600	1,779	4,510
	E	9,900	58	0	0	0	58
	Total	60,000	1,729	2,144	10,200	9,103	12,976
Atka mackerel	W	4,678	0	1,854	100	5	1,859
	C	500	0	tr	20	0	tr
	E	100	0	0	0	0	0
	Total	5,278	0	1,854	120	5	1,859
Flounder	W	10,400	8	339	200	101	448
	C	14,700	52	1,617	250	3	1,672
	E	8,400	37	0	0	0	37
	Total	33,500	97	1,966	250	104	2,157
Pacific ocean perch	W	1,302	658	204	30[b]	6	868
	C	3,906	1	24	16[b]	1	26
	E	875	31	0	0	0	31
	Total	6,083	690	228	46[b]	7	925
Sablefish	W	1,670	2,040	92	140[b]	16	2,148
	C	3,060	3,785	77	31[b]	3	3,865
	E	4,250	5,607	0	0	0	5,607
	Total	8,980	11,432	169	171	19	11,620
Squid	Total	5,000	0	7	50[b]	6	12
Rockfish	Total	5,000	389	49	25[b]	4	442
Thornyhead rockfish	Total	3,750	26	11	50	1	38
Other species	Total	22,460	0	2,165	283	96	2,261
Total	W	34,610	3,484	2,795	8,070	7,452	13,731
	C[a]	360,706	13,811	235,860	37,917	22,267	271,938
	E	40,125	5,733	0	0	0	5,733
	Total	471,651	23,443	240,887	46,912	29,826	294,155

a Pollock values for Western and Central combined.
b Bycatch amounts.

POLLOCK

Annual foreign and U.S. catches of pollock in the Gulf of Alaska have increased steadily since 1978 (Table 3). U.S. catches by domestic fishermen delivering to U.S. processors continue to remain small. U.S. catches by domestic fishermen delivering to foreign processors in joint ventures operating in Shelikof Strait have increased markedly from 1,100 mt in 1980 to over 222,400 mt in 1985. U.S. catches surpassed foreign catches for the first time in 1983.

Table 3.--Annual pollock catch in the Gulf of Alaska by foreign and U.S. fisheries, 1977-85 (in 1000's metric tons).

Year	Foreign fisheries	Joint-Venture Fisheries	Domestic	Total
1977	120.4	--	N.A.	120.4
1978	96.3	--	N.A.	96.3
1979	103.2	--	4.5	107.7
1980	113.0	1.1	2.2	116.3
1981	130.3	16.9	1.8	149.0
1982	92.6	73.9	2.2	168.8
1983	81.4	134.1	0.1	215.5
1984	99.3	207.1	.3	306.6
1985	20.5[a]	232.3	9.1	261.9

[a] Preliminary estimates as of November 18, 1985.
N.A. = Not available.

The abundance of pollock in the Gulf of Alaska as measured by acoustic trawl surveys in Shelikof Straits during spawning period has declined from a high of 3,770,000 mt in 1981 to 700,000 mt in 1985 (Table 4). The 1985 biomass is a 62% decline from the estimate of 1984 biomass of 1,840,000 mt and is more precipitous than projected for 1985 in 1984. This estimate is nearly half of the projected 1985 estimate of 1,200,000 to 1,270,000 mt given to the Council in the fall of 1984. Contributing to the decline is the poor recruitment of the 1980, 1981, and 1982 year classes. Comparison of the age composition data for the 1981-85 survey results shows an unexpected sharp drop in the abundance of the 1978 and 1979 year classes (Fig. 1) between 1984 and 1985. These year classes have been the main contributor to the fisheries catch in recent years. The mortality rate suggested by the survey results for these two year classes combined was 35% between 1983 and 1984 as compared to 73% between 1984 and 1985. This discrepancy of 500,000 mt between the 1985 projected and surveyed biomass estimates could be due to an unexpected increase in mortality of adult pollock, to statistical imprecision in the estimates of biomass, or to changes in availability of the pollock in these year classes to the survey sampling gear.

For comparison purposes the 1985 biomass estimate was projected from the 1981 and 1983 hydroacoustic estimates from Shelikof Strait surveys (Fig. 2). Two projections were made for 1981 using biomass estimates for age 3+ pollock of 3.2 and 3.6 million mt. The three projections for 1981 and 1983 were 1.8, 1.6, and 1.5 million mt for 1985 and 1.2, 1.1, and 1.0 million mt for 1986. Although these projects are greater than 1 million mt for 1986, this comparison shows that the projections have always overestimated the survey estimates for the following years. This suggests that we should expect the results of the projection model will be optimistic.

Table 4.--Pollock biomass estimates determined from 1981 and 1983 through 1985 Shelikof Strait acoustic-midwater trawl surveys.

Year	Survey number and period	Mean density (kg/103m2)	Total area (km2)	Biomass (t x 106)	95% confidence interval (t x 106)
1981[a/]	1 March 3-15	637.6	6,870	4.38	2.92 to 5.84 (+33.3%)
	2 March 24-27	363.6	8,674	3.15	2.07 to 4.23 (+34.3%)
	3 April 4-10	251.0	12,138	3.06	2.02 to 4.08 (+33.3%)
1982	- - - - - - - - - - - - - - - - No survey - - - - - - - - - - - - - - - -				
1983[a/]	1 March 6-15	144.9	17,587	2.46	1.54 to 3.40 (+37.7%)
	2 March 16-19	194.7	12,123	2.36	1.26 to 3.46 (+46.6%)
	3 April 6-13	41.2	19,733	0.82	0.57 to 1.07 (+30.5%)
1984[a/]	1 March 3-9	133.6	16,567	2.03	1.43 to 2.64 (+29.9%)
	2 March 9-16	107.1	15,043	1.57	1.31 to 1.84 (+17.1%)
	3 March 16-18	139.3	14,383	1.90	1.06 to 2.75 (+44.2%)
	4 March 22-25	127.5	15,641	1.72	0.98 to 2.46 (+42.9%)
	5 April 1-7	119.8	15,147	1.66	1.19 to 2.13 (+28.3%)
1985[a/]	1 Feb. 21-28	39.6	16,361	0.65	0.47 to 0.82 (+27.3%)
	2 March 1-9	43.8	15,975	0.70	0.48 to 0.92 (+31.3%)
	3 March 14-20	46.8	16,389	0.77	0.55 to 0.98 (+27.8%)
	4 March 21-28	51.9	13,736	0.71	0.51 to 0.91 (+27.8%)

Annual Estimates

Year	Biomass (t x 106)	95% confidence interval (t x 106)	Source of estimates
1981	3.77	2.86 to 4.67	Mean of estimates for surveys 1 and 2
1982	- - - - - - - - - - - - - - - -	No survey	- - - - - - - - - - - - - - - -
1983	2.43	1.69 to 3.13	Mean of estimates for surveys 1 and 2
1984	1.84	1.21 to 2.47	Mean of estimates for surveys 1, 2, 3
1985	0.70	0.50 to 0.91	Mean of estimates for surveys 1, 2, 3

[a/] Estimates for 1981, 1983 and 1984 include very small amounts of age 1 fish, e.g., the biomass of age 1 fish in the "annual estimates" for these years did not exceed 0.024% of the total biomass. The 1985 estimates include only fish age 2 and older.

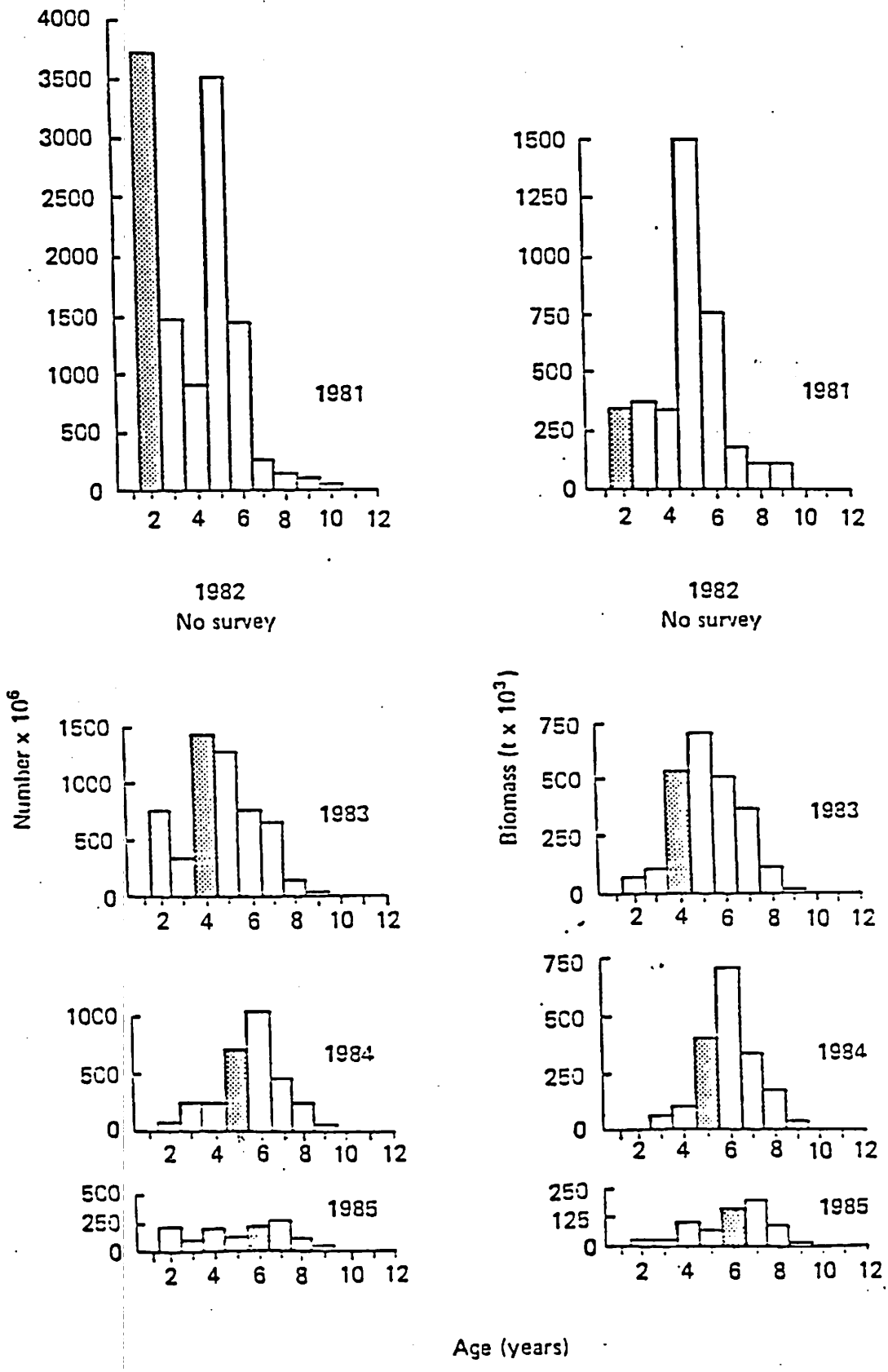

Figure 1. Pollock age distribution (numbers and biomass) estimated from 1981 and 1983-85 Shelikof Strait hydroacoustic-midwater trawl surveys (from Nelson and Nunnallee, 1985).

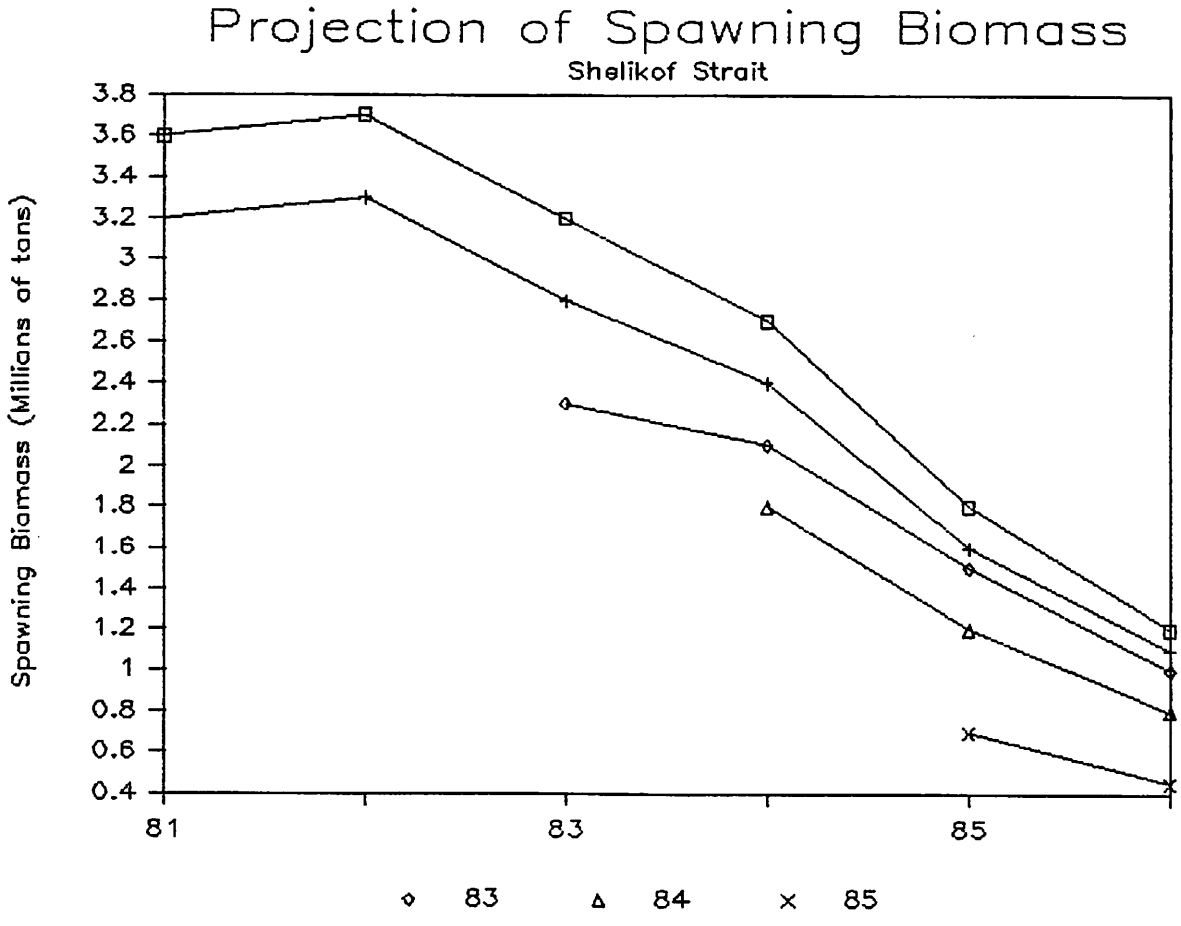

Figure 2. Projection model results of pollock biomass in Shelikof Straits in 1986 based on initial hydroacoustic estimates of 3.2-3.8 million mt in 1981, 2.3 million mt in 1983, 1.8 million mt in 1984, and 0.7 million mt in 1985

The estimated decline in biomass from 1984 to 1985 is contradicted by the trend in CPUE for the JV fishery and the results from the 1984 triennial bottom trawl survey. The CPUE data for the JV fishery provided by Mr. Hughes shows a three year decline from 1982 to 1984 followed by a slight increase in 1985. The biomass of pollock derived from the bottom trawl survey is 1,200,000 mt. Most of this biomass consisted of age 3 fish and older. This estimate is considered to be conservative since bottom trawls are less than 100% efficient in catching fish in their path and some unknown fraction of the population was off bottom and unavailable to the sampling gear. If the bottom trawl estimate is doubled to account for this inefficiency, then the discrepancy is much larger than 500,000 mt. If the bottom trawl estimate is closer to being correct, this implies that the hydroacoustic surveys of Shelikof Strait greatly underestimate pollock in the Gulf.

Catch-at-age analysis of the past fishery data suggests that the catchability of pollock to the fisheries peaks at age 5 with older fish being less available to fishing. This has been more apparent in the Shelikof Strait fishery than in the summer fisheries on the outer shelf, and this might be a factor contributing to the observed excessive decline in the abundance of the 1978 and 1979 year-classes between 1984 and 1985.

It has been suggested that the pollock unaccounted for by the acoustic surveys occur in the bottom layer component of the Shelikof Strait spawning concentration and/or occur in spawning areas outside the Shelikof spawning area. This bottom layer component is not routinely surveyed by the hydroacoustic/midwater trawl survey. The exception was in 1983 when a bottom trawl survey was conducted in Shelikof Strait in conjunction with the 1983 acoustic survey. This survey estimated an additional 7% of biomass in the

bottom layer. The age composition of the fish age 6 to 12 from the bottom trawl samples (29.7%) was similar to the midwater trawl samples (33.7%) contrary to the presentation given by Mr. Hughes, although fish were generally larger in the bottom trawl survey. A comparison of the age composition of 1984 triennial bottom trawl survey with the 1984 hydroacoustic/midwater trawl survey shows the percentages of fish age 8 and older to be nearly identical. The percentage of age 7 fish (1977 year-class) was higher in the bottom trawl (Table 5). A review of the fishing locations and catch rates of the foreign trawl fisheries throughout the Gulf for 1975-77 shows pollock were caught during the January-April period along the continental shelf, primarily southwest of Kodiak Island and in the Yakutat area. The catch rates in this latter area appear to be relatively low. The catch rates in the Chirikof and Kodiak areas are higher but nowhere near the magnitude experienced in the Shelikof Strait.

Although there is evidence of spawning pollock elsewhere in the Gulf besides Shelikof Strait, we do not know of any concentrations that are important or large compared to the Shelikof spawning group. We conclude that most pollock in the central and western Gulf spawn in the Shelikof Strait region.

The hydroacoustic surveys provide information on the abundance of age 2 and, to a very limited extent, age 1 pollock. These age groups are substantially less available to the surveys than fish age 3 through age 5 and, as a result, estimate of abundance or relative year class strength for these younger ages are not very reliable. However, age 1 fish in 1985 from the 1984 year class were aggregrated in a readily detectable midwater layer and were considerably more abundant than age 1 fish in earlier years. This marked difference suggests that the 1984 year class could be strong as it recruits to Shelikof Strait spawning concentration in 1987.

Table 5.--Relative age composition (%) of Gulf of Alaska pollock for ages 5 and older in 1984 and 1985 from various sources.

Source	Age					
	5	6	7	8	9	10+
1984 acoustic-midwater trawl estimate (March)	28	42	19	10	2	<1
1984 Shelikof Strait joint venture catch composition (January-April)	35	44	13	7	1	<1
Projection for July 1984[1/]	27	42	19	10	2	t
1984 bottom trawl survey estimate (June-October)	27	32	27	10	3	1
1984 foreign catch composition (July-December)	28	53	12	4	2	<1
Projection for January 1985[1/]	14	23	35	17	9	2
1985 acoustic-midwater trawl survey estimate (March)	15	29	37	14	4	1
1985 Shelikof Strait joint venture catch composition (January-April)	14	25	43	13	4	1

1/ Projection from 1984 acoustic-midwater trawl survey estimate after 1984 catch-at-age removals and accounting for natural mortality of 0.4.

Projections of exploitable biomass in Shelikof Strait for early 1986 and subsequent years (1987-88) were examined for six recruitment scenarios and various annual catch levels (Fig. 3). The projections are initiated using the 1984 acoustic estimate of biomass for age 3 and older fish (683,000 mt). Alternative harvest levels are from 0 to 300,000 mt at 100,000 mt intervals. Recruitment is at age 3 and at three levels: 0.5 billion fish for poor recruitment; 1.5 billion fish for average recruitment; 2.5 billion fish for strong recruitment. The biomass projections include only age 3 and older fish. The most likely scenarios have the following recruitment schedule:

Year:	1985	1986	1987	1988
Year class:	(1982)	(1983)	(1984)	(1985)
Scenario C:	poor	poor	strong	poor
D:	poor	poor	strong	average

Age composition data from the fisheries and surveys shows the 1982 and 1983 year-classes as weak. The unusual abundance of the 1984 year-class as age 1 fish encountered by the hydro-acoustic survey in 1985 is indicative of a strong year-class.

Given that recruitment is likely to be poor in 1985, abundance of the stock, as measured by the hydroacoustic survey, is projected to continue declining into early 1986. The biomass by early 1986 is expected to be 420,000 mt. A slight increase in biomass is projected for 1987 for the two most likely scenarios if harvests are 100,000 mt or less. The projected biomass would approach the 1985 level of about 700,000 mt by 1988. The stock would continue to decline into 1987 for harvest levels in excess of 100,000 mt. Based on these scenarios, the annual surplus production between the years 1986 and 1987 appears to be about 100,000 mt if the anticipated strong 1984 year-class recruits to the fishable stock. A removal of this 100,000 mt

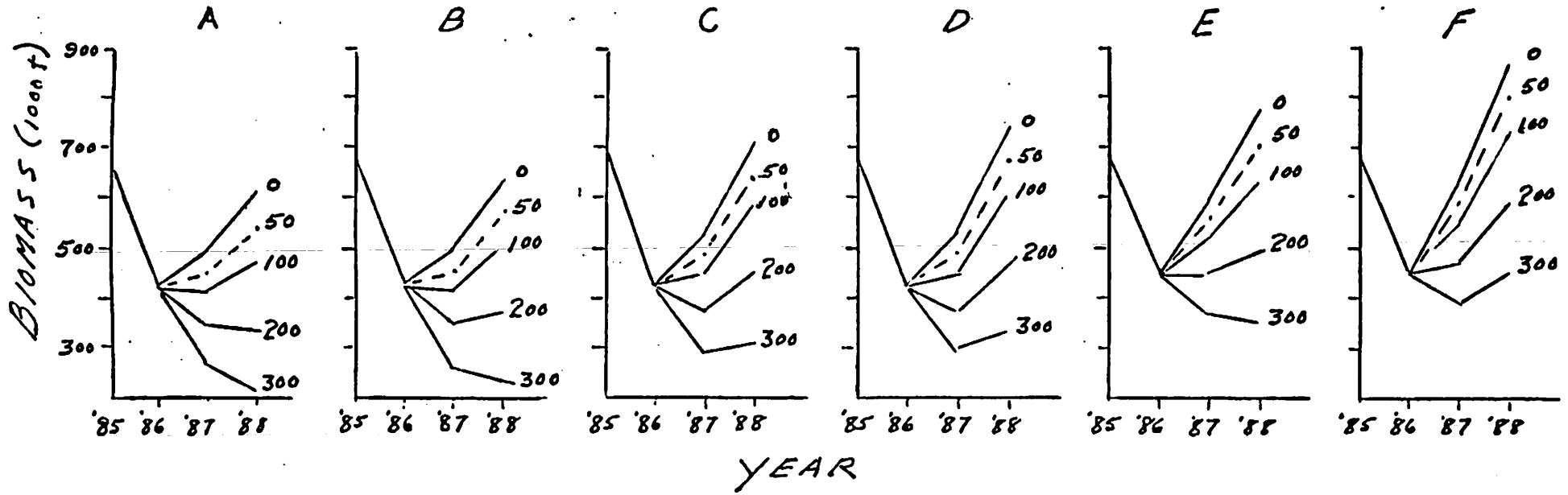

Figure 3.--Projections[1/] of spawning biomass (= exploitable biomass) of pollock in Shelikof Strait for 1986-88 given various catch levels (in 1,000 t) and recruitment scenarios. Recruitment in the population of age 3 fish in March-April (below average = 0.5 billion fish; average = 1.0 billion fish; above average = 1.5 billion fish). Recruitment scenarios are as follows:

(A)	1985 (below);	1986 (below);	1987 (average);	1988 (below)
(B)	"" (below);	"" (below);	"" (average);	"" (average)
(C)	"" (below);	"" (below);	"" (above);	"" (below)
(D)	"" (below);	"" (below)	"" (above);	"" (average)
	"" (below);	"" (average):	"" (average);	"" (average)
	"" (below);	"" (average);	"" (above);	"" (average)

[1/] Projections are from the acoustic-midwater survey estimates of biomass and population numbers of pollock in Shelikof Strait in early 1985 and are not adjusted for pollock near the sea bottom that were not estimated in the survey.

in 1986 would result in a 24% rate of exploitation. Using annual surplus production as a criterion for setting ABC, then ABC for 1986 would be 100,000 mt.

These forecasts assume that the unexplained high mortality observed between 1984 and 1985 does not reoccur. If the high mortality continues, then the forecasts overestimate stock production and biomass. Given our past experience with the corresponding acoustic estimate (Fig. 2), it is likely that these projections of biomass and ABC for 1986 and 1987 are also optimistic.

Alton and Rose (1985) reported that the low exploitable biomass estimates of 600,000 to 700,000 mt observed for years 1976-78 were capable of producing strong year-classes. In 1984 the team recommended that harvest levels be set such that the exploitable biomass does not fall below this minimum to protect the reproductive potential of the stock. This threshold level of biomass has been reexamined using age structure analyses of 6 different model assumptions updated with 1984 catch-at-age data (see Appendix 1). The exploitable biomass estimates for the 1976-78 period for the 6 models range from 450,000 to 940,000 mt. No particular model can be judged to be the best. Because a precise estimate of the threshold level is not possible and because the hydroacoustic estimates of biomass are not equivalent in scale to the estimated threshold level of exploitable biomass derived from the age structure analyses, setting ABC at zero when the projected biomass falls below the threshold is not a rigorous criterion.

Given the likelihood that 1986 hydroacoustic estimates will be below the projected biomass of 420,000 mt and that this estimate is less than all the threshold values, setting the lower range of ABC for 1986 at zero using this criterion is appropriate.

The OY values in 1984 and 1985 were set at 23.5 and 25.4% rates of exploitation based respectively on forecasted level of spawning biomass of 1,800,000 mt and 1,200,000 mt in Shelikof Strait. Given the actual catch and the actual survey estimates, the observed rates of exploitation are 17% for 1984 and about 37% for 1985. If the survey estimate had been in line with the forecast, then the 1985 exploitation rate would be about 22%. Previous age-structure analyses indicated that an optimal harvest rate of 28.5% would produce the long-term average surplus production (MSY) of 408,000 mt at an average exploitable biomass of 1,430,000 mt. For the updated age structure analyses of the 6 models, the optimal harvest rate averages 18%. This revised value is lower than the 28.5% value in part because the updated analyses include the declining trend beginning in 1982 for which annual estimates of surplus production are actually less than zero. The negative ASP values resulted from the poor recruitment in recent years. The current exploitation rate of 37% is much higher than the Council intended for the 1985 season and is too high at current biomass levels given this updated analysis. Applying this 18% rate to the projected biomass as a third criterion for ABC gives a value of 75,600 mt for the 1986 ABC. The objective of this criterion is to achieve average surplus production over the long-term.

The PT considered three criteria for specifying ABC for the 1986 fishing season. These are ABC = 0 based on the threshold biomass level, ABC = 75,600 mt based on an optimal harvest rate of 18% that would achieve long-term annual surplus production, and ABC = 100,000 based on the projected annual surplus production for 1986. The PT concluded that ABC = 7,600 mt, calculated from the optimal harvest rate, is the most appropriate since the threshold has not been rigorously derived and since annual surplus production is highly variable

and can be negative in some years. Any fishery in 1986 should be carried out in such a way as to have the least negative impact on the reproductive potential of the 1986 spawning stocks.

PACIFIC COD

The total 1984 catch of Pacific cod fell to 23,217 mt from a 1980-1983 annual catch of approximately 35,000 mt (Table 6). This was primarily due to the restrictions on foreign longlining in the central area because of the domestic fishery harvest of the sablefish OY. The bulk of foreign catches came from the Shumagin and Chirikof INPFC statistical areas, and the U.S. and joint-venture catches were concentrated in the Kodiak INPFC statistical area.

Table 6.--Catch (mt) of Pacific cod in the Gulf of Alaska, by North Pacific Fishery Management Council regulatory area, 1977-85.

Year	Western	Central	Eastern	Total
1977	626	1,238	359	2,223
1978	5,591	6,195	374	12,160
1979	3,981	10,370	518	14,869
1980	8,704	24,498	2,237	35,439
1981	11,579	22,149	2,358	36,086
1982	7,344	19,903	2,132	29,379
1983	9,178	25,243	1,981	36,402
1984	11,202	11,981	34	23,217
1985[a]	8,691	4,016	57	12,764

[a] As of September 6, 1985

Information on stock condition is from resource assessment surveys and catch per unit effort of the Japanese longline fishery.

The NMFS triennial trawl survey showed the highest CPUE was found in the 101-200 m depth interval in all areas, with the highest regional catch rate found in the Shumagin INPFC statistical area (Table 7). Cod abundance was low in waters deeper than 300 m. Total biomass from all three FMP management areas is about 603,000 mt. The combined total for the western and central Gulf is 549,000 with 95% confidence intervals of 390,000 to 708,000 mt. The 182,000 mt in the western and the 366,000 mt in the central regulatory areas

is close to the current 1:2 proportional allocation used to assign current regional OY's in these two areas. The biomass estimate in the eastern area is roughly 55,000 mt, which is double that of the survey biomass for the west Yakutat area.

Table 7.--Catch per unit effort (CPUE) in kilograms per square kilometer (kg/km^2) and biomass in metric tons (mt) of Pacific cod by 100 fathom depth intervals in the Shumagin, Chirikof, Kodiak, and western half of the Yakutat INPFC statistical areas as estimated from results of the 1984 Gulf of Alaska triennial groundfish trawl survey.

Depth interval (meters)	Shumagin		Chirikof		Kodiak		Yakutat*	
	kg/km^2	mt	kg/km^2	mt	kg/km^2	mt	kg/km^2	mt
0-100	2,641	117,251	1,839	49,074	1,099	43,021	784	9,621
101-200	4,341	63,108	3,474	82,508	3,930	169,699	2,079	16,717
201-300	823	2,253	896	10,305	1,017	11,275	1,251	438
301-500	2	6	77	125	41	122	--	--
501-700	--	--	--	--	2	4	--	--
0-700		182,618		142,012		224,121		26,776

*Western section of the Yakutat INPFC area, 144 - 147 deg. W long.

In the period between 1978 and 1984, Japanese longline CPUE for Pacific cod has increased in the Shumagin, Chirikof, and Kodiak INPFC statistical areas. Part of that trend, in addition to the increased cod abundance, may be associated with increased knowledge of cod abundance distribution.

Age and length information from the triennial survey shows that the 1977 is still contributing to the total biomass in the 80-94 cm size class. Additionally, indications are that recruitment has mostly been strong enough to maintain the GOA Pacific cod stocks at a relatively high level. Whether

the 1984 year class is strong will be investigated in the 1985 juvenile survey in the Kodiak area.

The 1984 survey indicates 1985 MSY, based on the potential yield model, is 124,000 mt. This is similar to estimates of 133,000 and 142,000 mt based on earlier trawl surveys in the Gulf of Alaska. However, this estimate does not include the small 12,000 mt estimate for the Yakutat and southeastern INPFC statistical areas. This would give a total 136,000 mt Gulf-wide MSY.

In summary, the Pacific cod stock in the Gulf of Alaska generally appears to be in good condition and stable. The best available information indicates that the total ABC is 136,000 mt. On the basis of results of the triennial survey, the team recommends that the distribution of ABC throughout the Gulf of Alaska be maintained at the current 28 percent, 56 percent, and 16 percent of Gulf OY for the three regulatory areas.

In the past OY has been set well below ABC to control halibut bycatch. The halibut PSC measures included in Amendment 14, if approved, may provide an alternative method of controlling halibut bycatches for those fisheries where observers are present. The 1985 OY is 60,000 mt, with the distribution among the western, central, and eastern regulatory areas of 16,560, 33,540, and 9,900 mt, respectively.

FLOUNDER

The fishery for flatfish, excepting halibut, has usually been incidental to fisheries for other species. Arrowtooth flounder is the dominant species in the catch, although all species are managed as a single stock. The foreign catch dropped sharply from 14,460.1 mt in 1981 to 3,033 mt in 1984, probably as a result of reduced foreign fishing effort. The 1984 domestic and joint-venture fisheries harvested 397 and 3,448 mt, respectively. The domestic catch in 1984 was similar to that in 1983, whereas the joint-venture catch in 1984 increased by 856 mt. The majority of the joint-venture catch occurred in the central area. The biomass estimates from the 1984 survey for the western and central Gulf is 1,760,000 mt. Estimates for the eastern area are not available. On the western and central areas, arrowtooth flounder made up 62% of the biomass followed by flathead sole and rock sole at 16% and 7%, respectively. The MSY has been calculated at 22,832 mt in the western Gulf, 101,449 mt in the central Gulf, and 16,800 mt in the eastern Gulf. Because of the relatively low exploitation rates, ABC is considered to be equal to MSY. If the total MSY of flatfish were taken, the bycatch of halibut in the western and central areas was projected to be almost 15,000 mt. There is also a potential for a 136 mt (300,000 lb) king crab bycatch in a flounder fishery. OY has been set below ABC to reduce halibut bycatch. The halibut PSC measures included in Amendment 14, if approved, may provide an alternative method of controlling halibut bycatches for those fisheries where observers are present. The OY in 1985 was 33,500 mt overall; 10,400 in the western area; 14,700 in the central area; and 8,400 in the eastern area.

PACIFIC OCEAN PERCH COMPLEX

There are five species included in the Pacific Ocean perch complex. Some of these are increasing in relative abundance and prior to 1984 Pacific ocean perch (S. alutus) did not dominate this complex in the commercial harvest. Estimates of current biomass are available but are highly variable. The point estimate of current biomass for S. alutus in the Gulf is 335,000 mt with confidence intervals for most areas exceeding ± 100%. The current biomass estimate for the POP complex is 552,000 mt with similar reliability.

Comparison between 1981 and 1984 catch rates at index sites in the eastern area shows no significant improvement. Based on historical trends in CPUE from the Japanese trawlers, the team considers the stock to be depressed, although there is slight improvement in 1984 catch rates over the 1980-83 period for the Japanese trawlers. This improvement could be the result of an early recruitment of the 1976 year-class which showed up in the 1984 trawl survey. This year-class should contribute to the spawning stock for the first time in 1986.

Last year the PT estimated EY for S. alutus at 7,232 to 19,432 mt and for the POP complex, 11,474 to 30,830. These estimates were based on stock reduction analysis, assuming current biomass was 152,000 to 508,000 for S. alutus (241,000 to 806,000 for the POP complex) and that current biomass was 11.8% to 30.8% of virgin biomass. The use of last year's assumptions and EY's is the practical and recommended estimate of current EY. An EY estimate obtained by interpolation on a biomass estimate of 335,000 mt is approximately 13,000 mt.

When reviewing foreign CPUE fishery data since 1980, no apparent growth in the POP stocks is observed with the exception of 1984. This data would suggest an EY closer to zero.

These two approaches provide an EY range of 0-13,000 mt. The plan team has set the 1986 POP ABC at the midpoint in this range, or 6,500 mt, apportioned according to biomass distribution. This would provide an ABC distribution of 1,755 mt (27%) in the Western area, 2,015 mt (31%) in the Central area, and 2,730 mt (42%) in the Eastern regulatory area.

The OY for 1985 was set at 75% of the apportioned EY in the western (1,302 mt) and central (3,906 mt) areas and 875 mt for the eastern area. Similarly, the Council may again want to set OY at a level which allows for incidental catch only if it wishes to maximize the opportunity to rebuild the POP complex. If the objective is to rebuild S. alutus, then the PT recommends the POP complex be managed such that catches of the complex are set below the EY for S. alutus. The PT notes that rebuilding will take place slowly and significant results of rebuilding efforts may not be observed for some time.

SABLEFISH

Gulf of Alaska Sablefish stocks appear to have recovered from their depressed conditions of the late 1970's and early 1980's. The strong 1977 year class, which has contributed substantially to the fishable biomass in recent years, is now declining in importance. Relative abundance indicators leveled off somewhat between 1982 and 1984 after increasing markedly with the recruitment of the 1977 year class. There are some indications of strong year classes recruiting to the stock following the 1977 year class. Future increases in abundance will depend on the magnitude of recruitment from these other year classes.

Relative population numbers and weights (RPN and RPW) from the U.S.-Japan cooperative longline survey increased more than 50% from 1979 to 1983, primarily due to the recruitment of the 1977 year class. Estimates of the variance of RPN have now become available and demonstrate that this increase was statistically significant. The Gulf-wide RPN for 1984 is similar to that of 1983. RPN estimates from 1985 indicate substantial increases, particularly in the 100-200 m depth stratum of the Kodiak INPFC area. Although, size data are not yet available from the survey, fish from this depth stratum are usually juveniles (age 4 or less). The large biomass from this stratum is similar to that observed in the 1984 trawl survey from the same area.

Time trends in relative abundance indicators based on fishery CPUE were disrupted in 1984 by the transition from foreign to domestic directed sablefish fisheries. Foreign directed sablefish fisheries were confined to the Western Gulf in 1984 and were excluded from all areas of the Gulf in 1985. The foreign observer based CPUE's for medium sized (57-66 cm) fish approximately doubled from 1977-1979 to 1982 as the 1977 year class recruited to the fishery. In 1983 the foreign CPUE for medium fish declined 23%.

Domestic fishery CPUE's are available from Alaska Department of Fish and Game port sampling in the Southeast area from 1980-1985. CPUE's were collected from the West Yakutat and Central Gulf areas in 1984 and 1985 as the domestic fishery expanded into those areas. Unfortunately, the domestic fleet began converting to more efficient circle hook gear in 1983, so that recent CPUE's cannot be directly compared with those of earlier years. In the Southeast area, domestic fishery circle hook CPUE's increased 27% in 1984, probably due to the influence of the 1977 year class. Domestic fishery CPUE's from southeast Alaska remained constant from 1984 to 1985. Trends in domestic CPUE from the West Yakutat and Central Gulf areas from 1984 to 1985 have not yet been analyzed.

The National Marine Fisheries Service has conducted a sablefish pot indexing survey in the Southeast area annually since 1978. The 1977 year class increased the abundance indices for small fish from 1980 to 1983 at two sites included in the pot survey but declined in 1984 to levels similar to those before 1982. Index values for small fish have not indicated the presence of any strong year classes after the 1977 and 1978 year classes. The index for large fish increased at several sites in 1985, again probably due to the abundant 1977 year class. This delayed increase in larger fish in the southeastern area may be due to the slow easterly migration of larger sablefish from the western and central Gulf as suggested by tag recovery data.

Biomass estimates which were available in earlier years were based on correlations of RPW from the U.S.-Japan longline survey with area swept expansions from trawl tows in nearby areas. These biomass estimates were assumed to have high variability because of the small number of trawl tows used to standardize RPW and because the correlations were not based on tows from the same areas as the longline survey sample sites.

In the summer of 1984, the U.S. and Japan cooperated in a trawl and longline survey of the Gulf of Alaska. The biomass estimate based on trawl surveys is 537,000 metric tons. Over 37% of the sablefish biomass estimate results from small fish from the 100-200 m depth zone of the Kodiak, Yakutat and Southeast areas, with 23% for the Gulf-wide biomass estimate occurring in this depth zone in the Kodiak area alone. The high Kodiak estimates resulted from concentrations of small fish encountered at survey stations over a relatively small area at the head of Amatuli Trench. Confidence limits for biomass estimates from these shallow strata are considerably wider than those of the deeper strata. The large catches of small fish from these shallow areas indicate the presence of a strong 1980 or 1981 year class. RPN of small fish from the U.S.-Japan longline survey in the 100-400 m depth zone increased in 1984 and 1985, providing additional evidence of a strong year class primarily in the Kodiak area (Fig. 4). The weight-frequency distribution of the domestic longline fishery catch in the Central Gulf also indicates the presence of large numbers of small fish. This abundant year class of small fish has not been detected in the relative abundance indicators from the eastern or western Gulf.

Previous EY's for sablefish in the Gulf of Alaska were determined by modifying a Maximum Sustained Yield (MSY) by the declines observed in relative abundance indicators. MSY was estimated from a stock production model fit to a time series of catch and effort from the Japanese longline fishery. The stock was assumed to be at MSY levels at the time that Japanese longline CPUE peaked in 1970, so that EY = MSY at that time. EY's have generally been determined from the MSY by reducing EY proportional to the declines observed in relative abundance indices since 1970. Because it has not been possible to update the stock production estimate with a continuous time series of

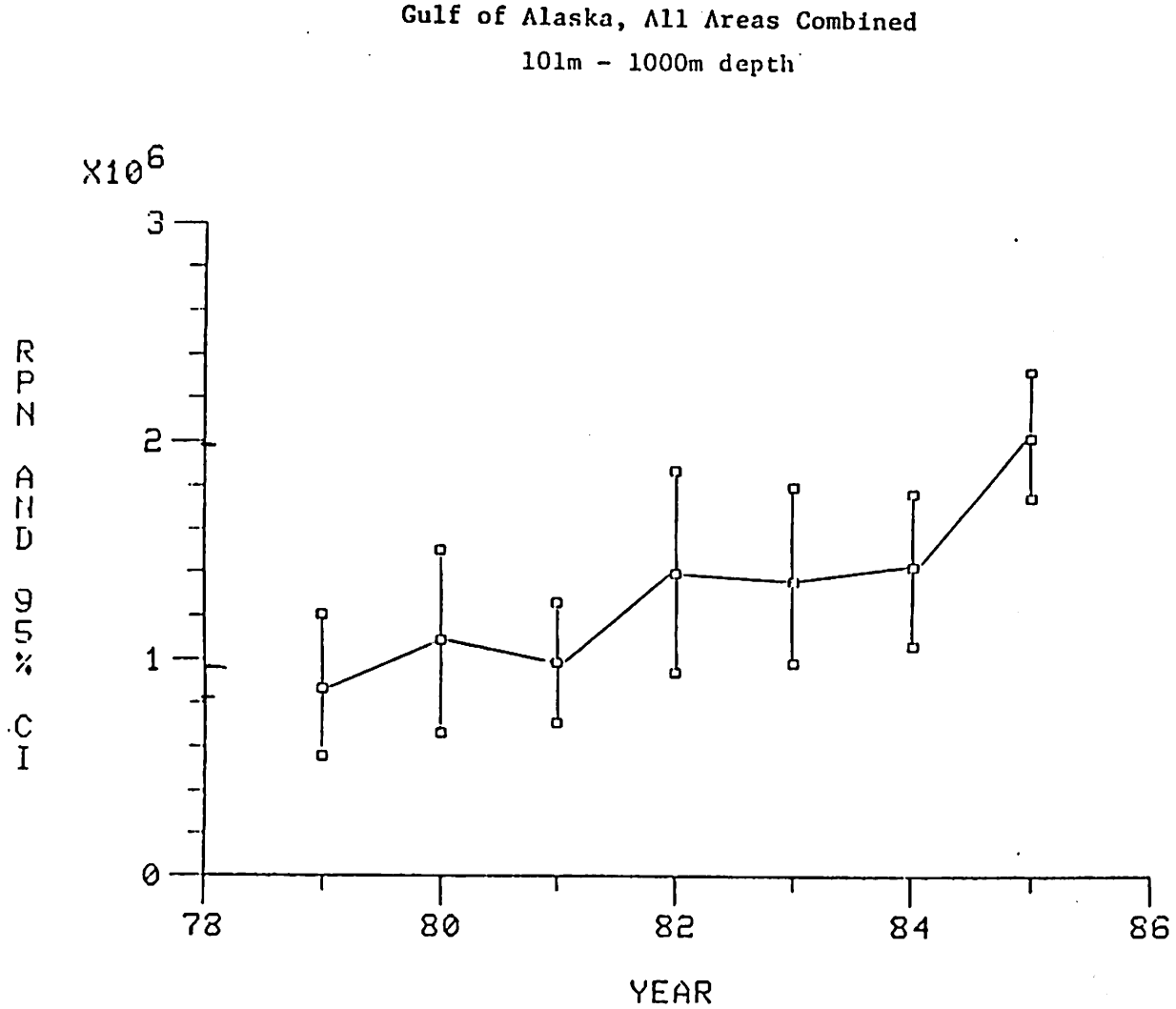

Figure 4. Relative population number of sablefish, with associated 95% confidence intervals, Japan-U.S. joint longline survey, 1979-1985. RPN and confidence intervals calculated using bootstrap method.

catch and effort data since the mid-1970's, the PT recommends that alternative methods of determining EY be used.

The PT has attempted to compute EY's from forward simulation models which are based on maintaining constant biomasses over time given estimates of current biomass, growth, natural mortality and future recruitment. The PT finds that when EY is determined as Annual Surplus Production (ASP) by these methods, EY is very sensitive to the as yet unknown levels of recruitment used for years beyond which survey estimates are available. Without surveys which focus on indices of juvenile abundance, the PT considers that average EY estimates derived from forward simulation models are not reliable.

Given the lack of EY criteria for specifying ABC, the PT considered two criteria for determining a 1986 ABC level. The first criterion is based on the Council's rebuilding policy for sablefish. The stock has rebuilt in recent years given past harvest levels of 9,000 mt and an EY of 12,630 mt established by the Council. This has resulted in current stock biomass probably being as high as that which occurred in the early 1970's. Consequently, an EY of 12,630 mt represents a lower bound for a 1986 ABC. This apparent recovery also implies an unlikely need for a continuation of the rebuilding policy (OY = 75% EY) established by the Council in past years.

The second criterion for ABC is based on past Japanese harvests and may be considered an upper bound. This upper bound is 25,000 mt, the average historical annual catch for the period 1968-1977. At a biomass of 537,000 this upper ABC value is also consistent with an ABC derived from a 5% exploitation rate used for the Bering Sea sablefish stock. It should be cautioned, however, that an average of harvest level of 25,000 mt coincided with a marked reduction in the GOA sablefish stock. Additionally, the

appropriateness of a 5% exploitation rate has not been evaluated for the GOA stocks.

Because both values of the ABC range has not been rigorously determined and the high level of uncertainty in the assessment of stock levels (i.e., 537,000 mt for the GOA), the PT recommends against an immediate increase in harvest to the upper ABC level. Consequently, the PT set ABC for 1986 at the midpoint of the ABC range, i.e., 18,800 mt.

Past apportionment of ABC has been determined from the proportion of historical catches in the various management areas by the Japanese longline fishery. Recent trawl and longline surveys shows a greater increase in biomass for the central area than other areas. The PT's recommends that the 1986 ABC be apportioned by management areas according to updated geographic distribution of biomass. These apportionments are shown in Fig. 5 for 1986 as percentages of the Gulf wide biomass compared to past percentages based on the historical Japanese catch.

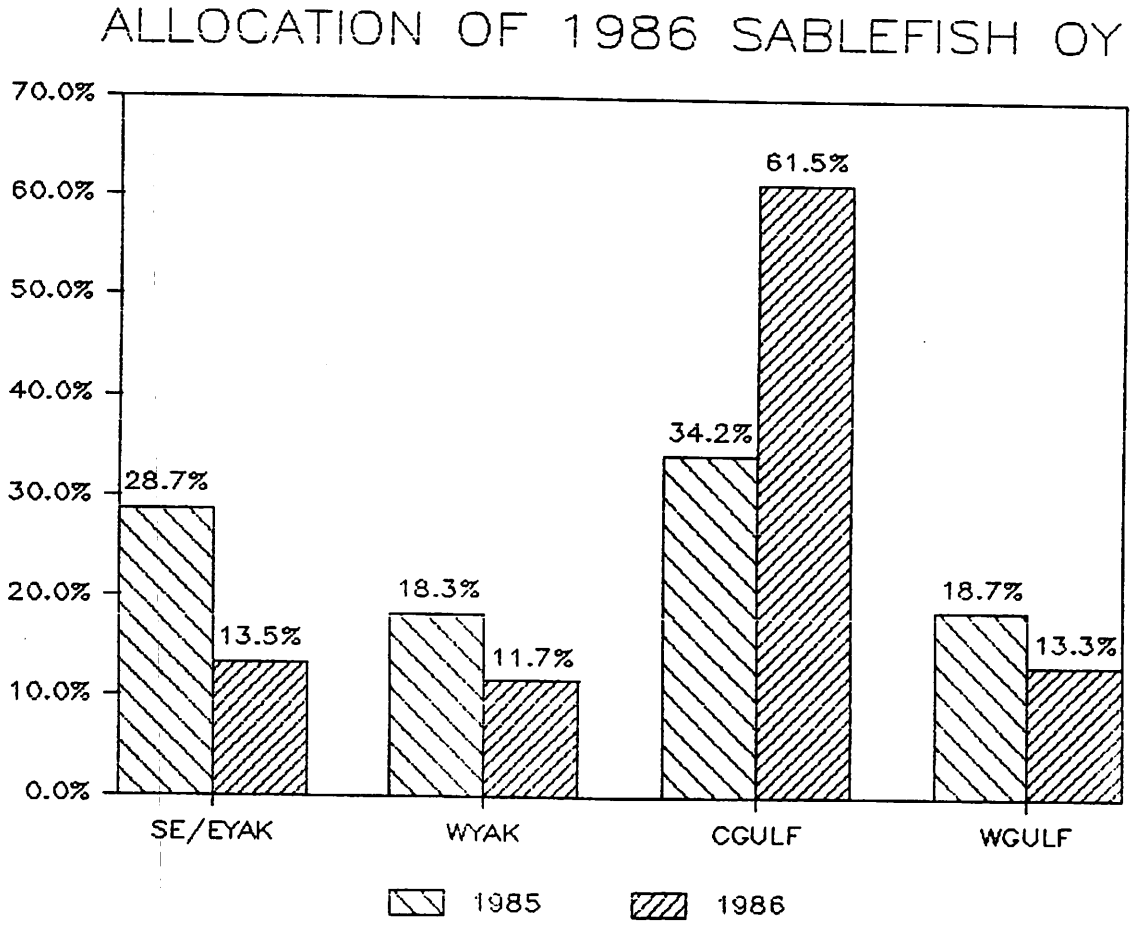

Figure 5.--Comparison of past 1985 apportionments (as percent) and recommended 1986 apportionments for management areas of the GOA sablefish ABC. Past apportionments were based on the proportion of catches in various management areas by Japanese longline fishery. Recommended apportionment for 1986 is based on sablefish biomass distribution in the various GOA management areas.

ATKA MACKEREL

Atka mackerel, Pleurogrammus monopterygius, have historically been distributed throughout the Gulf of Alaska (GOA), but are most abundant in the Central and Western Management areas at depths ranging from 50-350 m. While this fishery was exploited exclusively by directed foreign fleets (USSR, Republic of Korea and Japan) through 1982, joint venture (JV) operations began in 1983, and the first domestic landing, although a trace amount, was reported in 1984. Atka mackerel landings by JV fleets in 1984 comprised 51% (585 mt) of that year's total catch of this species. Annual Atka mackerel catches from the GOA have declined dramatically over the last 10 years from a high of roughly 28,000 mt in 1975 to a plateau of about 19,000 mt in 1976-78, followed by an abrupt decline to an historic low of 1,152 mt in 1984. Most of the GOA Atka mackerel catches through 1983 came from the Central Area, with fleet effort shifting in 1981 from the Kodiak Island grounds to those in the southwest portion of this management area immediately adjacent to the Alaska Peninsula. Fleet effort in 1984, however, shifted still further west to the Western Area where 94% of that year's Atka mackerel catch was taken. The 1985 reported catch as of September 6 was 3.2 mt.

Effort to obtain a precise measure of Atka mackerel stock condition in the GOA using conventional indicators such as catch-per-effort and age composition have been continually beset with difficulties. These problems, which include the intense schooling behavior of this species, the sporatic nature of available data base, as well as the different ageing methods and interpretative techniques used by U.S. and Soviet scientists in analyzing age composition complicate the interpretation of long-term trends. In light

of these factors, assessments of stock condition to date have been based primarily upon total catch data. It appears that data on total catch, even those without accompanying effort data, can be useful in a general sense in assessing stock condition, so long as any trends seen are supported by collaborating trends by other biological indicators of stock strength. Two primary indicators have been used for this purpose - biomass estimates and fish length-frequency information from U.S. and Soviet trawl surveys. The sharply declining catches seen in the Central Area between 1981 and 1984 coincide with extremely low catches by U.S. and Soviet research vessels - catches so low, in fact, that one vessel was unable to obtain catch samples. Unfortunately, the short history of the Atka mackerel fishery and the near absence of stock assessment surveys in the Western Area preclude any similar determination of trends in these areas. The 1984 trawl survey found significant numbers of Atka mackerel in the Western Area only, the area from which 94% of that year's total GOA catch was taken. The biomass estimate for this survey was 3600 mt, with 500 mt in the Central area and no catch in the Eastern Area. Bottom trawl surveys are not necessarily appropriate for assessing Atka mackerel since a significant portion of the stock is off bottom. The second of these biological indicators, size composition as determined from fish length frequency samples, is used as an index of recruitment success. Temporal increases or decreases in mean and modal lengths accompanied by the presence or absence of year-class pulses in the lower size ranges are interpreted to be indicative of fluctuating recruitment levels. Comparison of recruitment trends in the Kodiak Island portion of the Central Area interpreted in this manner show recruitment to be higher (as indicated by reduced mean length) during the high production years (1971-77), and

substantially lower (as indicated by increased mean length) from 1981-84. Unfortunately, interpretations of these trends in the Chirikof Island portion of the Central Area as well as in the Western Area are not as clear due to the short term and sporadic nature of the available data base.

Numerous and widely varying MSY estimates for Atka mackerel in the GOA have been made by both Soviet and U.S. investigators since 1977. The first, 33,000 mt, was made on rather subjective grounds by the Soviets in 1977. They subsequently revised this estimate in 1979 to 28,300 mt. As this latter estimate was based on years of high biomass, it was subsequently modified based on an equation developed by Alverson and Pereyra (and later modified by Gulland) to 21,680 mt. Subsequent studies of GOA Atka mackerel stocks suggest, however, that the large catches and biomass estimates of the 1970's may have been the result of a "population explosion" and an accompanying, though temporary, geographic expansion of the stock. Recent analyses indicate that the best estimate of MSY for Atka mackerel in the GOA is 7,800 mt.

In summary, the Atka mackerel fishery in the GOA since 1981 has been characterized by successive and dramatic catch declines, low recruitment levels, and the exploitation of new grounds in the Western Area following the apparent depletion of the resource in the Central Area. The coincidence of these factors led the NPFMC in 1984 to reduce the OYC in the Central and Eastern regulatory areas to by-catch levels only in an effort to rebuild these stocks. In addition, the NPFMC maintained OT in the Western Area at 4,678 mt. No new information has been presented to the plan team that would suggest any deviation from this management decision.

OTHER ROCKFISH

Other rockfish as defined in the FMP include all species of Sebastes not included in the POP complex. This group can be separated into three assembleges by habitat and/or behavioral preferences. Over twenty species occur in the commercial landings. Deep water species of the slope assemblege have been harvested in the foreign fisheries for POP along the edge of the continental shelf throughout the Gulf. The nearshore on-bottom or demersal species are the target of the rapidly developing domestic fishery in the southeastern Gulf.

The Gulf-wide OY for other rockfish was originally set at 7600 mt which is the lower bound of the average other rockfish harvest in the foreign POP fishery from 1973-1975. At that time the other rockfish category included all rockfish other than POP. Since the original OY was established, the four dominant Sebastes species in the foreign by-catch and two species of Sebastolobus were removed from the other rockfish category with no adjustment to the other rockfish OY.

Amendment 14 to the FMP reduces the Gulf-wide other rockfish OY from 7,600 mt to 5,000 mt and specifies that, due to concern for the status of the shelf demersal rockfish assemblege in a portion of the southeastern area, no more than 600 mt of shelf demersal rockfish may be harvested in the area between 56 N latitude and 57 N latitude west of 137 W longitude. Results of the 1984 NMFS triennial survey indicate that all but one rockfish species occurred in very low density. The dusky rockfish biomass was estimated at 25,700 mt in the Central and Western Gulf. Dusky rockfish were also present in low densities in the Yakutat area. Biomass estimates were not made for other species due to the extremely low densities encountered and the extreme

variabilty in the catch. No surveys have been conducted for nearshore species in the Eastern Gulf.

The average harvest of other rockfish in the foreign and joint-venture fisheries in the Central and Western Gulf between 1978 and 1984 is 1,700 mt with the 1984 harvest declining to 715 mt. Less than 10 mt have been reported in the joint-venture fishery this year. The reduction in catch the past two years may be the result of changes in regulations rather than an indication of stock decline.

In 1984 domestic landings totaled 800 mt with aproximately 600 mt from the Southeastern demersal rockfish quota area. Landings reported through August 1985 total approximately 650 mt with approximately 350 mt reported from the Southeastern quota area. The 1985 landings from the quota area are substantially below the same period last year. It is unclear whether that reduction is the result of reduced abundance or other factors in the fishery.

With the poor showing of other rockfish in the triennial survey in the Central and Western Gulf, there is no evidence that a harvest greater than the recent year average catch of 1,700 mt in the foreign and joint venture fisheries can be sustained.

Acceptable biological catch is not expected to exceed the recent year average harvest of 1,700 mt for those areas. No time series of data exists for the two nearshore species assembleges. Little data other than species composition and spacial distribution is available for the nearshore pelagic assemblege. Some evidence of decline in the nearshore demersal stocks occurred in the Sitka area of Southeastern with a peak harvest of 600 mt. Preliminary results of biological studies show that the primary target species in the nearshore fishery, yelloweye rockfish, is much older than previously thought

and ages in excess of 90 years are not uncommon. Average age ranged from 35 years to over 60 years for samples from different areas.

Given the above, the best estimate of ABC for other rockfish is 1,700 mt for all other rockfish in the Central and Western regulatory areas and 600 mt for shelf demersal rockfish in the quota area of the Eastern regulatory area for a combined ABC of 2300 mt. No data is available to estimate ABC for the remainder of the Eastern regulatory area.

Data for all other rockfish species is incomplete and appropriate EY levels cannot be established at this time. However, due to the complex multi-species nature of the other rockfish complex, the extreme longevity of many of these species, and an apparent sensitivity to stock reduction at low exploitation levels, sustainable yield is presumed to be very low.

THORNYHEAD ROCKFISH

Two species of Sebastolobus are commonly referred to as thornyhead rockfish. The shortspine thornyhead is the more abundant of the two species in the Gulf of Alaska and occurs primarily on the continential slope. The thornyhead rockfish are harvested in association with deep-water fishery for sablefish. The annual harvest of about 1,350 mt in 1980 and 1981 declined to about 750 mt in 1982 and 1983. With the reduced level of foreign longline fishery for sablefish, the observer reported bycatch of thornyhead rockfish dropped to 208 mt in 1984. The domestic fishery which displaced the foreign fisherv reported landings of 24 mt in 1984 and 27 in 1985 as of September 6. The actual catch, including discarded fish, was probably much greater than the reported landings if we assume the domestic longliners had bycatch rates similar to the prior foreign fisheries.

No information on recent trends in abundance or fish length can be gleaned from foreign CPUE or length frequency data, because the results are confounded with changes in the target species and fishing depths of the foreign fisheries. Biomass estimates from the 1984 U.S.-Japan trawl survey of the Western and Central Gulf of Alaska is 80,700 mt.

The MSY given in the FMP for thornyhead rockfish is 3,750 mt, however, the derivation is undocumented. This MSY is 5% of the estimated biomass for the western and central areas. If the standing stock were expanded to include the eastern area, this percentage would decrease. Because we lack information on rates of growth, mortality, and recruitment, we have no means to estimate ABC. Relative to the 1984 biomass estimates, MSY in the FMP is quite conservative. Furthermore, future domestic landings are likely to remain insignificant. As a result, there is no justification to alter MSY from 3,750 mt.

SQUID

The commercial catch of squid has been primarily taken by foreign trawlers in the central and western areas. The annual foreign squid catch averaged nearly 550 mt during 1978-1983 which were essentially incidental to the directed fisheries of other species. The harvests of squid for 1984 and 1985 as of September 6 are 125 mt and 6 mt, respectively.

Squid abundance and potential yield in the Gulf of Alaska has not been evaluated through research findings. Results of the 1984 U.S.-Japan cooperative bottom trawl survey show an estimated squid biomass at 2,566 mt in the western and central regulatory areas combined. It is noted that most of the squid resource is pelagic and not available to bottom trawls. There has been no assessment of the squid resource in the eastern area. Catches of Berrytheuthis magister, B. anonoychus, and Gonatus sp. by commercial fishing and research vessels and their occurrence in the stomach of fish and marine mammals indicate a large standing stock. OY has been set at 5,000 mt which is far greater than the present and past harvest levels.

OTHER SPECIES

The other species group includes sculpins, sharks, skates, octopus, eulachon, smelts, and capelin. The highest domestic and foreign catch during the period 1977 through 1984 was about 10,000 mt in 1981. The average catch for this period is approximately 4,875 mt, far below the OY level. The 1984 joint-venture and foreign fisheries were 1,268 mt and 576 mt, respectively. There are no biomass estimates available for these species. The OY for the other species group was originally derived from the lowest historical catch levels. There is no information available to set ABC. Under procedures currently described in the FMP, the OY is set at 5% of the sum of the OY's for the other nine OY species categories. Using this procedure, the 1985 OY was 22,460 mt.

Appendix 1

Sensitivity of Gulf of Alaska Pollock Population Biomass Estimates (as Estimated From Age-structured Stock Assessment Models) to Incorporation of Auxiliary Data.

BACKGROUND

The primary age-structured stock assessment (ASA) methodology used to assess pollock abundance in the Gulf of Alaska is the separable model of Doubleday (1976). The parameters of this model (absolute population abundance by cohort, effective full recruitment fishing effort by calendar year, and age-specific selectivities) are estimated statistically by a nonlinear least squares algorithm. This is a powerful model however one of its major shortcomings is that solutions produced by the statistical estimation procedure are not unique; that is, potentially several different sets of parameters values can fit the catch-at-age data equally well. For instance, one fit of the model may indicate low levels of fishing mortality and high levels of population abundance while another fit may indicate high levels of fishing mortality and low levels of population abundance. In both cases similar residual sums of square values and residuals are produced. This feature is quite disconcerting since estimates of total population biomass can widely vary. Naturally the immediate question arises as to which result represents the "correct" stock condition. This question cannot be answered because of the unfortunate fact that catch-at-age data alone are not sufficient to produce consistent and repeatable biomass estimates from heavily parameterized separable ASA models.

Two approaches are possible. First, the separable model can be constrained causing a reduction in the number of parameters being estimated. Secondly, auxiliary information can be incorporated into the analysis in the hope that fishery-independent data can help calibrate or "tune" resulting population biomass estimates.

OBJECTIVE

The objective of this analysis is to ascertain the sensitivity of population biomass estimates to incorporation of auxiliary data into the ASA model.

DATA SOURCES

Catch-at-age data aggregated over all nations and all INPFC statistical areas for years 1976-1984 were used in this analysis. Also auxiliary fishery-independent data was used. This consisted of hydroacoustic biomass estimates of the Shelikof Strait spawning pollock population for calendar years 1981, 1983 and 1984 and fecundity-at-age data for Gulf of Alaska pollock.

METHODOLOGY

The ASA model was run in six different configurations which are described below. The auxiliary hydroacoustic population biomass estimates were incorporated into the ASA model in two different ways. In the first, the

hydroacoustic population biomass estimates (Bh) were used along with the catch biomass estimates (Bc) to calculate an annual full-recruitment exploitation fraction (u=Bc/Bh) for years 1981, 1983 and 1984. This, along with an estimate of natural mortality, was used to éstimate the annual instantaneous full-recruitment fishing mortality rate using the equation

$$u = \frac{F}{F + M}\,(1-\exp(-(F+M))) \qquad [1]$$

These values of F were then used in the ASA by constraining the effective fishing effort parameters in years 1981, 1983 and 1984 to be exactly equal to those values estimated from equation [1] (assuming the catchability coefficient is 1.0).

In the second approach, abundance estimates from hydroacoustic surveys were used to stabilize fishing mortality estimates by incorporating into the minimization procedure an auxiliary effort sums of squares term (Deriso et al. 1985a). In this approach, solutions for F from equation [1] are used as estimates of effective fully recruited fishing effort, which can then be substituted into the auxiliary effort sums of squares term. These values can either be considered independent estimates of full-recruitment fishing mortality (constrain the catchability coefficient to be equal to 1.0) or proportional to full-recruitment fishing mortality (let the catchability coefficient be yet one more parameter to be estimated). This approach is described in more detail in Deriso et al. (1985b). Note that in this approach the effective effort estimates are actually used as data. observations which supplement the catch-at-age data.

The difference between these two approaches is that in the first, annual effective effort estimates will always equal exactly those values calculated from equation [1] while in the second approach annual effective effort estimates can be different from values calculated from equation [1]. The degree of difference in the second approach depends on how strongly the auxiliary effort sum of squares term is weighted. When a large enough weighting factor is used results from the two approaches will be comparable.

Results from the above descriptions are presented below.

Year	Hydroacoustic Biomass Estimate (MMT)	Catch Estimate (MT)	Exploitation Fraction	Effective Effort f (q=1.0)	ln(f)
1981	3.77	113689	0.0302	0.0372	-3.2914
1982	--	--	--	--	--
1983	2.43	244056	0.1004	0.1292	-2.0464
1984	1.84	289095	0.1571	0.2097	-1.5621

MODEL CONFIGURATIONS AND ASSUMPTIONS

In each configuration described below an instantaneous natural mortality rate of 0.4 per year was used.

Model 1

This model used no auxiliary data. Selectivities were estimated as follows: Over the period 1976-1981 selectivities for ages 3-6 were estimated and ages 7-10 were assumed to be fully recruited (selectivities assumed to be 1.0 and not estimated). Over the period 1982-1984 selectivities for ages 3-6 were constrained to be equal to the 1976-1981 values (i.e. not estimated) and selectivities for ages 7-10 were estimated. Under this configuration the selectivity trend with age appears as an asymptotic curve over the 1976-1981 period and as a dome-shaped curve over the 1982-1984 period. Effective effort and population abundance parameters were completely unconstrained.

Model 2

Same as model 1, but fecundity-at-age auxiliary data was used to estimate the parameters of a Ricker spawner-recruit model based on the addition of a spawner-recruit auxiliary sum of squares term (Deriso et al. 1985a). A weighting factor of 0.5 was used as recommended by Deriso et al. (1985a).

Model 3

Same as model 1, but hydroacoustic population biomass estimates were used to calculate effective fishing effort values which were then used in an effort auxiliary sum of squares term. The value of the catchability coefficient was constrained to be equal to 1.0 and a weighting factor of 0.5 was used.

(Deriso et. al. (1985a)

Model 4

Same as model 1, but both fecundity-at-age data and hydroacoustic population biomass estimates were used so that the final model included two auxiliary sum of squares terms. A weighting factor of 0.5 was used for each term. The value of the catchability coefficient was constrained to be equal to 1.0.

Model 5

Same as model 1, but hydroacoustic population biomass estimates were used to constrain the effective effort parameters for 1981, 1983 and 1984 to be equal to those values calculated from equation [1].

Model 6

Same as model 5, but fecundity-at-age auxiliary data was used to estimate the parameters of a Ricker spawner-recruit model (see model 2). A weighting factor of 0.5 was used as recommended by Deriso et al. (1985a).

RESULTS

Results from application of the various configurations of the ASA model were all consistent with respect to 1) the annual trend in population

biomass and 2) estimates of age-specific selectivities. In other words, differences between annual population biomass estimates from the different configurations (Table 1) only reflect differences in how the model estimated effective effort parameters. In just about every case bootstrap estimates are very close in value to the point estimates. The advantage of using the bootstrap estimates is that they are accompanied by variances estimates (expressed as CV's) and take into account statistical bias and statistical uncertainty in the parameter estimates.

Use of the fecundity-at-age data consistently produced reduced biomass estimates when compared to a similarly configured model that did not use this data (compare model 1 with model 2, model 3 with model 4, and model 5 with model 6). Incorporating the hydroacoustic data through the addition of an auxiliary sums of squares term reduced biomass estimates slightly only for more recent years, however it did produce a large reduction in the variability of the bootstrap biomass estimates for all years (compare model 1 with model 3). Incorporation of the hydroacoustic data via constraining annual effective effort parameters increased bootstrap biomass estimates and reduced their variability (compare model 1 with model 5).

The problem of which configuration is the "correct" one still remains. A solution to this dilemma would be take the average of the annual bootstrap estimate from each of the six models as our best estimate of the population biomass in a given year. These average values for 1976-1984 are 0.98, 0.85, 1.18, 1.89, 2.31, 2.77, 2.88, 2.29, and 1.81 million metric tons (MMT) respectively. These averages for years 1976-1981 are very close in value to bootstrap biomass estimates derived from an application of the ASA model to the 1976-1981 subset of the catch-at-age data, 0.97, 0.82, 1.16, 1.84, 2.04, and 2.24 respectively. The 1976-1981 subset of the catch-at-age data represents a stable period in the pollock fishery. ASA results from this period are the most stable as evidenced by very low CV's and are thus considered the best available biomass estimates for these early years.

Results from this analysis also permit estimation of the minimum spawning biomass that would produce a strong year class. We know from results of the 1976-1984 ASA that 1976-1979 were all strong year classes. This result is valid regardless of which configuration of the ASA model was used. Based on this observation, the minimum bootstrap biomass value over the period 1976-1979 from the six different models is 0.641 MMT. The average population biomass as calculated from bootstrap biomass estimates over the period 1976-1979 is 1.22 MMT with a standard deviation of 0.597.

LITERATURE CITED

Doubleday, W.G. 1976. A least squares approach to analyzing catch at age data. Res. Bull. Int. Commn. NW Atlant. Fish. 12: 68-81.

Deriso, R.B., T.J. Quinn II, and P.R. Neal. 1985. Catch-age analysis with auxiliary information. Can. J. Fish. Aquat. Sci. 42: 815-824.

Deriso, R.B., T.J. Quinn II, and P.R. Neal. 1985. Further aspects of the theory of catch-age analysis with auxiliary information. Can. J. Fish. Aquat. Sci. (in press)

Table 1. Population biomass estimates from application of a separable age-structured stock assessment model applied to the combined nation Gulf of Alaska pollock data 1976-1984 using a natural mortality estimate of 0.4 and different combinations of auxiliary data. Presented are point estimates (PE), bootstrap estimates (BE) based on 50 bootstrap replications and coefficients of variation (CV) for the bootstrap estimates. All biomass values are expressed in millions of metric tons.

	(no auxiliary data) Model 1			5-R Model 2			Acoustic Model 3		
Year	PE	BE	CV	PE	BE	CV	PE	BE	CV
1976	0.830	0.890	37	0.775	0.771	23	0.847	0.834	9
1977	0.706	0.763	44	0.647	0.641	26	0.718	0.710	10
1978	0.919	1.050	64	0.817	0.803	36	0.940	0.918	13
1979	1.410	1.630	80	1.230	1.210	41	1.450	1.410	15
1980	1.670	1.940	92	1.470	1.460	44	1.720	1.710	15
1981	1.930	2.330	101	1.680	1.680	46	1.990	2.050	17
1982	1.960	2.390	114	1.650	1.630	49	2.010	2.160	20
1983	1.480	1.830	129	1.230	1.230	59	1.530	1.670	22
1984	1.040	1.420	170	0.823	0.835	78	1.080	1.210	27

	5-R & acoustic Model 4			Model 5			Model 6		
Year	PE	BE	CV	PE	BE	CV	PE	BE	CV
1976	0.795	0.791	13	1.270	1.320	12	1.180	1.270	11
1977	0.667	0.673	15	1.140	1.190	11	1.060	1.120	12
1978	0.853	0.888	20	1.670	1.770	12	1.530	1.630	14
1979	1.300	1.360	25	2.790	2.940	12	2.540	2.760	18
1980	1.550	1.640	30	3.480	3.660	10	3.180	3.470	18
1981	1.780	1.870	32	4.250	4.570	9	3.830	4.130	15
1982	1.760	1.850	37	4.560	4.970	11	4.040	4.290	14
1983	1.320	1.440	42	3.700	4.050	13	3.290	3.540	15
1984	0.902	1.030	50	3.030	3.430	17	2.660	2.900	17

GOA1 Objectives

1. To accommodate all DAH requirements within biological constraints.
2. To minimize bycatch of fully-utilized and prohibited species.
3. To provide sufficient bycatch amounts to support target fisheries.
4. To continue rebuilding Pacific ocean perch and other rockfish.
5. To maintain the directed halibut harvest at 1985 levels for 1986.
6. Maximize economic benefit to the nation.

Decisions made in GOA1

1. Used ABCs recommended by Plan Team.
2. 1986 OYs:
   - Pollock. Western, Central, Eastern set equal to ABC.
   - Pacific cod. Set OY = DAH (based on NMFS survey estimate).
   - Flounder. Set OY = DAH (based on NMFS survey estimate).
   - Pacific ocean perch. Set OY at 75% ABC in Western/Central for rebuilding.
   - Pacific ocean perch. Set OY at 875 mt in Eastern for rebuilding.
   - Sablefish. Set cumulative OY at 15,000 (suggested by public comments).
   - Sablefish. OY in Southeast/East Yakutat set equal to ABC.
   - Sablefish. Sablefish OY in West Yakutat, Central, Western were set based on biomass distribution applied to remaining 15,000 OY after Southeast/East Yakutat was subtracted.
   - Atka mackerel. Set Western OY at ABC.
   - Atka mackerel. Central, Eastern OYs set at bycatch amounts (NMFS determined 500,100 mt).
   - Other rockfish. Set OY at ABC in Southeast, Central. Set OY at ABC at 1,700 mt for remaining Gulf, given limited evidence supporting a greater catch.
   - Thornyhead, Squid. Status quo.
3. DAP and JVP estimates obtained from NMFS Industry Survey.
4. Potential halibut bycatches as determined by some method used last year overestimate real bycatches in bottom trawls, since:

a. bottom trawls are used in a "mixed species" fishery, with the primary target being pollock, Pacific cod and flounder (comprising most of trawl catch). Data suggests in equal proportions.

b. Given the above, a bottom trawl fishery will be limited to the most constraining species designated as a target.

For example: Assuming: .33 pollock OY is bottom trawl
.85 Pacific cod is bottom trawl
1.0 flounder is bottom trawl

the most constraining OY will limit the bottom trawl harvest to three times that amount (given the assumption of three target species being caught in equal proportions).

to take 10,000 mt of flounder, you would take 10,000 each of Pacific cod and pollock.

This estimated bottom trawl harvest, is multiplied by bycatch rate which generates "Real halibut bycatch."

Gulf of Alaska Spreadsheet Assumptions

Bycatch subsection

Bottom Trawl

A.1 There is a mixed species "hard-on-bottom" trawl fishery which takes 1/3 pollock, 1/3 cod and 1/3 flounder.

A.2 Of the total pollock, 1/3 are caught by bottom trawl, 2/3 by midwater trawl.

A.3 Of the total cod, 85% are caught by bottom trawl, 15% are caught by longline.

A.4 Of pollock, 4% are caught in western Gulf, 96% are caught in central Gulf.

A.5 Bycatch rates for sablefish, Pacific ocean perch, other rockfish, salmon, king crab, Tanner crab and halibut are taken from 1984 observer data on joint venture bycatch rates (by area).

Longline

B.1 Here is a longline fishery which targets on cod, other rockfish and sablefish.

B.2 Of the total catch, 15% are taken by longline.

B.3 Of the total sablefish, 55% are by longline.

B.4 As in A.5.

Midwater

C.1 There is a midwater trawl fishery directed towards pollock, Atka mackerel, and Pacific ocean perch.

C.2 Of the total pollock, 2/3 comes from this fishery.

C.3 See A.4.

C.4 See A.5.

GULF OF ALASKA INCIDENTAL CATCH RATES
(shown in percent bycatch)

Fishery	Species	83		84		85	
Central Gulf		bt	mw	bt	mw	bt	mw
All joint venture	Sable	1.9	0.01	2.0	0.02	1.6	0.02
	POPC	0.5	0.01	0.21	0.13	0.16	0.01
	ORF	0.3	0	0.32	0.03	0.5	0
	SAL	0.13	0	0.07	0.08	0	0
	KC	0.23	0	0.22	0	0.18	0
	TC	0.85	0	0.23	0	0.63	0
	HAL	4.2	0.01	3.8	0.04	4.1	0.05
Japan LL cod fishery	Sable	target		2.22		0.01	
	POPC	0.13		0.03		0	
	ORF	0.14		0.04		0.01	
	SAL	0		0		0	
	KC	0.04		0		0	
	TC	0.53		0.02		0	
	HAL	1.2		9.2		6.1	
Japan surimi trawler	Sable	0.05		0.05		0.3	
	POPC	0.13		0.04		0	
	ORF	0.14		0.02		0	
	SAL	0.03		0.02		0	
	KC	0		0.01		0	
	TC	0		0.01		0	
	HAL	0.16		0.4		0	
Japan small & large trawler	Sable	1.1		0.3			
	POPC	target		target			
	ORF	4.0		2.5		NO	
	SAL	0.04		0.01			
	KC	0.02		0.01		FISHING	
	TC	0.3		0			
	HAL	1.4		0.9			
Korean Trawlers	Sable	0.2		1.2		0.3	
	POPC	1.2		0.2		0	
	ORF	0.9		0.1		0	
	SAL	0.02		0.02		0	
	KC	0		0		0	
	TC	0		0		0	
	HAL	0.6		1.0		0.9	

bt=bottom trawl
mw-midwater trawl

Source: NMFS Foreign Observer Program

GULF OF ALASKA INCIDENTAL CATCH RATES
(shown in percent bycatch)

Fishery	Species	83		84		85	
Western Gulf		bt	mw	bt	mw	bt	mw
Joint venture	Sable	3.1		16.3	0.02	0.07	0
	POPC	target		1.6	target	1.56	0
	ORF	target	NO	0.8	1.8	0.25	0.05
	SAL	0.01		0	.01	0	0
	KC	0	FISHING	0	0	0	0
	TC	0		0	0	0	0
	HAL	1.8		5.4	1.3	0.88	0.35
Japan LL cod fishery	Sable	target		2.8		0.1	
	POPC	0.2		0.1		0	
	ORF	0.4		0.1		0.01	
	SAL	0		0		0	
	KC	0.01		0		0	
	TC	0.55		0		0	
	HAL	0.7		5.3		3.2	
Japan surimi trawler	Sable	0.3		0.1		0.01	
	POPC	0.3		0.1		0	
	ORF	0.03		0.1		0	
	SAL	0.02		0.04		0	
	KC	0		0		0	
	TC	0		0		0	
	HAL	0.07		0.2		0.03	
Japan small & large trawler	Sable	0.3		0.9			
	POPC	5.2		2.8			
	ORF	1.3		0.3		NO	
	SAL	0.3		0.03			
	KC	0		0		FISHING	
	TC	0		0			
	HAL	0.8		0.7			
Korean Trawlers	Sable	0.5		0.3		0.09	
	POPC	0.55		0.2		0.06	
	ORF	1.3		0.06		0.01	
	SAL	0.02		0		0	
	KC	0		0		0	
	TC	0		0		0	
	HAL	0.2		0.1		0.2	

bt=bottom trawl
mw-midwater trawl

Source: NMFS Foreign Observer Program

AGENDA D-1(a)
SUPPLEMENTAL

Alaska Contact Ltd.

December 4, 1985

North Pacific Fishery
Management Council
P. O. Box 103136
Anchorage, AK 99510

Dear Fellow Council Members:

I urge you each to review carefully the material forwarded to you entitled "Critique of Gulf of Alaska Pollock Stocks and Their Management." Alaska Contact contributed to cover the cost of the research and the production of this report. We have supported this effort for several reasons, of which the two most important are:

1. I am increasingly concerned about the Council's charge to make the difficult decisions we must make with inadequate data. I was impressed and supportive of the effort made by the industry to become involved in this way in this process; and

2. I personally had questions about the numbers we reviewed in September, and welcomed the opportunity to have additional research undertaken and questions asked.

This is not to say that I question the Plan Team's work as inadequate or faulty. We are all keenly aware of budget and time constraints and there is so much data to be considered in these assessments. I see this report as an augmentation of the information developed by the Council staff and Plan Team.

It goes without saying that we must protect our resource; however, we must also protect our very fragile industry. It is with this in mind that I urge you to consider all the information available as we undertake some very difficult decisions at our December meeting.

Sincerely,

Sara S. Hemphill

Sara S. Hemphill
President

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Steve 12/12 11:18 AM
Spreadsheet explanation

GOA1 Objectives

1. To accommodate all DAH requirements within biological constraints.
2. To minimize bycatch of fully-utilized and prohibited species.
3. To provide sufficient bycatch amounts to support target fisheries.
4. To continue rebuilding Pacific ocean perch and other rockfish.
5. To maintain the directed halibut harvest at 1985 levels for 1986.
6. Maximize economic benefit to the nation.

Decisions made in GOA1

1. Used ABCs recommended by Plan Team.
2. 1986 OYs:
   - Pollock. Western, Central, Eastern set equal to ABC.
   - Pacific cod. Set OY = DAH (based on NMFS survey estimate).
   - Flounder. Set OY = DAH (based on NMFS survey estimate).
   - Pacific ocean perch. Set OY at 75% ABC in Western/Central for rebuilding.
   - Pacific ocean perch. Set OY at 875 mt in Eastern for rebuilding.
   - Sablefish. Set cumulative OY at 15,000 (suggested by public comments).
   - Sablefish. OY in Southeast/East Yakutat set equal to ABC.
   - Sablefish. Sablefish OY in West Yakutat, Central, Western were set based on biomass distribution applied to remaining 15,000 OY after Southeast/East Yakutat was subtracted.
   - Atka mackerel. Set Western OY at ABC.
   - Atka mackerel. Central, Eastern OYs set at bycatch amounts (NMFS determined 500,100 mt).
   - Other rockfish. Set OY at ABC in Southeast, Central. Set OY at ABC at 1,700 mt for remaining Gulf, given limited evidence supporting a greater catch.
   - Thornyhead, Squid. Status quo.
3. DAP and JVP estimates obtained from NMFS Industry Survey.
4. Potential halibut bycatches as determined by some method used last year overestimate real bycatches in bottom trawls, since:

a. bottom trawls are used in a "mixed species" fishery, with the primary target being pollock, Pacific cod and flounder (comprising most of trawl catch). Data suggests in equal proportions.

b. Given the above, a bottom trawl fishery will be limited to the most constraining species designated as a target.

For example: Assuming: .33 pollock OY is bottom trawl
.85 Pacific cod is bottom trawl
1.0 flounder is bottom trawl

the most constraining OY will limit the bottom trawl harvest to three times that amount (given the assumption of three target species being caught in equal proportions).

to take 10,000 mt of flounder, you would take 10,000 each of Pacific cod and pollock.

This estimated bottom trawl harvest, is multiplied by bycatch rate which generates "Real halibut bycatch."

Example 1

GULF OF ALASKA GROUNDFISH 1986 ABCs, OYS, DAPs, JVPs, TALFF, and PSCs (MT)

Species	Area	1986 ABC	1986 OY	Reserves 20% OY	1986 DAP	1986 JVP	1986 DAH	TALFF	Bycatch Rate	Potential Halibut Bycatch	Real Halibut Bycatch
Pollock	Western/Central	75,600	75,600	15,120	94,875	0	94,875	(34,395)	3.8%	958	2,460
	Eastern	16,600	16,600	3,320	1,841	0	1,841	11,439			
Pacific Cod	W	37,500	29,892	5,978	25,531	4,361	29,892	(5,978)	3.8%	966	$8,704,257 G. value
	C	76,000	31,213	6,243	26,094	5,119	31,213	(6,243)	3.8%	1,008	$12,200,229 H. value
	E	22,500	8,157	1,631	8,157	0	8,157	(1,631)			
Flounders	W	23,000	18,842	3,768	3,252	15,590	18,842	(3,768)	3.8%	716	
	C	101,000	2,733	547	2,733	0	2,733	(547)	3.8%	104	
	E	17,000	332	66	332	0	332	(66)		---	
									total	3,751	
Pacific ocean perch	W	1,755	1,316	263	4,449	0	4,449	0			
	C	2,015	1,511	302	2,696	0	2,696	(1,487)			
	E	2,730	875	175	790	0	790	(90)			
Sablefish	W	2,500	1,869	0	8,119	0	8,119	0			
	C	11,562	8,848	0	9,342	0	9,342	0			
	W. Yakutat	2,200	1,745	0		0	0	0			
	E. Yakutat	846	846	0	4,012	0	4,012	0			
	S.E.Outside	1,692	1,692	0		0	0	0			
Atka Mackeral	W	4,678	4,678	936	0	4,540	4,540	0			
	C	500	500	100	0	0	0	0			
	E	100	100	20	0	0	0	0			
Rockfish	S.E.Central Outside	600	600	0	1,916	0	1,916	0			
	Remaining Gulf	1,700	1,700	340	5,320	0	5,320	(3,960)			
Thornyhead	GW	3,750	3,750	750	0	0	0	3,000			
Squid	GW	5,000	5,000	1,000	0	0	0	4,000			
Other Species	GW	**	10,920	2,184	0	200	200	8,536			
TOTAL		410,828	229,319	45,864	199,459	29,810	229,269	(45,814)			

Gulf of Alaska Spreadsheet Assumptions

Bycatch subsection

Bottom Trawl

A.1 There is a mixed species "hard-on-bottom" trawl fishery which takes 1/3 pollock, 1/3 cod and 1/3 flounder.

A.2 Of the total pollock, 1/3 are caught by bottom trawl, 2/3 by midwater trawl.

A.3 Of the total cod, 85% are caught by bottom trawl, 15% are caught by longline.

A.4 Of pollock, 4% are caught in western Gulf, 96% are caught in central Gulf.

A.5 Bycatch rates for sablefish, Pacific ocean perch, other rockfish, salmon, king crab, Tanner crab and halibut are taken from 1984 observer data on joint venture bycatch rates (by area).

Longline

B.1 Here is a longline fishery which targets on cod, other rockfish and sablefish.

B.2 Of the total catch, 15% are taken by longline.

B.3 Of the total sablefish, 55% are by longline.

B.4 As in A.5.

Midwater

C.1 There is a midwater trawl fishery directed towards pollock and Pacific ocean perch.

C.2 Of the total pollock, 2/3 comes from this fishery.

C.3 See A.4.

C.4 See A.5.

GULF OF ALASKA INCIDENTAL CATCH RATES
(shown in percent bycatch)

Fishery	Species	83		84		85	
Central Gulf		bt	mw	bt	mw	bt	mw
All joint venture	Sable	1.9	0.01	2.0	0.02	1.6	0.02
	POPC	0.5	0.01	0.21	0.13	0.16	0.01
	ORF	0.3	0	0.32	0.03	0.5	0
	SAL	0.13	0	0.07	0.08	0	0
	KC	0.23	0	0.22	0	0.18	0
	TC	0.85	0	0.23	0	0.63	0
	HAL	4.2	0.01	3.8	0.04	4.1	0.05
Japan LL cod fishery	Sable	target		2.22		0.01	
	POPC	0.13		0.03		0	
	ORF	0.14		0.04		0.01	
	SAL	0		0		0	
	KC	0.04		0		0	
	TC	0.53		0.02		0	
	HAL	1.2		9.2		6.1	
Japan surimi trawler	Sable	0.05		0.05		0.3	
	POPC	0.13		0.04		0	
	ORF	0.14		0.02		0	
	SAL	0.03		0.02		0	
	KC	0		0.01		0	
	TC	0		0.01		0	
	HAL	0.16		0.4		0	
Japan small & large trawler	Sable	1.1		0.3			
	POPC	target		target			
	ORF	4.0		2.5		NO	
	SAL	0.04		0.01			
	KC	0.02		0.01		FISHING	
	TC	0.3		0			
	HAL	1.4		0.9			
Korean Trawlers	Sable	0.2		1.2		0.3	
	POPC	1.2		0.2		0	
	ORF	0.9		0.1		0	
	SAL	0.02		0.02		0	
	KC	0		0		0	
	TC	0		0		0	
	HAL	0.6		1.0		0.9	

bt=bottom trawl
mw-midwater trawl

Source: NMFS Foreign Observer Program

GULF OF ALASKA INCIDENTAL CATCH RATES
(shown in percent bycatch)

Fishery	Species	83		84		85	
Western Gulf		bt	mw	bt	mw	bt	mw
Joint venture	Sable	3.1		16.3	0.02	0.07	0
	POPC	target		1.6	target	1.56	0
	ORF	target	NO	0.8	1.8	0.25	0.05
	SAL	0.01		0	.01	0	0
	KC	0	FISHING	0	0	0	0
	TC	0		0	0	0	0
	HAL	1.8		5.4	1.3	0.88	0.35
Japan LL cod fishery	Sable	target		2.8		0.1	
	POPC	0.2		0.1		0	
	ORF	0.4		0.1		0.01	
	SAL	0		0		0	
	KC	0.01		0		0	
	TC	0.55		0		0	
	HAL	0.7		5.3		3.2	
Japan surimi trawler	Sable	0.3		0.1		0.01	
	POPC	0.3		0.1		0	
	ORF	0.03		0.1		0	
	SAL	0.02		0.04		0	
	KC	0		0		0	
	TC	0		0		0	
	HAL	0.07		0.2		0.03	
Japan small & large trawler	Sable	0.3		0.9			
	POPC	5.2		2.8			
	ORF	1.3		0.3		NO	
	SAL	0.3		0.03			
	KC	0		0		FISHING	
	TC	0		0			
	HAL	0.8		0.7			
Korean Trawlers	Sable	0.5		0.3		0.09	
	POPC	0.55		0.2		0.06	
	ORF	1.3		0.06		0.01	
	SAL	0.02		0		0	
	KC	0		0		0	
	TC	0		0		0	
	HAL	0.2		0.1		0.2	

bt=bottom trawl
mw-midwater trawl

Source: NMFS Foreign Observer Program

updated w/ PT reports

Modified by SSC
December 11, 1985

TABLE 1
SSC MINUTES
ACCEPTABLE BIOLOGICAL CATCH WORKSHEET

Species	Area	1985 OY	1985 Catch[1/]	PT ABC	SSC ABC	Council ABC
Pollock	W/C	305,000	269,144	75,600	150,000 (a)	
	E	16,600	1	16,600	16,600	
Total		321,600	269,145	92,200	166,600	
Pacific cod	W	16,560	8,422	37,500	37,500	
	C	33,540	4,589	76,000	76,000	
	E	9,900	59	22,500	22,500	
Total		60,000	13,070	136,000	136,000	
Flounder	W	10,400	456	23,000	23,000	
	C	14,700	1,943	101,000	101,000	
	E	8,400	38	17,000	17,000	
Total		33,500	2,437	141,000	141,000	
Pacific ocean perch	W	1,302	871	1,755	2,800	
	C	3,906	29	2,015	3,300	
	E	875	32	2,730	4,400	
Total		6,083	932	6,500	10,500	
Sablefish	W	1,670	2,149	2,500	2,500	
	C	3,060	3,899	11,562	11,600	
	W.Yak.	1,680	2,483	2,200	2,200	
	E.Yak.	1,135		846	800	
	S.E.Out.	1,435	2,890[2/]	1,692	1,700	
Total		8,980	11,421	18,800	18,800	
Atka Mackeral	W	4,678	1,869	4,678	4,700	
	C	500	1	500	(bycatch only)	
	E	100	0	100	(bycatch only)	
Total		5,278	1,870	5,278	4,700	
Rockfish	S.E.Central Outside	600	590	600	(b)	
	Remaining Gulf	4,400	101	1,700	(b)	
Total		5,000	691	2,300		
Thornyhead	Gulf-wide	3,750	40	3,750	(b)	
Squid	Gulf-wide	5,000	12	5,000	(b)	
Other Species	Gulf-wide	22,460[3/]	2,261	n/a	n/a	
TOTAL		471,651	301,879	417,328	~~477,600~~	

1/ 1985 catch as of December 2.
2/ 1985 catch for E. Yakutat and Southeast Outside Districts combined.
3/ Set by formula (5% of sum of other nine species categories).

(a) 50,000 mt restricted to be harvested between January 15 and April 10 outside the defined Shelikof Straits fishing area.
(b) No data to set ABC.

ACCEPTABLE BIOLOGICAL CATCH WORKSHEET

Species	Area	1985 OY	1985 Catch[1]	PT ABC	SSC ABC	Council ABC
Pollock	W/C	305,000	269,144	75,600		
	E	16,600	1	16,600		
Total		321,600	269,145	92,200		
Pacific cod	W	16,560	8,422	37,500		
	C	33,540	4,589	76,000		
	E	9,900	59	22,500		
Total		60,000	13,070	136,000		
Flounder	W	10,400	456	23,000		
	C	14,700	1,943	101,000		
	E	8,400	38	17,000		
Total		33,500	2,437	141,000		
Pacific ocean perch	W	1,302	871	1,755 ~~3,500~~		
	C	3,906	29	~~4,000~~ 2,815		
	E	875	32	~~5,500~~ 2,730		
Total		6,083	932	~~13,000~~ 6,500		
Sablefish	W	1,670	2,149	2,500		
	C	3,060	3,899	11,562		
	W.Yak.	1,680	2,483	2,200		
	E.Yak.	1,135		846		
	S.E.Out.	1,435	2,890[2]	1,692		
Total		8,980	11,421	18,800		
Atka Mackeral	W	4,678	1,869	4,678		
	C	500	1	500		
	E	100	0	100		
Total		5,278	1,870	5,278		
Other Rockfish	S.E.Central / Outside	600	590	600		
	Remaining Gulf	4,400	101	1,700		
Total		5,000	691	2,300		
Thornyhead	Gulf-wide	3,750	40	3,750		
Squid	Gulf-wide	5,000	12	5,000		
Other Species	Gulf-wide	22,460[3]	2,261	n/a		
TOTAL		471,651	301,879	417,328		

1/ 1985 catch as of December 2.
2/ 1985 catch for E. Yakutat and Southeast Outside Districts combined.
3/ Set by formula (5% of sum of other nine species categories).