Agenda Item G-5
April, 1980

MEMORANDUM

DATE: April 19, 1980

TO: Council Members, Scientific & Statistical Committee and Advisory Panel

FROM: Jim H. Branson, Executive Director

SUBJECT: Bering Sea/Aleutian Islands FMP

ACTION REQUIRED

1. *Reschedule a public hearing date for public comment on the 1981 amendment package. Action needed at this meeting.*
2. *Review 1981 amendment package as prepared for public comment. Information only. No action required at this meeting.*
3. *Consider a proposal to increase the OY-ABC for Pacific cod for 1980. A decision is needed at this meeting.*

BACKGROUND

1. The Council set a date (April 23) for public comment on the 1981 BS/A amendment package. The public hearing has been postponed for reasons explained in Agenda Item G-4. It is necessary at this meeting to reschedule the public hearing. Enclosure #1 presents a scenario for this.

2. The amendment material has not changed since the March meeting. It is included as Enclosure #2.

3. This is a proposal to increase the OY-ABC for Pacific cod to be effective during the remainder of 1980. A current status of stock section for Pacific cod is included, as is the SSC report. You will find it in Enclosure #3. A decision should be made at this meeting.

*ACTION REQUIRED OPTION

4. The second reserve release for the BS/A is scheduled for June 2. Consideration of a release of reserves for June 2 will be needed at this meeting IF the May meeting is rescheduled for June 5-6. The status of reserve amounts may be found in Enclosure #4.

Attachments

AGENDA G-5

Enclosure #1

PUBLIC HEARING SCHEDULE

Bering Sea/Aleutian Groundfish
FMP

The public hearing process for the BS/A groundfish FMP must be accomplished on a different schedule from the Gulf of Alaska FMP.

The assumption is that Council has chosen OPTION #2 (a separate schedule) for the public hearings to be conducted on the two groundfish FMPs.

There is a possibility that the following schedule will enable us to have the BS/A groundfish FMP implemented by Jan. 1, 1981.

That possibility is contingent on our success in having the 60-day SOC review period reduced by 30 days. We are told by Pat Travers that this is a real possibility.

SCHEDULE

DATE	ACTION
Mid-June (16-20)	Public hearing
June 20 - July 15	Prepare amendment and public comments for Council review.
July 24-25	Council approves amendments as revised through public hearing process.
August 7	Transmitted to SOC. Start 60-day review.
October 7	End 60-day SOC review.
September 7	End 30-day abbreviated SOC review
September 14	Published in Federal Register
November 14	60 day comment period ends
December 1	Final regs prepared and published.
January 1, 1981	30-day "cooling" period ends, plan implemented.

PROCESSOR PREFERENCE POLICY

((Council intent is to propose a joint venture policy as an amendment to the BS/A fishery management plan.))

The following material is proposed to be added to the FMP for the Bering Sea/Aleutian area groundfish:

14.3.2.3 (D) Joint Venture

The Council finds that one method of implementing provisions of the Processor Preference Amendment (P.L. 95-354) requires that ocean areas in the vicinity of U.S. processing facilities be designated as closed areas to joint venture processing operations.

The Fishery Management Plan therefore provides that the Regional Director, NMFS, Alaska Region, may, upon the recommendation of the Council, designate such areas within which foreign fishing vessels may not receive U.S. harvested fish.

North Pacific Fishery Management Council

Clement V. Tillion, Chairman
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Agenda G-5

Enclosure 2b

April 14, 1980

TO THE PUBLIC

The North Pacific Fishery Management Council will hold a public hearing on Wednesday, April 23rd, 1980 in the Anchorage Westward Hilton Hotel. We are soliciting comments on proposed amendments for the 1981 Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish Fishery Management Plans.

The attached material explains these proposed amendments to the Bering Sea/Aleutian Groundfish Plan. Action by the Council to accept, reject or modify these proposals will take place May 22 and 23, 1980 at a Council meeting in Kodiak.

A Supplemental Environmental Impact Statement (SEIS) is being prepared for the amendments. It should be filed with EPA in early May with a 45-day comment period ending in mid-June. Comments on the actual amendments should be made at the April 23rd public hearing or in writing by May 16th, 1980. Comments on the SEIS should be made early in the 45-day review and if possible, before May 22nd and 23rd.

The submission of an approved amendment package to the Secretary of Commerce is planned to coincide with the end of the 45-day SEIS comment period. All comments received on the SEIS will be considered and handled separately.

You are however encouraged to send in your comments on the amendments early.

Additional information on any portion of this package may be obtained from this office, 333 W. 4th Street, Suite 32, Anchorage, Alaska 99501, (907) 274-4563. Comments may be made in person at the public hearing or in writing at any time before May 16, 1980.

Sincerely,

Mark Hutton

for: Jim H. Branson
Executive Director
North Pacific Fishery Management Council

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DRAFT

PROPOSED AMENDMENT TO THE

BERING SEA/ALEUTIAN ISLAND AREA

FISHERY MANAGEMENT PLAN

OPTIMUM YIELD CONCEPT: OPTION 1 of 3

The following 3 sections go as a package as Option 1 of 3 options. These sections are:

Section 11.0	Optimum Yield (OY)
Section 12.0	Reserve
Section 13.0	Total Allowable Catch (TAC)

This is the preferred option of the 3 options.

CONTENTS

This amendment package contains proposed amendments to the following sections of the existing FMP dated November 19, 1979:

The amendment package now contains the following:

Annex I, III, and VI have been updated and amended and maintain the same numbering system as before.

11.0 OPTIMUM YIELD (OY)

11.1 Maximum Sustainable Yield (MSY) of the Groundfish Complex

The groundfish complex and its fishery is a distinct management unit in the Bering Sea. It is made up of more than 10 commercially important species and many others of lessor or no commercial importance. Together, they form a large subsystem of the Bering Sea ecosystem with intricate inter-relationships between predators and prey, between competitors, and between those species and their environment. Therefore, the productivity and MSY of groundfish should be conceived for the groundfish complex as a unit rather than for many individual species groups.

Although MSY can be calculated for each species included in this fishery by applying single species concepts, their values are of limited value in fisheries management if they ignore species inter-relationships within the ecosystem. It has been noted that while the yield of individual species within the groundfish complex may fluctuate widely in magnitude, the yield of the compelx is more stable. Using an ecosystem (DYNUMES III) model that simulated the principal components (mammal-birds-groundfish-herring-squid benthos) of the Bering Sea ecosystem in Section 9.5.3, the total biomass of finfish was noted to vary little from year to year. In fact, commercial production from this complex has been reasonably stable during the 15-year history of intense exploitation where annual total catch remained in the 1.2-2.4 million mt range even though individual species experienced substantial and sometimes violent fluctations in abundance (e.g. yellowfin sole, Pacific ocean perch).

In order to calculate the MSY of the groundfish complex, it is not adequate to add up MSY's of individual species groups that are derived from single species analysis as noted in Annex I. If this is done, the

MSY would be 1,713,200-2,338,100 mt. There are compelling theoretical and empirical studies which indicate that the MSY of an ecosystem subsystem (e.g., finfishes) is less than the sum of individual MSY's calculated from standard single species models (Sissenwine, 1979).

Rather than utilizing single species production models of questionable validity to calculate individual MSY's the total average catch over the period 1968-77 is, in light of the above discussion, considered a reasonable approximation of MSY for the groundfish complex as a whole. This value, 1,773,000 mt, is encompassed by a range of 1,116,000 - 2,443,000 mt. Although several species experienced profound declines in abundance during this period, by 1979 all but three had rebounded to near the level of abundance that would closely approximate that needed to produce their individual "MSY." These three exceptions are Pacific halibut, Pacific ocean perch, and sablefish.

11.2 Allowable Biological Catch (ABC) of the Groundfish Complex

The historical trend on the status of individual species groups are described in Annex I. In this Annex, the ABC, EY, and MSY values reflect the intensity of exploitation on the stocks, natural mortality, and overall productivity of each stock. The ABC values best reflect the ability of each stock to produce at this time. Based on these values and emperical relationships between historical catch and condition of the stocks, the ABC for the entire groundfish complex for the foreseeable future (3-5 years) to vary from 1,300,000 mt - 2,000,000 mt.

Much of this variation in ABC reflect the productivity of the more abundant species like pollock and yellowfin sole; and other species with high variation in biological productivity like Pacific cod. From empirical relationships between historical catches and subsequent status of the stocks, it was determined that when total groundfish catches exceeded 2 million mt for a number of years, population stresses were observed in a number of species like pollock, yellowfin sole, sablefish, and Pacific ocean perch. The status of all species, except sablefish and Pacific ocean perch, are extremely good at this time and ABC for the entire complex is now 1,866,000 mt (Annex I). From Annex I, it appears that the condition of pollock, Pacific cod and yellowfin sole are steadily improving and the ABC for the entire groundfish complex may reach 2,000,000 mt in the near future.

At the other extreme end of ABC, recent trends in catch history and condition of stocks show that ABC for the entire groundfish complex is not expected to drop below 1,300,000 mt, even if the ice condition of the more abundance species (pollock, yellowfin sole, and Pacific cod) were to change for the worse. These changes may be induced by natural fluctuations in the ecoystem and the environment and can be very unpredictable. Therefore, in order to take into account both good and bad conditions of individual species groups in the near future, the ABC for the entire groundfish complex is deteremined at 1,300,000 - 2,000,000 mt.

The actual ABC within a single year can only be determined accurately within the year as data are collected through research and from the fishery as it progresses. This ABC is then apportioned by species to reflect the ability of each species to produce at the time.

From ecosystem models of the Bering Sea (Laevastu and Favorite 1979), it can be inferred that groundfish catches of 1.3 - 2.0 million mt should have minimum impact on the ecosystem. Therefore, the ABC range should insure (1) that the ecosystem provide sufficient food for marine mammals and birds; (2) that ecoystem production is not shifted to lower trophic levels of little or no commercial value; and (3) that a large resource biomass (a biological cushion) is maintained to buffer anticipated anomalies in upper trophic level production. With further catch limits set on individual depressed stocks, this ABC should allow for the rebuilding of the still depressed Pacific ocean perch, Pacific halibut, and sablefish stocks.

11.3 Optimum Yield fo the Groundfish Complex

Although the MSY for the groundfish complex is 1,773,000 mt, the ABC for the near future is expected to vary from 1,300,000 mt - 2,000,000 mt. Based on ecosystem models, the ABC range should have minimum impact on the ecosystem. When catches are varied within this range according to the ability of individual stocks to produce, the condition of the stocks should remain good.

For the determination of OY, socio and economic factors must also be taken into account. These factors are expected to vary from year to year but for the near future, OY is determined to vary from 1,300,000 mt - 2,000,000 mt. If the ABC or the OY is determined to fall outside this range, this FMP shall have to be amended. Meantime, the final OY for a particular year will be determined during that year as the fishery progresses by the Council. This final OY will then be published in the Federal Register as a supplement to this FMP.

12.0 RESERVE

The OY is apportioned to the TAC and Reserve. Since this OY is a range and will be determined only during the year, an initial TAC and Reserve must be set up to allow the fishery to start operation at the beginning of a plan year. Therefore, the low end of the OY (1,300,000 mt) will be used to apportion to initial TAC and Reserve. The final figures will be determined during the year.

Twenty-five percent of the OY range of the groundfish complex, or 325,000 mt, will be reserved from initial annual allocations to TAC. Therefore, the total of the initial TAC's will be 975,000 mt. The reserve will be released to TAC according to the schedule in Section 12.1.2 and to either DAH or TALFF as determined by domestic needs, unless the Secretary exercises his emergency authority under Section 305(e) of the FCMA.

Rationale for the reserve is: (1) to assure that unanticipated needs of the domestic fishery can be met without exceeding OY; (2) to provide in-season management flexibility which will allow the Regional Director to mitigate minor operational problems in the fishery (see Section 12.1.1); and (3) to provide the pool which the Regional Director will distribute to individual species' TAC's (see Section 13) on the basis of the most current status of stocks analyses. The amount of the reserve (325,000 mt) is the minimum required to allocate to species that have highly variable TAC's from one year to another. The notable example is pollock whose ABC has varied between 850,000 and 1,200,000 mt during recent years.

A flow diagram on how the Reserve is apportioned is shown in Figure 25-1.

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12.1.1 Special Reserve

Five percent of the Reserve (16,250 mt) will be set aside as a Special Reserve and be available for the Regional Director to allocate at his discretion among all elements of the fishery, foreign and domestic, to rectify unforeseen operational problems of the fishing fleet that have insignificant biological consequences to the stocks.

12.1.2 Normal Reserve

The remaining reserve of 308,750 mt will be released to TAC, apportioned among species groups as described in Section 13, and allocated to TALFF and DAH according to the following schedule:

A. Release of Normal Reserve to DAH. At any time, the Regional Director may reasses DAH and apportion to DAH any amounts from the Normal Reserve he determines are needed to supplement DAH.

B. Release of Normal Reserve and Unused DAH to TALFF. In consultation with the North Pacific Fishery Management Council, the Regional Director shall apportion to TALFF all or part of the Normal Reserve according to the following schedule: 40% at the beginning of month 4, 40% at the beginning of month 6, and 20% at the beginning of month 8.

As soon as practicable after the first day of the eighth month of the fishing year and after consultation with the North Pacific Fishery Management Council, the Regional Director shall apportion to TALFF that part of the DAH he determines will not be harvested by U.S. fishermen during the remainder of the fishing year.

12.1.3 Final Reserve

The release of 325,000 mt is the minimum reserve based on an OY of 1,300,000 mt. Since the OY may be increased during the fishing year, the amount of reserve may increase. Therefore, the final reserve will be (Final OY - Initial TAC - Initial Reserve). This final reserve will be released to TAC, apportioned among species groups as described in Section 13, and allocated to TALFF and DAH according to the schedule described in Section 12.1.2.

12.1.4 In addition to the above, any portion of the reserve not transferred to TALFF as scheduled may be transferred on a subsequent scheduled date.

13.0 Total Allowable Catch (TAC)

Just as OY for the groundfish complex will be determined during a fishing year, the TAC's that apply to individual species or species groups will be determined annually by the Regional Director, with advice from the Council, in the following manner.

Initial TAC's for each species group are based on the average proportion of the total groundfish production that can be expected of each species group as inferred from catch records (1969-76), estimates of equilibrium yield (1975-79), and preliminary estiamtes of equilibrium biomasses from the Prognostic Bulk Biomass model (Laevastu and Favorite 1979). Those proportions (Table 23-1) multiplied by 975,000 mt (minimum OY for the complex less Reserve for the complex) result in the guideline TAC for each species group (Table 23-2). These guideline TAC's are adjusted according to status of stocks (ABC's in Annex I) to determine initial TAC's which will remain unchanged from year-to-year unless this FMP is amended.

Final TAC's for each species group will be determined annually by apportioning the final OY determined by the Council among species groups in the following manner.

By the beginning of each fishing year the Regional Director, with advice from the Council and on the basis of the then most current status of stock and socio-economic analyses, will apportion all the OY that has not been apportioned to individual species TAC's. The resulting TAC's for each species group will be published in the Federal Register as an annual supplement to this FMP.

Therefore, the final TAC's will total the final OY determined by the Council unless this FMP is amended. The final OY will fall within 1,300,000 mt and 2,000,000 mt.

Table 23-1.--Determination of relative yield of the Bering Sea/Aleutian groundfish complex by species groups.

Species Group	Region	Commercial Catch (69-79)	Equilibrium Yield (75-79)2/	Ecosystem Model Equilibrium Biomass3/	Relative Yield4
Pollock	(Areas I, II)	.758	.650	.629	.680
	(Areas III, IV)	.002	.063	-	.010
Pacific ocean perch	(Areas I, II, III)	.010	.004		.005
	(Area IV)	.020	.009	.048	.010
Other rockfish	(Areas I, II, III)	.002	.002		.005
	(Area IV)		.002		.005
Sablefish	(Areas I, II, III)	.005	.003	.005	.003
	(Areas IV)	.005	.001		.002
Pacific cod		.040	.040	.073	.050
Yellowfin sole		.050	.092	.039	.060
Turbots		.046	.057	.024	.040
Other flatfish		.020	.028	.064	.050
Atka mackerel		.010	.012	.051	.030
Squid		.002	.006	.062	.020
All others		.030	.031	-	.030
Pacific halibut				.005	-
TOTAL		1.000	1.000	1.000	1.000

1/ Applies to entire Bering Sea/Aleutian Region combined unless otherwise indicated.

2/ From status of stocks analyses.

3/ From ecosystem model (Prognostic Bulk Biomass Model) which took into consideration prey-predator inter-relationships of all fish, mammals, and birds.

4/ Best blend of values derived from all three assessments of relative yields.

Table 23.2--Bering Sea/Aleutians groundfish MSY, ABC, OY, and initial TAC values, in metric tons.

Average catch = MSY = 1,773,000 metric tons
ABC = 1,300,000 - 2,000,000 metric tons
OY Range = 1,300,000 - 2,000,000 metric tons
Minimum OY = 1,300,000 metric tons
Reserve = 25% of minimum OY = 325,000 metric tons
Initial Guideline TAC = 975,000 metric tons

Species	Region	Relative yield 1/	x 975,000 =	Initial guideline TAC	Initial TAC 2/
Pollock	(Areas I, II)	.680		663,000	663,000
	(Areas III, IV)	.010		9,750	30,000
POP	(Areas I, II, III)	.005		4,875	500
	(Area IV)	.010		9,750	1,600
Other Rockfish	(Areas I, II, III)	.005		4,875	4,300
	(Area IV)	.005		4,875	4,400
Sablefish	(Areas I, II, III)	.003		2,925	1,200
	(Area IV)	.002		1,950	750
Pacific cod		.050		48,750	65,000
Yellowfin sole		.060		58,500	75,000
Turbots		.040		39,000	39,000
Other flatfish		.050		48,750	36,600
Atka mackerel		.030		29,250	15,000
Squid		.020		19,500	8,000
All others		.030		29,250	30,600
TOTAL 3/		1.000		975,000	975,000
Non-specific reserve				325,000	325,000
TOTAL TAC				1,300,000	1,300,000

1/ Best estimate of relative yield, the ability of each species group to produce in relation to the groundfish complex.

2/ Prior to reserve release and adjusted according to status of stocks. Initial TAC's are based on present status of stocks (Annex I) and therefore may deviate from Initial guideline TAC's which are decreased for depleted stocks and increased for healthy stocks.

3/ Excluding Pacific halibut and herring.

Public

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OPTIMUM YIELD CONCEPT: OPTION 2 of 3

The following 3 sections go as a package as Option 2 of 3 options. These sections are:

Section 11.0	Optimum Yield (OY)
Section 12.0	Reserve
Section 13.0	Total Allowable Catch (TAC)

11.0 OPTIMUM YIELD (OY)

11.1 Maximum Sustainable Yield (MSY) of the Groundfish Complex

The groundfish complex and its fishery is a distinct management unit in the Bering Sea. It is made up of more than 10 commercially important species and many others of lesser or no commercial importance. Together, they form a large subsystem of the Bering Sea ecoystem with intricate inter-relationships between predators and prey, between competitors, and between those species and their environment. Therefore, the productivity and MSY of groundfish should be conceived for the groundfish complex as a unit rather than for many individual species groups.

Although MSY can be calculated for each species included in this fishery by applying single species concepts, their values are of limited value in fisheries management if they ignore species inter-relationships with the ecosystem. It has been noted that while the yield of individual species within the groundfish complex may fluctuate widely in magnitude, the yield of the complex is more stable. Using an ecosystem (DYNUMES III) model that simulated the principal components (mammal-birds-groundfish-herring-squid benthos) of the Bering Sea ecosystem in Section 9.5.3, the total biomass of finfish was noted to vary little from year to year. In fact, commercial production from this complex has been reasonably stable during the 15-year history of intense exploitation where annual total catch remained in the 1.2-2.4 million mt range even though individual species experienced substantial and sometimes violent fluctations in abundance (e.g. yellowfin sole, Pacific ocean perch).

In order to calculate the MSY of the groundfish complex, it is not adequate to add up MSY's of individual species groups that are derived from single species analysis as noted in Annex I. If this is done, the MSY would be 1,713,200-2,338,100 mt. There are compelling theoretical and empirical studies which indicate that the MSY of an ecoystem subsystem (e.g., finfishes) is less than the sum of individual MSY's calculated from standard single species models (Sissenwine, 1979).

Rather than utilizing single species production models of questionable validity to calculate individual MSY's the total average catch over the period 1968-77 is, in light of the above discussion, considered a reasonable approximation of MSY for the groundfish complex as a whole. This value, 1,773,000 mt, is encompassed by a range of 1,116,000 - 2,443,000 mt. Although several species experienced profound declines in abundances during this period, by 1979 all but three had rebounded to near the level of abundance that would closely approximate that needed to produce their individual "MSY." These three exceptions are Pacific halibut, Pacific ocean perch and sablefish.

11.2 Allowable Biological Catch (ABC) of the Groundfish Complex

The Bering Sea groundfish fishery and its impact on the resources have been well monitored and evaluated since the early 1960's. When the fishery was targeting excessively on yellowfin sole and Pacific ocean perch in the late 1950's and early 1960's, there was rapid depletion of these resources. After the mid-1960's, the fishery targeted on more species, particularly pollock and production, rose rapidly. When the total groundfish production reached close to and beyond 2 million mt, population stresses were observed in a number of species including pollock, yellowfin sole, sablefish, and Pacific ocean perch (see Annex I for species by species stock assessments). When catches were lowered gradually and controlled to levels close to 1.6 million mt (with further limitations to catch of individual species), the condition of the entire groundfish resource either improved or stabilized.

Based on the observed relationships between the history of groundfish catches and the condition of groundfish stocks in the Bering Sea and until such time that Bering Sea ecoystem models are developed as the biological basis for management, the ABC of this fishery complex will be set at 1,600,000 mt (which turns out to be 90% of MSY). This ABC level reflects the situation that three species in the groundfish complex are not producing at MSY levels. The level has also been inferred from ecosystem models (Laevastu and Favorite 1979) to be at a safe level where the ecosystem will continue to insure: (1) sufficient food for marine mammals and birds; (2) that ecosystem production is not shifted to lower trophic levels of little or no commercial value; and (3) that a large resource biomass (a biological cushion) is maintained to buffer unanticipated anomalies in upper trophic level production. With further catch limits set on individual depressed stocks, this ABC should allow for the rebuilding of the still depressed Pacific ocean perch, Pacific halibut, and sablefish stocks.

Therefore, it is determined that an ABC of 1.6 million mt for the groundfish complex, apportioned out proportionately to individual species groups according to their ability to produce, will allow healthy stocks to remain in good condition and depleted stocks to continue improving and stabilize. Although ABC will vary about 1.6 million mt from year-to-year, a fixed level of 1.6 million mt per year may be taken in the forseeable future (3-5 years) without harm to the resource complex.

It is consistent with historic catch levels that did not impact severely on the stocks and is about the same level of recent fisheries (1977-79). Based on discussions in Section 10.2, it is also evident that this ABC should have any adverse impact on marine mammal and bird populations in the area.

Should the ABC change drastically from the 1.6 million mt in the future, this FMP should be amended to reflect stock conditions of that time.

11.3 Optimum Yield of the Groundfish Complex

Based on ecosystem models (Laevastu and Favorite, 1979), the ABC of 1.6 million mt should have a larger exploitable biomass than that required for the groundfish complex to achieve MSY. This, in turn, should provide higher catch rates and larger average fish sizes that testimony to the Council indicates are important to the further development of the domestic commercial fishery. Therefore, the OY for this fishery is 1,600,000 mt.

12.0 RESERVE

Twenty-five percent of the groundfish complex OY, or 400,000 mt, will be reserved from initial annual allocations to TAC. Therefore, the total of the intial TAC's will be 1,200,000 mt. The reserve will be released to TAC according to the schedule in Section 12.1.2 and to either DAH or TALFF as determined by domestic needs, unless the Secretary exercises his emergency authority under Section 305(e) of the FCMA.

Rationale for the reserve is: (1) to assure that unanticipated needs of the domestic fishery can be met without exceeding OY; (2) to provide in-season management flexibility which will allow the Regional Director to mitigate minor operational problems in the fishery (see Section 12.1.1); and (3) to provide the pool which the Regional Director will distribute to individual species' TAC's (see Section 13) on the basis of the most current status of stocks analyses. The amount of the reserve (400,000 mt) is the minimum required to allocate to species that have highly variable TAC's from one year to another. The notable example is pollock whose ABC has varied between 850,000 and 1,200,000 mt during recent years.

A flow diagram on how the Reserve is apportioned is shown in Figure 25-2.

12.1.1 Special Reserve

Five percent of the Reserve (20,000 mt) will be set aside as a Special Reserve and be available for the Regional Director to allocate at his discretion among all elements of the fishery, foreign and domestic, to rectify unforeseen operational problems of the fishing fleet that have insignificant biological consequences to the stocks.

RESERVE CONCEPT

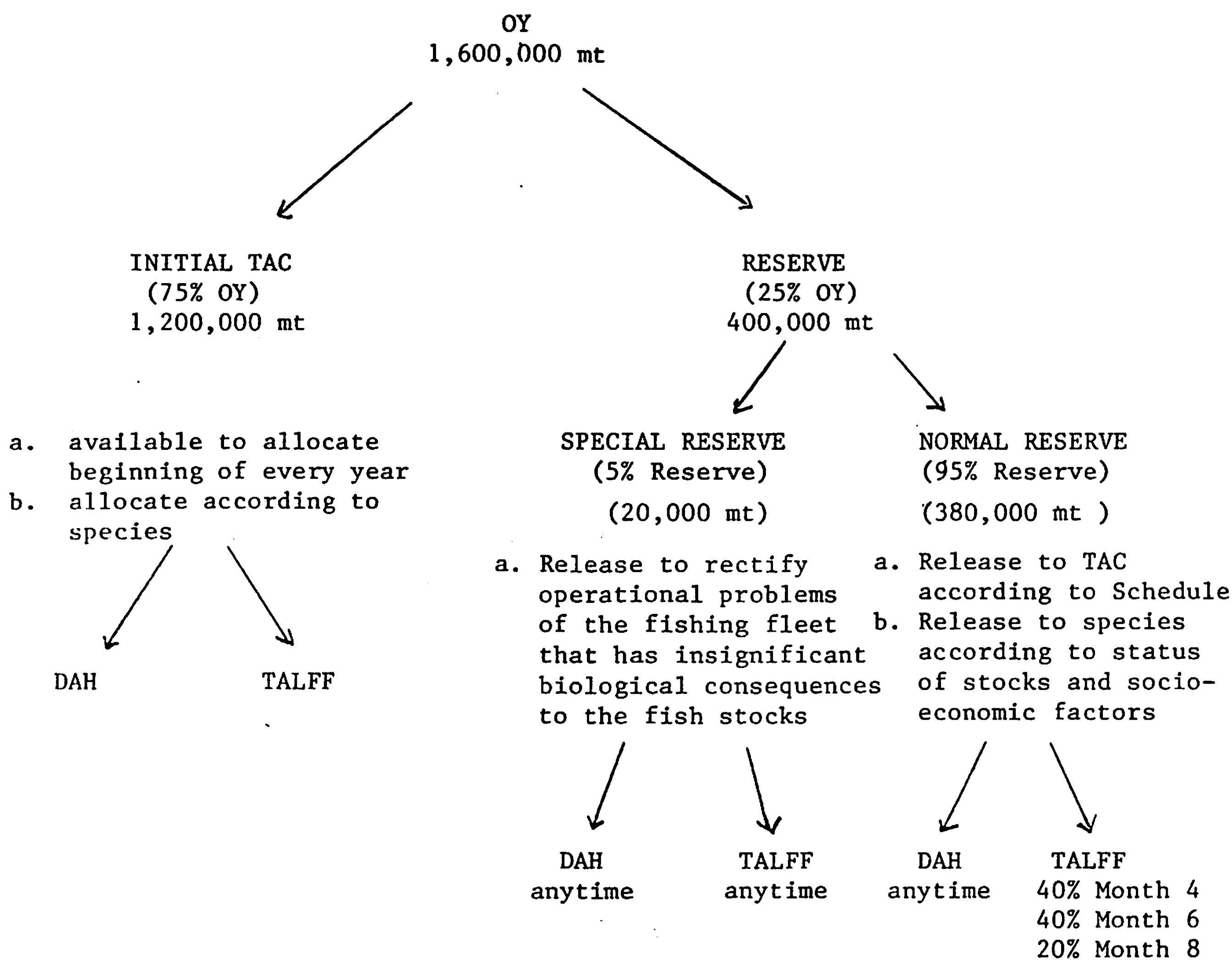

Figure 25-1. Flow diagram on apportioning of the optimum yield to initial Total Allowable Catch and Reserve and subsequently apportioning fo the Reserve.

12.1.12 Normal Reserve

The remaining reserve of 380,000 mt (Normal Reserve) will be released to TAC, apportioned among species groups as described in Section 13, and allocated to TALFF and DAH according to the following schedule:

A. Release of Normal Reserve to DAH. At any time, the Regional Director may reassess DAH and apportion to DAH any amounts from the Normal Reserve he determines are needed to supplement DAH.

B. Release of Normal Reserve and Unused DAH to TALFF In consultation with the North Pacific Fishery Management Council, the Regional Director shall apportion to TALFF all or part of the Normal Reserve according to the following schedule: 40% at the beginning of month 4, 40% at the beginning of month 6, and 20% at the beginning of month 8.

As soon as practicable after the first day of the eighth month of the fishing year and after consultation with the North Pacific Fishery Management Council, the Regional Director shall apportion to TALFF that part of the DAH he determines will not be harvested by U.S. fishermen during the remainder of the fishing year.

12.1.3 In addition to the above, any portion of the reserve not transferred to TALFF as scheduled may be transferred on a subsequent scheduled date.

13.0 TOTAL ALLOWABLE CATCH (TAC)

Whereas, MSY, ABC, OY, and Reserve apply to the groundfish complex as a whole and are intended to remain unchanged from year-to-year unless this FMP is so amended, TAC's apply to individual species or species groups, and will be determined annually by the Regional Director, with advice from the Council, in the following manner.

Initial TAC's for each species group are based on the average proportion of the total groundfish production that can be expected of each species group as inferred from catch records (1969-76), estimates of equilibrium yield (1975-79), and preliminary estimates of equilibrium biomasses from the Prognostic Bulk Biomass model (Laevastu and Favorite 1979). Those proportions (Table 23-1) multiplied by 1,200,000 mt (OY for the complex less Reserve for the complex) result in the guideline TAC for each species group (Table 23-4). These guideline TAC's are adjusted according to the status of stocks (ABC's in Annex I) to determine initial TAC's which will remain unchanged from year-to-year unless this FMP is amended.

Final TAC's for each species group will be determined annually by apportioning the 400,000 mt Reserve (20,000 mt Special Reserve plus 380,000 mt Normal Reserve) among species groups in the following manner:

By the beginning of each fishing year the Regional Director, with advice from the Council and on the basis of the then most current status of stock and socio-economic analyses, will apportion 380,000 mt of the Reserve (Normal Reserve) to individual species TAC's. The resulting TAC's for each species group will be published in the Federal Register as an annual supplement to this FMP.

During the fishing year, the Regional Director will allocate the remaining 20,000 mt of Reserve (Special Reserve) among species groups as necessary to prevent or rectify operational problems in the fishery.

Therefore, the final TAC's will total 1,600,000 mt unless this FMP is amended.

Table 23-3.--Determination of relative yield of the Bering Sea/Aleutian groundfish complex by species groups.

Species Group	Region	Commercial Catch (69-79)	Equilibrium Yield (75-79) 2/	Ecosystem Model Equilibrium Biomass 3/	Relative Yield 4
Pollock	(Areas I, II)	.758	.650	.629	.680
	(Areas III, IV)	.002	.063	-	.010
Pacific ocean perch	(Areas I, II, III)	.010	.004		.005
	(Area IV)	.020	.009	.048	.010
Other rockfish	(Areas I, II, III)	.002	.002		.005
	(Area IV)		.002		.005
Sablefish	(Areas I, II, III)	.005	.003	.005	.003
	(Areas IV)	.005	.001		.002
Pacific cod		.040	.040	.073	.050
Yellowfin sole		.050	.092	.039	.060
Turbots		.046	.057	.024	.040
Other flatfish		.020	.028	.064	.050
Atka mackerel		.010	.012	.051	.030
Squid		.002	.006	.062	.020
All others		.030	.031	-	.030
Pacific halibut				.005	-
TOTAL		1.000	1.000	1.000	1.000

1/ Applies to entire Bering Sea/Aleutian Region combined unless otherwise indicated.

2/ From status of stocks analyses.

3/ From ecosystem model (Prognostic Bulk Biomass Model) which took into consideration prey-predator inter-relationships of all fish, mammals, and birds.

4/ Best blend of values derived from all three assessments of relative yields.

Table 23.4--Bering Sea/Aleutians groundfish MSY, ABC, OY, and initial TAC values, in metric tons.

Average catch = MSY	= 1,773,000 metric tons
ABC = 90% of MSY = OY	= 1,600,000 metric tons
Reserve = 25% of ABC	= 400,000 metric tons
Initial Guideline TAC	= 1,200,000 metric tons

Species	Region	Relative yield1/	x 1,200,000 =	Initial guideline TAC	Initial TAC2/
Pollock	(Areas I, II)	.680		816,000	816,000
	(Areas III, IV)	.010		12,000	40,000
POP	(Areas I, II, III)	.005		6,000	750
	(Area IV)	.010		12,000	1,950
Other Rockfish	(Areas I, II, III)	.005		6,000	5,350
	(Area IV)	.005		6,000	5,475
Sablefish	(Areas I, II, III)	.003		3,600	1,450
	(Area IV)	.002		2,400	825
Pacific cod		.050		60,000	80,000
Yellowfin sole		.060		72,000	90,700
Turbots		.040		48,000	48,000
Other flatfish		.050		60,000	45,000
Atka mackerel		.030		36,000	18,600
Squid		.020		24,000	10,000
All others		.030		36,000	36,000
TOTAL3/		1.000		1,200,000	1,200,000
Non-specific reserve				400,000	400,000
TOTAL TAC				1,600,000	1,600,000

1/ Best estimate of relative yield, the ability of each species group to produce in relation to the groundfish complex.

2/ Prior to reserve release and adjusted according to status of stocks. Initial TAC's are based on present status of stocks (Annex I) and therefore may deviate from Initial guideline TAC's which are decreased for depleted stocks and increased for healthy stocks.

3/ Excluding Pacific halibut and herring.

OPTIMUM YIELD CONCEPT: Option 3 of 3

The third option of the optimum yield concept is essentially the same concept that is presently in the FMP dated November 19, 1979 that has been out for public review.

Under this concept, optimum yield are derived for individual species groups rather than for the entire groundfish complex. The OY of these individual species groups are derived mainly through species-by-species assessments of the stocks as described in Annex I of the FMP.

In this Annex I, the ABC for all the species groups combined is 1,865,800 mt as compared to the OY in Option 1 of 1,300,000-1,900,000 mt and the OY in Option 2 of 1,600,000 mt. Individual OY's for the species groups are listed in Table I.1 in Annex I.

Table I.1--MSY, EY, and ABC values for Groundfish in the Bering Sea/Aleutian Region during 1981 (1000's mt).

Species	Region1/	MSY	EY	ABC	(1979 OY)	(1979 OY - 1981 ABC Change
Pollock	BS	1,100-1,600	1,200	1,200	(1,000)	(+200)
	AL	?	?	100	(100)	(0)
Yellowfin sole	BS-AL	169-260	169	169	(117)	(+52.0)
Turbots	BS-AL	90	71	71	(90)	(-19)
Other flatfishes	BS-AL	42.9-76.8	60	60	(61)	(-1)
Pacific cod	BS-AL	58.7	160	120	(58.7)	(+61.3)
Pacific ocean perch	BS	32	5	1.0	(3.25)	(-2.25)
	AL	75	13	2.6	(7.50)	(-4.9)
Other rockfish	BS	?	7.0	7.0	(7.7)	(+6.6)
	AL	?	7.3	7.3		
Sablefish	BS	11.35	2.6	2.6	(3.5)	(-0.9)
	AL	1.85	1.1	1.1	(1.5)	(-0.4)
Atka mackerel	BS-AL	33	?	24.8	(24.8)	(0)
Squid	BS-AL	>10	>10	10	(10)	(0)
Pacific halibut	BS-AL	5	0.3	2/	-	-
Other included species	BS-AL	89.4	89.4	89.4	(74.2)	(+15.2)
Total3/		1,713.2-2,338.1	1,795.4	1,865.8	(1,559.15)	(+306.65)

1/ BS - Eastern Bering Sea (statistical areas I & II).
AL - Aleutian Region (statistical area IV).

2/ Subject to separate FMP.

3/ Excluding Pacific halibut.

14.0 CATCH AND CAPACITY DESCRIPTORS

14.1. Domestic Annual Capacity

14.1.1. Commercial commercial processing characteristics

14.1.2. Commercial fishing fleet

14.2. Expected Domestic Annual Harvest (DAH)

NOTE: THIS ENTIRE SECTION MAY HAVE TO BE REVISED ACCORDING TO REVISIONS OF ANNEX II (DERIVATION OF EXPECTED DOMESTIC ANNUAL HARVESTING CAPACITY)

THIS REVISION MAY NOT BE COMPLETED BY JULY 1980

15.0 MANAGEMENT REGIME

15.1 Management Objectives

Four priority objectives dictate the philosophy of management for the groundfish fishery in the region:

(A) Rational and optimal use, in biological and socio-economic sense, of the region's fishery resources as a whole;

(B) Minimize the impact of groundfish fisheries on prohibited species and continue the rebuilding of the Pacific halibut resource;

(C) Provide for the opportunity and orderly development of domestic groundfish fisheries, consistent with (A) and (B) above; and

(D) Provide for foreign participation in the groundfish fishery, consistent with all three objectives above, to take the portion of the optimum yield not utilized by domestic fishermen.

15.2 Area, Fisheries, and Stocks Involved

This Fishery Management Plan and its Management Regime applies:

A. To the U.S. Fishery Conservation Zone of that portion of the North Pacific Ocean adjacent to the Aleutian Islands which is west of 170°W, and of the entire Bering Sea (See Figure 26).

B. To all foreign and domestic fishing vessels operating in the area described in A above, except:

   1. U.S. and Canadian fishermen when they are operating under IPHC regulations;
   2. Those U.S. vessels which are operating legally in any fishery for shellfish.

C. To all stocks of finfish and squid except salmon, steelhead trout, Pacific halibut, and herring which are distributed or are exploited predominantly in the area described in A, above.

15.2.1 Plan Year

The plan year shall apply on a calendar year basis (January 1 - December 31). Should the FMP be implemented at a date other than January 1, fish allocation will have to be prorated on a 12 month basis.

15.3.1 Prohibited Species Rationale

Prohibited species are listed in Annex VI. These species may not be retained by domestic or foreign fishermen fishing under this FMP, unless specificially permitted by other State and Federal regulations. When incidentally caught, they must be immediately returned to the sea in a manner that maximizes the opportunity for their survival.

In additon to non-retention of these prohibited species, incidental TAC's are set for specific species in Section 15.3.1.1, and economic disincentives are imposed to mitigate for losses to the domestic fishery for these species (Section 15.3.1.2). These species are either fully utilized by U.S. fishermen and/or of great socio-economic value to them. Their incidental catch in the groundfish fishery is <u>not</u> <u>desirable</u> but recognizing

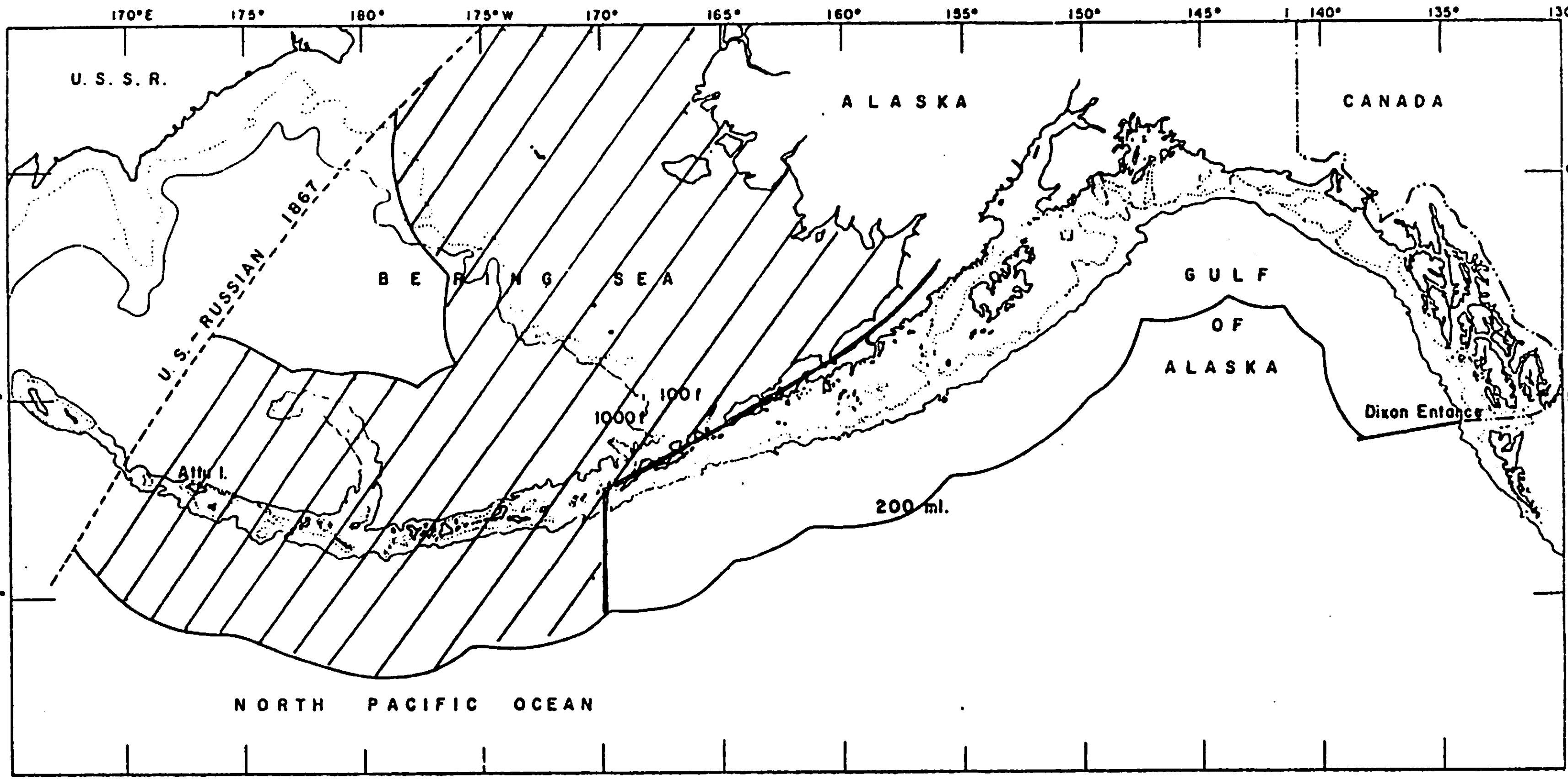

Figure 26.--Area (diagonal lines) over which this Fishery Management Plan applies.

that some incidental catch is unavoidable, incidental TAC's and economic disincentives are imposed to control the problem.

15.3.1.1 Incidental Total Allowable Catch

Absolute limits on the incidental TAC of Prohibited Species will be imposed for the groundfish fishery. Such limits should be set, variable from year-to-year, to take into account: (1) the need to protect prohibited species; (2) the magnitude of the groundfish fishery; (3) historical catch trends of groundfish and prohibited species; and, (4) the population size of the prohibited species. In the case of certain species (Pacific halibut, red and blue king crabs, C. opilio and C. bairdi snow crabs), information on their incidental catch, population size, and socio-economic value are adequate to formulate a system to set incidental TAC's annually. For salmonid and golden king crabs, preliminary incidental TAC's are set slightly below or at recent levels for lack of additional information on their population abundance. Accordingly, incidental TAC's are set as follows.

Pacific halibut	- 1,500 mt
Red king crab	- 0.0010% of estimated red king crab population
Blue king crab	- 0.0018% of estimated blue king crab population
C. opilio (snow crab)	- 0.0040% of estimated C. opilio population
C. bairdi (snow crab)	- 0.0106% of estimated C. bairdi population
Golden king crab	- 600 mt (920,000 crabs)
All salmonids	- 41,400 fish

For king and snow crab incidental catch, the percentage of the estimated population size is based on estimated incidental catches by U.S. observers aboard foreign vessels and population sizes estimated by NMFS research vessels. In recent years, the estimated population size of crabs by NMFS in a standardized crab-groundfish area in the eastern Bering Sea (Otto et al., 1979) were:

Estimated Population Size (millions of crabs, all sizes, both sexes combined

	1977	1978	1979
Red king crab	365.3	324.0	311.5
Blue king crab	34.5	47.1	20.6
C. opilio snow crab	8,378.7	2,253.1	3,209.7
C. bairdi snow crab	1,007.6	440.4	385.6

Note: Population size of snow crabs are for area south of 58°N latitude.

Based on these values, the incidental TAC of crabs for 1979 would have been:

	Incidental TAC
Red king crab	600 mt (320,000 crabs)
Blue king crab	50 mt (38,000 crabs)
C. opilio snow crab	2,580 mt (23,920,000 crabs)
C. bairdi snow crab	820 mt (4,080,000 crabs)

The incidental TAC for Pacific halibut is equal to the 1977 incidental catch and about 75% the average 1977-78 incidental catch. It is set to allow rebuilding of the depleted Pacific halibut stocks throughout the North Pacific. Incidental TAC's on crabs are based on the most reliable estimate in recent years (1979) and are set as a percentage of the estimated population size for each species except golden king crab. The incidental TAC for golden king crab is set at the 1979 incidental catch level. The average incidental catch of all salmonids in the groundfish fishery for 1977-78 was 46,000 salmon. Since salmon are of great socio-economic value to U.S. fishermen and Alaskan natives, its incidental TAC is set at 90% of the former level -- 41,400 salmon.

15.3.1.2 Apportionment of Incidental TAC to TALFF and DAH

Incidental TAC's will be allocated between domestic and foreign fishermen on the basis of total groundfish DAH and TALFF, with the domestic share being based on twice the incidence rate as the foreign share (i.e., if the total groundfish DAH is 5 per cent of the total groundfish OY, the domestic fishery would receive 10 per cent of the incidental TAC of each Prohibited Species or species group). This disproportionality will be maintained only as long as the total groundfish DAH is less than (20) per cent of the total groundfish OY and reflects the fact that inasmuch as the foreign groundfish fishery had an opportunity to develop without this type of restriction in the past, the domestic fishery should have a period of development before it is equally restricted in its incidental catch of prohibited species.

The specific allocations to each country of the incidental TAC of Prohibited Species will be considered to be an absolute quota subject to the provision which closes this entire management unit to all fishermen of a nation for the remainder of the fishing year when that nation's allocation of any species or species group--including Prohibited Species--is exceeded. (With regard to Pacific halibut taken by hook and line gear, only one-half of the estimated incidental catch will be counted against national allocations of this species, reflecting the assumption that half of such fish survive.)

15.3.1.3 Mitigation for Loss to the Domestic Fishery

Of the Prohibited Species listed for this fishery, four are fully utilized by domestic fishermen--Pacific halibut, salmon, king and *C. bairdi* snow crab. Therefore, the mortality of such species associated with their incidental capture in the foreign groundfish fishery results directly in a loss to the domestic fisheries targeting on them.

Accordingly, that loss will be mitigated by requiring compensation to be paid by foreign fishermen for the mortality caused by their operations. Similar compensation will not be required of U.S. fishermen. That compensation will equal the average ex-vessel price paid U.S. fishermen for each of the previously mentioned four species groups during each year times the incidental catch mortality factor caused by each foreign nation's groundfish fishery. This mortality factor is estimated to be virtually 100 per cent for all species except Pacific halibut taken by hook where the mortality is believed to be 50 percent.

This provision allows foreign fishermen the choice of reducing their incidental catches to near zero or compensating the U.S. for the loss to its fishermen of the opportunity to increase their catch of halibut and king and snow crabs.

Although beyond the scope of this FMP, it would be desirable for the funds received in compensation to be applied to management research and observer coverage, associated with the incidental catch problem of this region, because such research and coverage are presently inadequate.

15.3.1.4 Determination of Amount of Catch of Prohibited Species

For the purpose of implementing incidental TAC's (Section 15.3.1.1) and mitigation compensation (Section 15.3.1.2), the national catches of each Prohibited Species will be determined using both observer data and reported catches by foreign fishermen.

Weights will be used as a measure for all species, except salmon, for the purpose of monitoring incidental catches. Quantities of crabs given in numbers assume that average weight of individuals are 1.87 kg per red king crab; 1.30 kg per blue king crab, 0.20 kg per C. opilio snow crab, 0.20 kg per C. bairdi snow crab, and 0.65 kg per golden king crab. If the average weight of crabs caught in the groundfish fishery changes during the year, the incidental TAC in numbers will change but not the total weight, which form the basis for implementing regulations.

With regard to the mitigation fee schedule, the Regional Director shall determine, annually, the average ex-vessel price paid domestic fishermen for Pacific halibut, and the various salmonid and crab species.

15.3.2 Incidental Catch of Fully Utilized Species

According to guideline TAC's (Table 23-2) and DAH (Annex II) for Pacific ocean perch, this species is now fully utilized by domestic fishermen, and no surplus is available to TALFF. Accordingly, the catch of POP by foreign fishermen will have to be incidental and controlled so that catches will not negate the objective of rebuilding the depleted POP stock.

There are two stocks of POP -- one in the Bering Sea and the other in the Aleutians. Each is affected differently because of POP stock conditions and volume of groundfish catch in each region. The ABC for the POP stock in the Bering Sea is about 1,000 mt, and that in the Aleutians is about 2,600 mt (Annex I). Equilibrium yields for these stocks are much higher (5,000 mt in the Bering Sea and 13,000 mt in the Aleutians). Therefore, an absolute incidental catch of POP by foreign fishermen is set at 10% of EY (which turns out to be 50% of ABC) in both regions, that is:

Incidental POP catch in Bering Sea = 500 mt

and Incidental POP catch in Aleutians = 1,300 mt

These incidental catch amounts are determined so that the rebuilding of POP stocks is not adversely hindered while permitting a groundfish fishery for other species in both regions.

15.3.3 Area closure rationale

Specific areas described in Sections 15.3.3.3 and 15.3.4.3, and Appendix III, unless otherwise indicated, will be closed during certain times of the year for the groundfish fishery. These area-time closures are designed to prevent gear conflicts between user groups, and to reduce high incidental catch and mortality of prohibited species, particularly halibut.

If incidental TAC's are established for prohibited species as described in Section 15.3.1, future needs for these area-time closures will be re-evaluated after ample data are collected, in a year or two, to assess their effectiveness for controllng incidental catches. Meantime, it is questionable whether the present degree of observer coverage is adequate to monitor incidental catches of prohibited species. If observer coverage of the foreign groundfish fishery can be extended to 20% of the total vessel-days spent by the fleets on the fishing ground, then it is optional to maintain those time-area closures designed to protect prohibited species.

15.3.4. Management measures--Domestic fishery

15.3.4.1. Permit requirements

All U.S. vessels operating in that part of the Bering Sea/Aleutian groundfish fishery under this FMP must have on board a current permit issued by the Secretary of Commerce, or, if considered acceptable by the Secretary, a State of Alaska vessel license.

15.3.4.2. Prohibited species

In accordance with existing State and Federal statutes and subject to incidental TAC's established for these species.

15.3.4.3. Area closures

A. General

None

B. Trawl

1. Area A--"Bristol Bay Pot Sanctuary" (as described in Appendix III and Figure 27) -- domestic trawling will be permitted year-round on an experimental basis and be monitored closely by observers.

2. Area B--"Winter Halibut-savings Area" (as described in Appendix III and Figure 27):

(i) December 1 - May 31 -- domestic trawling will be permitted on an experimental basis and monitored closely by observers.

(ii) June 1 - November 30 -- no closures.

3. Other areas -- no closures.

Rationale -- To reduce high incidental catches and mortality of juvenile halibut which are known to occur in winter concentrations in the Bristol Bay Pot Sanctuary and the Winter Halibut-savings Area while allowing some expansion in primarily the traditional crab-bait trawl fishery and the development of a domestic groundfish fishery for human consumption.

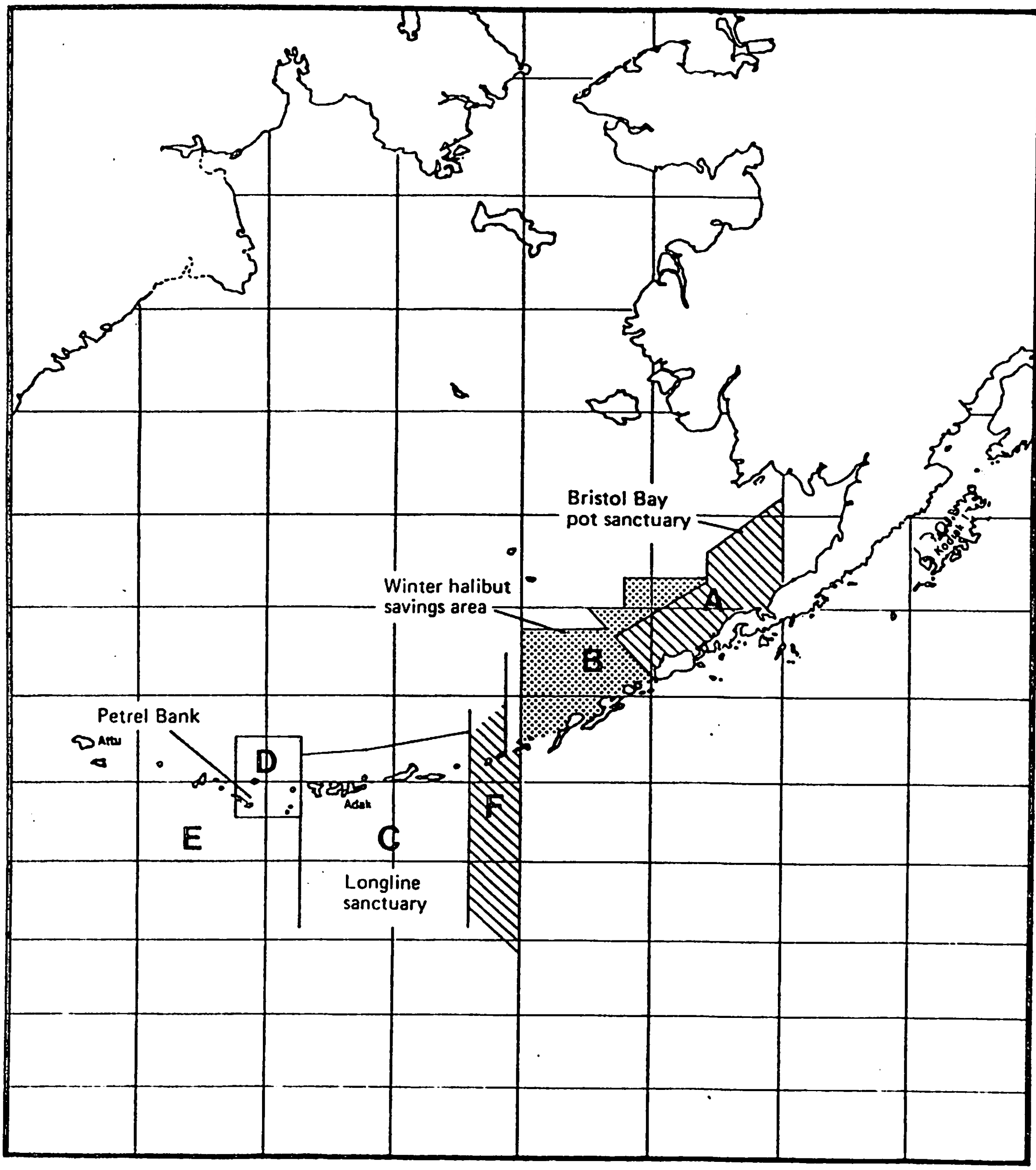

Figure 27. General location of areas described in management measures for the Bering Sea/Aleutians groundfish fisheries (see Appendix II for geographical coordinates).

C. Longline

1. Area B - Winter Halibut-savings Area (as described in Appendix III and Figure 27):

(i) December 1 - May 31 -- domestic longlining will be permitted landward of the 500 m isobath until the total U.S. longline catch (excluding halibut) from this area exceeds 2,000 mt.

(ii) June 1 - November 30 -- no closures.

2. Other areas -- no closures.

Rationale -- To reduce high incidental catch and mortality of juvenile halibut which are known to occur in winter concentrations in the Winter Halibut-savings Areas while allowing for some expansion in the domestic setline fishery for species other than halibut.

D. In-Season Adjustment of Time and Area

The Regional Director or his designee may issue field orders adjusting time and/or area restrictions. The field orders may open or close fishing areas or parts thereof and fishing seasons based upon the following considerations:

1. The effect of overall fishing effort within a fishing area or part thereof;
2. Catch per unit of effort and rate of harvest;
3. Relative abundance of stocks within the area in comparison with pre-season expectations;
4. The proportion of prohibited species being caught;
5. General information on the condition of stocks within the area;
6. Information pertaining to the guideline harvest level for species within a fishing area or part thereof; or

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7. Any other factors necessary for the conservation and management of the groundfish resource.

Rationale: The Council finds that the guideline harvest levels in this FMP, which are based upon projections of the status of stocks, economic and other conditions several months in advance of the actual conduct of the fishery may be found to be mis-specified in light of unpredicted and unanticipated adverse or favorable stock conditions which are revealed in-season. Under such circumstances, the Council further finds it appropriate for conservation purposes only, that the Regional Director of NMFS, Alaska Region, or his designee, in close coordination with the Commissioner of the Alaska Department of Fish and Game, take immediate action by issueing field orders adjusting the time and/or area restrictions; therefore this FMP provides that seasons and areas shall be subject to in-season adjustment by the Regional Director of NMFS.

It is expected that the actual opening and/or closing dates for the seasons prescribed in this plan will be adjusted by the Regional Director pursuant to the authority described in this section. Such action is not considered emergency action that would require admentment of the plan; adjusting the season opening and closing dates is meant to be an inherent part of the seasons themselves. For this reason, any adjustments made by the Regional Director or his designee will be effected by the issuance of a field order and announcement in the maner currently utilized by the State of Alaska.

15.3.4.4. Gear Restrictions

None

15.3.4.5. Statistical Reporting Requirements

A. Fishermen Reports

Fishery data compiled for the domestic groundfish fishery should be of the same general degree of precision as those required of foreign fishermen:

catch by species, by ½ degree latitude x 1 degree longitude areas, by gear type and vessel class, and by month;

effort (e.g. hours towed, number of hooks, number of pots, number of landings, number of trips) by gear type and vessel class, and by month.

In order to compile such data sets, the performance of individual vessels must be made available. To do so will probably require, in addition to fish sales tickets made out for each delivery, one or a combination of the following: logbooks, port sampling, and interviews with fishermen.

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In addition to collecting this information from domestic vessels which land their catches at Alaskan ports, it must also be collected from those vessels which sell or use their catch for bait on the fishing grounds, from vessels which land their catches in other states, and from vessels which deliver their catches to foreign processing vessels.

Annual data compilations, in the above format, should be available to the Secretary by May 31 of the following year. In addition, preliminary catch data -- by species and by major statistical area (i.e., Areas I, II, III, IV) -- should be compiled by month and made available to the Secretary by the end of the following month.

Arrangements, including financing and schedule of implementation, for the collection, compilation, and summarization of these fishery data will be developed through consultations between officials of NMFS, State of Alaska, and other states in which landings of catch from this fishery are likely.

B. Processor reports

All processors of groundfish shall report information necessary for the periodic reassessment of DAP. The regulations implementing this plan specify the information to be reported and the time schedule for reporting.

C. Joint Venture reports

Persons delivering U.S. caught groundfish to foreign processing vessels shall report information required for periodic reassessment of that portion of the DAH to be delivered to foreign processors. JVP. The JVP will be responsible for reporting the catch statistics required of domestic trawlers since the entire catch is delivered in cod ends to JVP. The regulations implementing this plan specify the information to be reported and the time schedule for reporting.

D, Non-processed Fish

Persons catching or delivering non-processed fish for use as bait or for direct consumption shall report information necessary for periodic reassessment of DNP. The regulations implementing this plan specify the information to be reported and the time schedule for reporting.

15.3.4.6. Limited Entry

Implementation of a limited entry program will not be necessary for this fishery now. However, a limited entry program should be designed by the Council during the early stages of domestic fishery development so that it can be implemented well before the time that the fishery becomes fully or over-capitalized.

15.3.5. Management measures -- Foreign fisheries

15.3.5.1. Permit requirements

All foreign vessels operating in this Management Unit must have on board a permit issued by the Secretary of Commerce. Required by FCMA.

15.3.5.2. Prohibited species

No retention of salmon, steelhead trout, halibut or Continental Shelf Fishery Resource to prevent covert targetting on species of special socioeconomic importance to U.S. fishermen. The catch of prohibited species is also subject to individual TAC's established for them. The Longline fishery is exempt from incidental TAC's for crabs and salmon because it has insignificant impact on them.

15.3.5.3. Area closures

A. General

(i) No harvesting year-round within 12 miles of the baseline used to measure the territorial sea, except in the western Aleutian Islands as described in Appendix III. To prevent conflicts with U.S. fixed gear and small inshore fishery vessels and to prevent catch of localized inshore species important to U.S. commercial and subsistence fishermen. If joint venture operations are permitted, foreign ships receiving fish from American fishermen may operate to within three miles of the baseline used to measure the territorial sea. However, when operating within that area between 3 and 12 miles of the baseline used to measure the territorial sea, such foreign processors may not receive fish from foreign vessels.

(ii) This management unit (or individual sub-area where specific quotas apply) will be closed to all fishermen of a nation for the remainder of the calendar year when that nation's allocation of any species or species group is exceeded, except that such closures will affect longline fishing only if the national allocation of any of the following species is exceeded: sablefish; Pacific cod; Greenland turbot; and Pacific halibut.

Purpose -- to discourage foreign fleets from covertly targetting on depleted species/stocks and to prevent damaging by-catches after the allowed catch has been taken; this provision places the burden of responsibility on the foreign fleets to avoid taking such species/stocks and to develop fishing gear and fishing practices which will minimize or eliminate their incidental capture.

B. Trawl

(i) Area A -- No trawling year-round in the Bristol Bay Pot Sanctuary (as described in Appendix III and Figure 27).

Rationale--to prevent conflicts between foreign mobile gear and concentrations of U.S. crab pots; to prevent incidental catch of juvenile halibut which are known to concentrate in this area.

(ii) Area B -- No trawling from December 1 to May 31 in the Winter Halibut-savings Areas (as described in Appendix II and Figure 27).

Rationale--to protect winter concentrations of juvenile halibut, to protect spawning concentrations of pollock and flounders.

(iii) Area C -- No trawling year-round in the Longline Sanctuary Area (as described in Appendix III and Figure 27).

Rationale -- To provide a sanctuary for foreign and domestic longline fishing in recognition of the situation in which highly developed trawl fisheries in both the Bering Sea/Aleutian area and the Gulf of Alaska have tended to preempt grounds from the traditional longline fishing method.

(Prior to 1977, no Danish seiners, side trawlers, or pair trawlers operated in this area, and less than one percent of the foreign stern trawl effort occurred in this area. Because of the displacement of the Japanese land-based dragnet fleet from the Soviet 200-mile zone that fleet has, since 1977, increased its utilization of the trawl grounds surrounding the Aleutian archipelago. As a result, during the first 7 months of 1978, of the total foreign stern trawl effort in the Bering Sea/Aleutian region, about three percent (3%) occurred in this longline sanctuary area.)

(iv) Area D --No trawling January 1 - June 30 in the area known as Petrel Bank (as described in Appendix III and Figure 27. Trawling is permitted seaward of three nautical miles from July 1 - December 31.

Rationale -- to avoid gear conflicts during the conduct of the domestic king crab fishery and to avoid the incidental catch of king crab by trawling. Data available from the fishery in the Petrel Bank area indicates a substantial incidental trawl catch of red, blue and golden king crab. The crab savings effected by the trawl closure is a direct benefit to the domestic fleet in terms of potential catch and of long-range benefit in terms of conservation of crabs not subject to the rigors of a trawl effort during the softshell or moulting period.

(v) Area E --No trawling January 1 - April 30 in Area E (as described in Appendix III and Figure 27) EXCEPT trawling is permitted seaward of three nautical miles from May 1 - December 31.

Rationale -- To avoid gear conflicts during the conduct of the domestic king crab fishery and the development of the domestic bottomfish effort and to avoid the adverse effects of the incidental catch of king crabs by trawl.

(vi) Area F -- Trawling permitted up to three nautical miles in Area F (as described in Appendix III and Figure 27).

C. Longline

(1) Area B -- Winter Halibut Savings Area (as described in Appendix III and Figure 27)

(i) December 1 - May 31 -- no longlining landward of the 500 m isobath.

(ii) June 1 - November 30 -- no closures

Rationale -- To prevent high incidental catch and mortality of juvenile halibut which are known to occur in winter concentrations in the area.

(2) Other areas -- no closures.

(3) Throughout the area west of 172-00'W, longlining is permitted seaward of three nautical miles.

(4) Area F -- Longlining permitted up to three nautical miles in Area F (as described in Annex III and Figure 27).

D. In-Season Adjustment of Time and Area

The Regional Director or his designee may issue field orders adjusting time and/or area restrictions on foreign vessels to solve serious gear conflict problems with domestic fixed gear fishing operations. The field orders may open or close fishing areas or parts thereof in such gear conflict situations. The criteria for determining the seriousness of the situations as basis for implementing special in-season time-area closures are:

1. More than two gear loss reports have been submitted in person or by radio to NMFS or Coast Guard detailing:
   (a) amount of gear lost, (b) date set and date gear was found missing, (c) observations of foreign vessels operating in area, identified, if possible by call letters, and (d) other pertinent information of gear conflict situation. Reports of gear loss must be confirmed by affidavit at the earliest opportunity.
2. Foreign vessels are verified by NMFS or Coast Guard to have been operating in the area of conflict.
3. Coast Guard or NMFS patrol unit has visited area and confirmed the general gear conflict situation as indicated by reports.
4. Foreign vessels in area have been contacted by patrol unit or by radio message advising of the gear conflict, defining the problem area and requesting that the foreign vessels depart the area voluntarily.
5. Foreign vessels decline to depart area and domestic fixed gear fishing is continuing and need for specific closure is clear.

15.4. Operational Needs and Costs (1000's dollars)

150 observer-months of foreign fishery observer coverage	450	1/
12 observer-months of domestic fishery observer coverage	35	
NWAFC allocation compliance analyses	10	
NMFS computerized foreign fishery information system	36	
NMFS Alaska Regional Office Management Division	435	
NOAA/Justice administration of penalties	12	
800 Coast Guard ship patrol days	2800	
2500 Coast Guard aerial patrol hours	1900	
State of Alaska fishery data collection	20	
Total	5698	

Costs of federal, State, and IPHC biological research are not included inasmuch as they would be financed in the absence of this Fishery Management Plan.

1/ Reimbursed by foreign governments to the U.S. Treasury. Same degree of observer coverage as in 1979. The optimal coverage representing about 20% coverage is 270 observer-months costing $810,000.

15.5. ~~14.5~~ Effects of the Management Regime on Availability, Cost, and Quality of Fishery Products

Except where necessary to restore depleted stocks (Pacific ocean perch, Pacific halibut, and sablefish), optimum yields have been set equal to maximum biological production. The total OY for the Bering Sea/Aleutian groundfish fishery druing 1979 is 1,409,400 mt, some 34,000 mt greater than that allowed by the Preliminary Management Plan for 1978 -- hence, availability of fishery products will not be reduced.

Although any mangement measure is likely to add expense to a fishery, the fishery restrictions proposed by the FMP are the minimum necessary to assure healthy stocks of all species, and most are carry-overs from the past several years -- therefore, costs of fishery products should neither be unreasonably inflated nor significantly increased as a result of implementation of this FMP.

The management regime of this FMP is not expected to have any effect on the quality of commodities produced from Bering Sea/Aleutian groundfishes.

As has been discussed earlier in Section 8.1.3, it seems highly unlikely that management actions taken in the Bering Sea will have any significant effect on the availability, cost, or quality of groundfish products to U.S. consumers. Therefore, specific management actions including the determination of optimum yield, have not been taken for the express purpose of addressing consumer interests. However, in future years this situation may change. At that time it will be necessary to more explicitly take into account consumer interests. Several studies are currently under way to provide the information upon which such decisions can be based. The largest of these is a contract let by the U.S. Department of Commerce to examine both international and national opportunities for the development of underutilized species in the U.S. fisheries conservation zone. Although primarily focused on opportunities for domestic industry development, this study should provide a good deal of useful information on patterns of groundfish consumption and prices. Particularly, it will fill important gaps in our understanding of foreign groundfish markets.

Other studies funded by the National Marine Fisheries Service, Northwest and Alaska Fisheries Center, and the Pacific and North Pacific Councils will provide further useful information. The proper orientation of near term research efforts to reflect consumer interests is probably the most important thing that can be done at this stage. If accomplished, it will insure that the information is available upon which decisions representative of consumer interests can be made when they are required in future Bering Sea and Aleutian groundfish management plans.

19.0 REFERENCES

(Add the following new references)

Laevastu, T. and F. Favorite. 1979. Ecosystem dynamics in the eastern Bering Sea. U.S. Dept. Commerce, NOAA, NMFS, NWAFC, Seattle, Wa. unpubl. manuscr.

Otto, R.S., T.M. Armetta, R.A. MacIntosh, and J. McBride. 1979. King and Tanner crab research in the eastern Bering Sea, 1979. U.S. Dept., NOAA, NMFS, NWAFC, Seattle, Wa. Unpubl. manuscr. (Submitted to INPFC)

Sissenwine, M.P. 1978. Is maximum sustained yield an adequate foundation for optimum yield? Fisheries 3(6):22-42.

ANNEX II

Derivation of Expected Domestic Annual Harvesting Capacity

(NOTE: THIS ANNEX MAY HAVE TO BE UPDATED; IT WILL TAKE MORE THAN 2 MONTHS TO CONDUCT A NEW SURVEY OF THE INDUSTRY: PHIL CHITWOOD OF THE NMFS REGIONAL OFFICE, ALASKA REGION HAS INITIATED THIS NEW SURVEY IN MARCH 1980)

Appendix III. Specific areas closed to fishing during certain times of the year for some fishing vessels are shown in Figure 27 and defined as follows:

Area A -- Bristol Bay Pot Sanctuary

The portion of the Fishery Conservation Zone encompassed by straight lines connecting the following points, in the order listed:

Cape Sarichef Light (54°36'N - 164°55'42"W)

55°16'N - 166°10'W

56°20'N - 163°00'W

57°10'N - 163°00'W

58°10'N - 160°00'W

Intersection of 160°00'W with the Alaska Peninsula

Area B -- Winter Halibut-savings Area

That portion of the Fishery Conservation Zone encompassed by straight lines connecting the following points, in the order listed:

Cape Sarichef Light (54°36'N - 164°55'42"W)

52°40'N - 170°00'W

55°30'N - 170°00'W

55°30'N - 166°47'W

56°00'N - 167°45'W

56°00'N - 166°00'W

56°30'N - 166°00'W

56°30'N - 163°00'W

56°20'N - 163° 00'W

55°16'N - 166°10'W

55°16'N - 166°10'W

Cape Sarichef Light (54°36'N - 164°55'42"W)

Area C -- The area between 172-00'W and 178-30'W within the FCZ south of a line drawn to connect the following coordinates:

53°14'N - 172°00'W

52°13'N - 176°00'W

52°00'N - 178°30'W

Area D -- The area known as Petrel Bank on the north side of the Aleutian Islands between the following coordinates:

52°51'N - 178°30'W

51°15'N - 178°30'W

51°15'N - 179°00'E

52°51'N - 179°00'E

52°51'N - 178°30'W

Area E -- The area west of 178°30'W but excluding Area D known as Petrel Bank that is defined above.

Area F -- The area bounded by 170°W and 172°W on the south side of the Aleutian Islands and that bounded by 170°30'W and 172°W on the north side of the Aleutians.

Annex III--Derivation of Initial Total Allowable Level of Foreign Fishing (TALFF), in metric tons.

Reference Species Group	Region 1/	Section 13 Initial TAC	Annex II Initial DAH	Initial TALFF
Pollock	(Areas I, II)	816,000	19,550	796,450
	(Areas III, IV)	40,000	0	40,000
Pacific ocean perch	Bering Sea	750	750 3/	0
	Aleutians	1,950	1,950 3/	0
Other Rockfish	Bering Sea	5,250	775	4,475
	Aleutians	5,475	775	4,700
Sablefish	Bering Sea	1,450	700	750
	Aleutians	825	700	125
Pacific cod		80,000	24,265	55,735
Yellowfin sole		90,200	2,050	88,150
Turbots		48,000	1,075	46,925
Other Flatfish 2/		45,000	1,300	43,700
Atka mackerel		18,600	100	18,500
Squid		10,000	50	9,950
All Others		36,000	2,000	34,000
TOTAL		1,200,000	56,040	1,143,960
Non-Specific Reserve		400,000		
Total TAC		1,600,000		

1/ Bering Sea (Statistical Areas I, II, and III)
Aleutians (Statistical Area IV).

2/ Excluding Pacific halibut.

3/

	Actual DAH	Initial DAH	Maximum TAC	Reserve
Bering Sea	1,380	750	1,000	250
Aleutians	1,380	1,950	2,600	650

Annex IV-B. Foreign catches of groundfish in the Aleutian Island Region (170°W to 170°E) by calender year, 1962-1978. 1/ 2/

Species	Nation	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Pollock	Japan	6	1,359	543	663	1,102	1,359	2,680	512	178	624
	USSR	--	--	--	--	--	--	--	726	9,490	2,535
	ROK	0	0	0	0	0	--	--	--	--	--
	Taiwan	0	0	0	0	0	0	0	0	0	0
	TOTAL	6	1,359	543	633	1,102	1,359	2,680	1,238	9,668	3,159
Pacific cod	Japan	26	601	241	451	154	274	289	220	283	425
	USSR	--	--	--	--	--	--	--	--	--	1,653
	ROK	0	0	0	0	0	--	--	--	--	--
	Taiwan	0	0	0	0	0	0	0	0	0	0
	TOTAL	26	601	241	451	154	274	289	220	283	2,078
Pacific ocean perch and other rockfish	Japan	214	7,636	29,377	38,204	28,733	10,285	23,889	15,641	14,173	14,809
	USSR	--	20,000	61,000	71,000	57,700	45,720	26,584	23,172	53,274	7,190
	ROK	0	0	0	0	0	--	--	--	--	--
	Taiwan	0	0	0	0	0	0	0	0	0	0
	TOTAL	214	27,636	90,377	109,204	86,433	56,005	50,473	38,813	64,447	21,999
Sablefish	Japan	--	639	1,496	1,224	1,321	1,608	1,676	1,667	1,246	2,700
	USSR	--	--	--	--	--	--	--	--	--	170
	ROK	0	0	0	0	0	--	--	--	--	--
	Taiwan	0	0	0	0	0	0	0	0	0	0
	TOTAL	--	639	1,496	1,224	1,321	1,608	1,676	1,667	1,246	2,870
Atka mackerel	Japan	--	--	--	--	--	--	--	--	--	--
	USSR	--	--	--	--	--	--	--	--	--	--
	ROK	0	0	0	0	0	--	--	--	--	--
	Taiwan	0	0	0	0	0	0	0	0	0	0
	TOTAL	--	--	--	--	--	--	--	--	--	--
Yellowfin sole	Japan	--	2	61	92	98	18	6	20	9	1
	USSR	--	--	--	--	--	--	--	--	--	--
	ROK	0	0	0	0	0	--	--	--	--	--
	Taiwan	0	0	0	0	0	0	0	0	0	0
	TOTAL	--	2	61	92	98	18	6	20	9	1
Rock sole	Japan	--	27	152	147	82	25	17	2	2	1
	USSR	--	--	--	--	--	--	--	--	--	--
	ROK	0	0	0	0	0	--	--	--	--	--
	Taiwan	0	0	0	0	0	0	0	0	0	0
	TOTAL	--	27	152	147	82	25	17	2	2	1
Flathead sole	Japan	--	14	43	128	25	32	186	2	11	16
	USSR	--	--	--	--	--	--	--	--	--	--
	ROK	0	0	0	0	0	--	--	--	--	--
	Taiwan	0	0	0	0	0	0	0	0	0	0
	TOTAL	--	14	43	128	25	32	186	2	11	16
Alaska plaice	Japan	--	--	45	41	--	--	--	--	--	--
	USSR	--	--	--	--	--	--	--	--	--	--
	ROK	0	0	0	0	0	--	--	--	--	--
	Taiwan	0	0	0	0	0	0	0	0	0	0
	TOTAL	--	--	45	41	--	--	--	--	--	--
Halibut	Japan	1	67	681	1,268	163	215	333	331	350	387
	USSR	--	--	--	--	--	--	--	--	--	--
	ROK	0	0	0	0	0	--	--	--	--	--
	Taiwan	0	0	0	0	0	0	0	0	0	0
	TOTAL	1	67	681	1,268	163	215	333	331	350	387
Arrowtooth flounder	Japan	CATCHES OF ARROWTOOTH FLOUNDER COMBINED WITH GREENLAND TURBOT UNTIL 1970								274	581
	USSR									--	--
	ROK									--	--
	Taiwan									0	0
	TOTAL									274	581
Greenland turbot	Japan	--	7	504	300	63	394	213	228	285	1,750
	USSR	--	--	--	--	--	--	--	--	--	--
	ROK	0	0	0	0	0	--	--	--	--	--
	Taiwan	0	0	0	0	0	0	0	0	0	0
	TOTAL	--	7	504	300	63	394	213	228	285	1,750
Other groundfish	Japan	--	513	66	768	131	563	318	2,361	1,181	2,753
	USSR	--	--	--	--	--	7,979	8,630	727	9,490	220
	ROK	0	0	0	0	0	--	--	--	--	--
	Taiwan	0	0	0	0	0	0	0	0	0	0
	TOTAL	--	513	66	768	131	8,542	8,948	3,088	10,671	2,973
All groundfish total	Japan	247	10,865	33,209	43,286	31,872	14,773	29,607	20,984	17,992	24,047
	USSR	--	20,000	61,000	71,000	57,700	53,699	35,214	24,625	72,254	11,768
	ROK	0	0	0	0	0	--	--	--	--	--
	Taiwan	0	0	0	0	0	0	0	0	0	0
All nations total		247	30,865	94,209	114,286	89,572	68,472	64,821	45,609	90,246	35,815

1/ Catch statistics up to 1963 from Forrester et al. 1974 and for 1964-78 from data on file, Northwest and Alaska Fisheries Center, with the following exceptions: Pacific ocean perch and other rockfish - USSR catches for 1963-66 from Chikuni 1975; all flounders except halibut - all national catches, 1963-76 from Wakabayashi and Bakkala 1978.

2/ 0 indicates no fishing, -- indicates fishing, but no catch reported.

Annex IV-B -- Foreign catches of groundfish in the Aleutian Island Region (170 W to 170 E) by calender year, 1962-1978. 1/ 2/ (metric tons) (Continued).

Species	Nation	1972	1973	1974	1975	1976	1977	1978
Pollock	Japan	571	848	1,318	1,519	1,015	5,667	5,025
	USSR	866	9,628	21,346	12,262	3,673	1,618	1,193
	ROK	--	--	--	--	344	325	64
	Taiwan	0	0	--	--	--	15	--
	TOTAL	1,437	10,476	22,664	13,781	5,032	7,625	6,282
Pacific cod	Japan	435	566	1,334	2,581	3,862	2,066	3,165
	USSR	--	411	45	257	312	100	120
	ROK	--	--	--	--	16	--	6
	Taiwan	0	0	--	--	--	--	--
	TOTAL	435	977	1,379	2,838	4,190	2,166	3,291
Pacific ocean perch and other rockfish	Japan	8,789	9,793	22,317	9,528	11,204	12,708	10,428
	USSR	24,595	3,017	824	8,147	6,951	785	231
	ROK	--	--	--	--	33	87	246
	Taiwan	0	0	--	--	--	2	--
	TOTAL	33,384	12,810	23,141	17,675	18,188	13,582	10,905
Sablefish	Japan	3,308	2,690	2,451	1,624	1,569	673	728
	USSR	269	162	14	79	61	--	0
	ROK	--	--	--	--	71	86	22
	Taiwan	0	0	--	--	--	--	--
	TOTAL	3,577	2,852	2,465	1,703	1,701	759	750
Atka mackerel	Japan	--	--	--	--	5	585	673
	USSR	4,515	1,604	1,377	12,078	20,092	20,970	22,065
	ROK	--	--	--	--	--	--	0
	Taiwan	0	0	--	--	0	--	--
	TOTAL	4,515	1,604	1,377	12,078	20,097	21,555	22,738
Yellowfin sole	Japan	--	--	--	--	0	98	668
	USSR	--	--	--	--	--	--	0
	ROK	--	--	--	--	--	--	0
	Taiwan	0	0	--	--	--	--	--
	TOTAL	--	--	--	--	0	98	668
Rock sole	Japan	5	2	36	3	24	75	806
	USSR	--	--	--	--	--	44	8
	ROK	--	--	--	--	--	--	0
	Taiwan	0	0	--	--	--	--	--
	TOTAL	5	2	36	3	24	119	814
Flathead sole	Japan	4	24	41	1	7	39	240
	USSR	--	--	--	--	--	1	0
	ROK	--	--	--	--	--	--	0
	Taiwan	0	0	--	--	--	--	--
	TOTAL	4	24	41	1	7	40	240
Alaska plaice	Japan	--	--	--	--	--	--	1
	USSR	--	--	--	--	--	--	0
	ROK	--	--	--	--	--	--	0
	Taiwan	0	0	--	--	--	--	--
	TOTAL	--	--	--	--	--	--	1
Halibut	Japan	357	245	363	145	15	1	0
	USSR	1	4	4	3	2	--	0
	ROK	--	--	--	--	--	--	0
	Taiwan	0	--	0	--	--	--	--
	TOTAL	358	249	367	148	17	1	--
Arrowtooth flounder	Japan	1,323	3,705	3,195	784	1,370	2,015	1,780
	USSR	--	--	--	--	--	20	2
	ROK	--	--	--	--	5	--	0
	Taiwan	0	0	0	--	--	--	--
	TOTAL	1,323	3,705	3,195	784	1,375	2,035	1,782
Greenland turbot	Japan	12,874	8,666	8,788	2,970	1,955	2,449	4,765
	USSR	--	--	--	--	112	4	0
	ROK	--	--	--	--	6		1
	Taiwan	0	0	0	--	--		--
	TOTAL	12,874	8,666	8,788	2,970	2,073	2,453	4,766
Other groundfish	Japan	3,028	2,630	7,998	8,110	6,250	11,504	11,701
	USSR	19,419	1,614	1,726	178	562	4,662	88
	ROK	--	--	--	--	241	0	647
	Taiwan	0	0	0	--	--	4	--
	TOTAL	22,447	4,244	9,724	8,288	7,053	16,170	12,436
All groundfish total	Japan	30,694	29,169	47,841	27,265	27,276	37,880	39,980
	USSR	49,665	16,440	25,336	33,004	31,765	28,204	23,707
	ROK	--	--	--	--	716	498	986
	Taiwan	0	0	--	--	--	21	--
All nations total		80,359	45,609	73,177	60,269	59,757	66,603	64,673

Annex IV-C.--Foreign catches of groundfish in the eastern Bering Sea (east of 180°) by calender year, 1954 to 1978. 1/ 2/ (metric tons)

Species	Nation	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Pollock	Japan	-	-	-	-	6,924	32,793	26,097	24,216	58,765	103,353	171,957	229,275
	USSR	0	0	0	0	-	-	-	-	-	-	-	-
	ROK 3/	0	0	0	0	0	0	0	0	0	0	0	0
	Taiwan	0	0	0	0	0	0	0	0	0	0	0	0
	Total	-	-	-	-	6,924	32,793	26,097	24,216	58,765	103,353	171,957	229,275
Pacific cod	Japan	-	-	-	-	171	2,864	5,679	2,448	6,054	3,879	13,408	14,722
	USSR	0	0	0	0	-	-	-	-	-	-	-	-
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	Taiwan	0	0	0	0	0	0	0	0	0	0	0	0
	Total	-	-	-	-	171	2,864	5,679	2,448	6,054	3,879	13,408	14,722
Pacific ocean perch and other rockfish	Japan	-	-	-	-	-	-	1,100	13,000	12,900	17,500	13,588	8,723
	USSR	0	0	0	0	-	-	5,000	34,000	7,000	7,000	7,000	9,000
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	Taiwan	0	0	0	0	0	0	0	0	0	0	0	0
	Total	-	-	-	-	-	-	6,100	47,000	19,900	24,500	20,588	17,723
Sablefish	Japan	-	-	-	-	32	393	1,861	26,183	28,521	18,404	6,165	5,001
	USSR	0	0	0	0	-	-	-	-	-	-	-	-
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	Taiwan	0	0	0	0	0	0	0	0	0	0	0	0
	Total	-	-	-	-	32	393	1,861	26,183	28,521	18,404	6,165	5,001
Yellowfin sole	Japan	12,562	14,690	24,697	24,145	39,153	123,121	360,103	399,542	281,103	20,504	48,880	26,039
	USSR	0	0	0	0	5,000	62,200	96,000	154,200	139,600	65,306	62,297	27,771
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	Taiwan	0	0	0	.0	0	0	0	0	0	0	0	0
	Total	12,562	14,690	24,697	24,145	44,153	185,321	456,103	553,742	420,703	85,810	111,177	53,810
Rock sole	Japan	-	-	-	-	-	-	-	-	-	1,196	1,432	1,780
	USSR	0	0	0	0	-	-	-	-	-	3,806	1,806	1,898
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	Taiwan	0	0	0	0	0	0	0	0	0	0	0	0
	Total	-	-	-	-	-	-	-	-	-	5,002	3,238	3,678
Flathead sole	Japan	-	-	-	-	-	-	-	-	-	7,079	11,121	3,287
	USSR	0	0	0	0	-	-	-	-	-	22,546	14,167	3,426
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	Taiwan	0	0	0	0	0	0	0	0	0	0	0	0
	Total	-	-	-	-	-	-	-	-	-	29,625	25,288	6,713
Alaska plaice	Japan	-	-	-	-	-	-	-	-	-	233	808	474
	USSR	0	0	0	0	-	-	-	-	-	742	1,030	505
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	Taiwan	0	0	0	0	0	0	0	0	0	0	0	0
	Total	-	-	-	-	-	-	-	-	-	975	1,838	979
Pacific halibut	Japan	-	-	-	-	196	674	6,931	3,480	7,865	7,452	1,271	1,369
	USSR	0	0	0	0	-	-	-	-	-	-	-	-
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	Taiwan	0	0	0	0	0	0	0	0	0	0	0	0
	Total	-	-	-	-	196	674	6,931	3,480	7,865	7,452	1,271	1,369
Arrowtooth flounder	Japan	Catches of arrowtooth flounder and Greenland turbot combined until 1970.											
	USSR												
	ROK												
	Taiwan												
	Total												
Greenland turbot	Japan	-	-	-	-	-	-	36,843	57,348	58,226	31,565	33,729	7,947
	USSR	0	0	0	0	-	-	-	-	-	-	-	1,800
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	Taiwan	0	0	0	0	0	0	0	0	0	0	0	0
	Total	-	-	-	-	-	-	36,843	57,348	58,226	31,565	33,729	9,747
Other groundfish	Japan	-	-	-	-	147	380	10,260	554	5,931	1,102	736	2,218
	USSR	0	0	0	0	-	-	-	-	-	-	-	-
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	Taiwan	0	0	0	0	0	0	0	0	0	0	0	0
	Total	-	-	-	-	147	380	10,260	554	5,931	1,102	736	2,218
All groundfish total	Japan	12,562	14,690	24,697	24,145	46,623	160,225	448,874	526,771	459,365	212,267	303,095	300,835
	USSR	0	0	0	0	5,000	62,200	101,000	188,200	146,600	99,400	86,300	44,400
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	Taiwan	0	0	0	0	0	0	0	0	0	0	0	0
All Nation Total		12,562	14,690	24,697	24,145	51,623	222,425	549,874	714,971	605,965	311,667	389,395	345,235

1/ Catch statistics up to 1963 from Forrester et al. 1974, and for 1964-78 from data on file, Northwest and Alaska Fisheries Center, Seattle, with the following exceptions: Pacific ocean perch and other rockfish--Japanese catches 1960-63 and USSR catches 1960-66 from Chikuni 1975; blackcod--Japanese catches 1958-63 from Sasaki 1976; and all flounders except halibut--all nation catches, 1954-76 from Wakabayashi and Bakkala 1978.

2/ 0 indicates no fishing, - indicates fishing, but no reported catch.

3/ ROK - Republic of Korea

Annex IV-C. -- Foreign catches of groundfish in the eastern Bering Sea (east of 180°) by calender year, 1954 to 1978. 1/ 2/ (metric tons) (Contd.)

Species	Nation	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Pollock	Japan	261,694	550,152	701,124	830,525	1,231,347	1,514,030	1,616,532	1,471,189	1,250,654	1,065,078	986,696	774,450	783,048
	USSR	-	-	-	33,571	35,590	233,511	213,895	280,005	309,613	216,567	175,539	63,382	91,647
	ROK	0	0	1,200	5,000	5,000	10,000	9,200	3,100	26,000	3,438	84,987	39,895	59,570
	Taiwan	0	0	0	0	0	0	0	0	-	-	-	1,334	-
	Total	261,694	550,152	702,324	869,096	1,271,937	1,757,541	1,839,627	1,754,294	1,586,267	1,285,083	1,247,222	879,061	934,265
Pacific cod	Japan	18,200	31,982	57,915	50,487	70,078	40,555	35,877	40,817	45,915	33,322	32,009	33,141	41,234
	USSR	-	-	-	-	-	2,486	7,028	12,569	16,547	18,229	17,756	177	419
	ROK	0	0	-	-	-	-	-	-	-	-	716	-	859
	Taiwan	0	0	0	0	0	0	0	0	-	-	-	2	-
	Total	18,200	31,982	57,915	50,487	70,078	43,041	42,905	53,386	62,462	51,551	50,481	33,320	42,512
Pacific ocean perch and other rockfish	Japan	16,786	20,598	26,214	16,150	10,392	10,369	5,837	3,147	6,811	3,716	3,300	7,771	4,291
	USSR	9,000	-	3,087	-	-	-	150	475	31,877	16,465	12,124	90	5
	ROK	0	0	-	-	-	-	-	-	-	-	578	478	560
	Taiwan	0	0	0	0	0	0	0	0	-	-	-	0	-
	Total	25,786	20,598	29,301	16,150	10,392	10,369	5,987	3,622	38,688	20,181	16,002	8,339	4,856
Sablefish	Japan	9,502	10,330	10,143	14,454	8,897	12,304	10,643	4,769	4,189	2,776	2,815	2,801	909
	USSR	-	1,237	4,256	1,579	2,874	2,830	2,137	1,192	77	38	29	0	0
	ROK	0	0	-	-	-	-	-	-	-	-	115	9	173
	Taiwan	0	0	0	0	0	0	0	0	-	-	-	53	-
	Total	9,502	11,567	14,399	16,033	11,771	15,134	12,780	5,961	4,266	2,814	2,959	2,863	1,082
Yellowfin sole	Japan	45,423	60,429	40,834	81,449	59,851	82,179	34,846	75,724	37,947	59,715	52,673	58,190	62,736
	USSR	56,930	101,799	43,355	85,685	73,228	78,220	13,010	2,516	4,288	6,060	2,908	283	76,300
	ROK	0	0	-	-	-	-	-	-	-	-	655	-	69
	Taiwan	0	0	0	0	0	0	0	0	-	-	-	-	-
	Total	102,353	162,228	84,189	167,134	133,079	160,399	47,856	78,240	42,235	65,775	56,236	58,473	139,105
Rock sole	Japan	4,037	1,890	2,633	4,285	9,616	20,159	43,055	22,840	17,311	9,682	8,598	5,025	6,671
	USSR	5,067	2,872	2,617	4,955	10,507	20,260	17,769	995	2,664	1,463	1,328	265	354
	ROK	0	0	-	-	-	-	-	-	-	-	107	-	13
	Taiwan	0	0	0	0	0	0	0	0	-	-	-	-	-
	Total	9,104	4,762	5,250	9,240	20,123	40,419	60,824	23,835	19,975	11,145	10,033	5,290	7,038
Flathead sole	Japan	4,996	10,621	11,851	9,168	20,088	25,538	9,850	17,190	12,889	4,873	7,379	7,057	13,446
	USSR	6,024	12,816	9,724	9,395	21,064	25,486	5,840	951	2,028	672	795	531	1,152
	ROK	0	0	-	-	-	-	-	-	-	-	90	-	19
	Taiwan	0	0	0	0	0	0	0	0	-	-	-	-	-
	Total	11,020	23,437	21,575	18,563	41,152	51,024	15,690	18,141	14,917	5,545	8,264	7,588	14,617
Alaska plaice	Japan	2,054	1,340	1,223	3,127	1,326	517	171	1,082	2,168	2,407	3,519	3,119	4,716
	USSR	2,579	2,513	1,396	3,815	2,076	475	119	35	220	207	102	0	4,752
	ROK	0	0	-	-	-	-	-	-	-	-	44	-	0
	Taiwan	0	0	0	0	0	0	0	0	-	-	-	-	-
	Total	4,633	3,853	2,619	6,942	3,402	992	290	1,117	2,388	2,614	3,665	3,119	9,468
Pacific halibut	Japan	2,199	3,756	2,775	2,764	1,735	4,861	955	644	81	137	88	-	0
	USSR	-	-	-	-	-	-	490	296	123	137	58	-	0
	ROK	0	0	-	-	-	-	-	-	-	-	-	-	0
	Taiwan	0	0	0	0	0	0	0	0	-	-	-	2	-
	Total	2,199	3,756	2,775	2,764	1,735	4,861	1,445	940	204	274	146	2	0
Arrowtooth flounder	Japan					9,354	11,603	3,823	4,929	2,823	1,241	1,717	8,213	7,475
	USSR					3,244	7,189	9,301	4,288	18,650	19,591	16,132	3,294	2,576
	ROK					-	-	-	-	-	-	2	-	91
	Taiwan					0	0	0	0	-	-	-	-	-
	Total					12,598	18,792	13,124	9,217	21,473	20,832	17,851	11,507	10,142
Greenland turbot	Japan	10,842	21,230	19,980	19,231	14,715	30,193	49,813	43,354	58,834	52,625	51,677	28,248	40,643
	USSR	2,200	2,639	15,252	16,798	4,976	10,271	14,697	11,926	10,820	12,194	8,867	2,039	1,543
	ROK	0	0	-	-	-	-	-	-	-	-	425	-	28
	Taiwan	0	0	0	0	0	0	0	-	-	-	-		-
	Total	13,042	23,869	35,232	36,029	19,691	40,464	64,510	55,280	69,654	64,819	60,969	30,287	42,214
Other groundfish	Japan	2,239	4,378	2,984	4,182	9,227	29,617	32,370	39,911	47,491	42,531	13,527	33,742	47,582
	USSR	-	-	19,074	6,277	6,068	3,879	78,523	15,915	12,770	12,314	12,294	624	11,020
	ROK	0	0	-	-	-	-	-	-	-	-	322	1,445	2,935
	Taiwan	0	0	0	0	0	0	0	0	-	-	-	91	-
	Total	2,239	4,378	22,058	10,459	15,295	33,496	110,893	55,826	60,261	54,845	26,143	15,902	61,537
All groundfish total	Japan	377,972	716,706	877,676	1,035,822	1,446,626	1,781,925	1,843,772	1,725,596	1,487,113	1,278,103	1,163,998	961,757	1,012,751
	USSR	81,800	123,876	98,761	162,075	159,627	384,607	362,959	331,163	409,677	303,937	247,932	70,685	189,768
	ROK	0	0	1,200	5,000	5,000	10,000	9,200	3,100	26,000	3,438	88,041	41,827	64,317
	Taiwan	0	0	0	0	0	0	0	0	-	-	-	1,482	-
All Nation Total		459,772	840,582	977,637	1,202,897	1,611,253	2,176,532	2,215,931	2,059,859	1,922,790	1,585,478	1,499,971	1,075,751	1,266,836

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ANNEX VI -- SPECIES CATEGORIES WHICH APPLY TO THE BERING SEA/ALEUTIAN GROUNDFISH FISHERY

Prohibited Species 1/	Target Species 2/	"Other" Species 3/	Non-Specified Species 4/	
FINFISHES				
Salmonids	Pollock	Sculpins	Eelpouts (family Zoarcidae)	
Pacific Halibut	Cod	Sharks	Poachers (family Agonidae) and alligator fish	
	Flounders	Skates	Snailfish, Lumpfishes, Lumpsuckers (family Cyclopteridae)	
	Herring	Eulachon	Sandfishes (Trichodon sp.)	
	Atka mackerel	Smelts	Rattails (family Macrounidae)	
	Sablefish	Capelin	Ronquils, Searchers (family Bathymasteridae)	
	Pacific ocean perch		Lancetfish (family Alepisanvidae)	
	Other Rockfish		Pricklebacks, Cockscombs, Warbonnets, Shanny (family Stichaeidae)	
			Prowfish (Zaprora silenus)	
			Hagfish (Eptatretus sp.)	
			Lampreys (Lampetra sp)	
			Blennys, Gunnels, (Various small bottom dwelling fishes of the family Stichaeidae and Pholidae)	
INVERTEBRATES				
King crab	Squids	Octopus	Anemones	Jellyfishes
Tanner crab			Starfishes	Tunicates
Coral			Egg cases	Sea cucumber
Shrimp			Sea mouse	Sea pen
Clams			Sea slug	Isopods
Horsehair crab			Sea potato	Barnacles
Lyre crab			Sand dollar	Polychaetes
Dungenous crab			Hermit crab	Crinoids
			Mussels	Crab - unidentified
			Sea urchins	Misc. - unidentified
			Sponge-unident.	

1/ Must be returned to the sea, fees charged for some species
2/ OY for each items; fee as in fee schedule.
3/ Aggregate OY for group

4/ List not exclusive; includes any species not listed under Prohibited, Target, or "Other" categories; no fee charged.

Agenda G-5

Enclosure 2a

HIGHLIGHTS OF PROPOSED AMENDMENTS
TO
BERING SEA/ALEUTIANS GROUNDFISH FMP

1. INTRODUCE OY CONCEPT FOR GROUNDFISH COMPLEX

...Long-term OY
...Modified Reserve Concept
...Re-introduce TAC for species groups

2. MODIFIED PROHIBITED SPECIES CONCEPT

...Introduce Incidental TAC Concept
...Introduce Incidental TAC for fully-utilized species
...Introduce Mitigation Fee Concept
...Retained or modified Time-Area Closures

3. INCORPORATE REGIONAL DIRECTOR AUTHORITY FOR IN-SEASON ADJUSTMENTS ON TIME-AREA CLOSURES

4. UPDATED ANNEX I -- DERIVATION OF ABC BY SINGLE SPECIES ASSESSMENTS

I. OPTIMUM YIELD CONCEPT FOR GROUNDFISH COMPLEX

A. Groundfish complex is a distinct management and biological unit.

B. MSY for entire groundfish complex = 1,773,000 metric tons

...based on catch history of 1968-77
...based on comparison with single species MSYs, which total 1,713,200 to 2,338,000 mt.

C. ABC = 1,600,000 mt (90% of MSY)

...based on observed relationships between historical catch and population condition trends

D. Suggest that OY = ABC = 1,600,000 mt

...conforms with historical catch trend
...conforms with ecosystem model results
...minimum impact on marine mammals
...maintain species make-up
...allow biological cushion to buffer anomalies

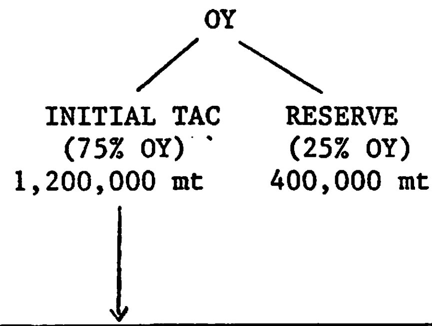
RESERVE CONCEPT

OY
1,600,000 mt

→ INITIAL TAC (75% OY) 1,200,000 mt
- a. available to allocate beginning of every year
- b. allocate according to species
  - → DAH
  - → TALFF

→ RESERVE (25% OY) 400,000 mt
- → SPECIAL RESERVE (5% Reserve) (20,000 mt)
  - a. special delegation of authority from Department of State to allocate to rectify insignificant biological problems
    - → DAH anythime
    - → TALFF anytime
- → NORMAL RESERVE (95% Reserve) (380,000 mt)
  - a. Release to TAC according to Schedule
  - b. Release to species according to status of stocks and socio-economic factors
    - → DAH anytime
    - → TALFF 40% Month 4, 40% Month 6, 20% Month 8

INITIAL TOTAL ALLOWABLE CATCH



SPECIES	RELATIVE YIELD	x 1,200,000 mt = INITIAL TAC	PRELIMINARY HARVEST GUIDELINE	ADJUSTMENT	GUIDELINE INITIAL TAC	TAC UPPER LIMIT
A	.69		828,000	+28,000	856,000	Determine
B	.03		36,000	-15,900	15,700	21,600
C	.05		60,000	+20,000	80,000	Determine
D	.15		180,000	+ 3,700	183,700	Determine
E	.08		96,000	-31,400	64,600	Determine
TOTAL	1.00		1,200,000	0	1,200,000	
RESERVE			400,000		400,000	
TOTAL (OY)			1,600,000		1,600,000	

Notes: Initial TAC by species is available for allocation at beginning of year

Species: A = Pollock B = Rockfish + Sablefish C = Cod
D = Flatfish E = Atka Mackerel + Squid + Others

OPTIMUM YIELD = 1,600,000 mt

EXAMPLE of FINAL TACs BY SPECIES GROUPS

SPECIES	RELATIVE YIELD	x 1,600,000 mt OY	= HARVEST GUIDELINE	ADJUSTMENT	GUIDELINE TAC FINAL TAC	GUIDELINE TAC UPPER LIMIT
A	.69		1,104,000	+36,000	1,140,000	1,300,000
B	.03		48,000	-24,600	23,400	22,900
C	.05		80,000	+20,000	100,000	120,000
D	.15		240,000	0	240,000	300,000
E	.08		128,000	-31,400	96,600	124,200
TOTAL	1.00		1,600,000	0	1,600,000	

Notes:

1. OY = 1,600,000 mt for groundfish complex is long-term
2. Species TAC is adjusted according to;
   a. status of stocks---biological ability of stock to produce
   b. socio-economic and other considerations
3. If OY for groundfish complex changes, FMP must be amended.

Species: A = Pollock B = Rockfish + Sablefish C = Cod
D = Flatfish E = Atka Mackerel + Squid + Others

3 ?

INCIDENTAL CATCH OF FULLY UTILIZED SPECIES

THE EXAMPLE: POP

		BERING SEA	ALUETIANS
1.	EY	5,000	13,000
2.	ABC	1,000	2,600
3.	Initial Maximum TAC	1,000	2,600
4.	Maximum Initial Allocation (75% of ABC)	750	1,950
5.	Actual DAH (2,760)	1,380	1,380
6.	Modified DAH (2,700)	750	1,950
7.	Surplus for TALFF	0	0
8.	Incidental TAC for TALFF (10% of EY)	500	1,300
9.	Modified Maximum TAC	1,500	3,900

PROHIBITED SPECIES

PROCEDURES TO CONTROL PROBLEM

1. Set incidental TAC, Catch cannot be retained
2. Impose mitigation fee as disincentives, for foreign fisheries only
3. Impose time-area closures

INCIDENTAL TACs

Pacific halibut	- 1,500 mt
Red king crab	- 0.0010% of estimated red crab population
Blue king crab	- 0.0018% of estimated blue crab population
C. opilio (snow crab)	- 0.0040% of estimated *C. opilio* population
C. bairdi (snow crab)	- 0.0106% of estimated *C. bairdi* population
Golden king crab	- 600 mt (920,000 crabs)
All salmonids	- 41,400 fish

BASED ON 1979 FIGURES, INCIDENTAL TAC's on CRABS

Red king crab	600 mt (320,000 crabs)
Blue king crab	50 mt (38,000 crabs)
C. opilio snow crab	2,580 mt (23,920,000 crabs)
C. bairdi snow crab	820 mt (4,080,000 crabs)

MONITORING FOR COMPLIANCE

Catch in weight will be means of measure, except salmon

Incidental Catch = Amount caught x mortality factor

MITIGATION FEE

Mitigation Fee = Incidental Catch x U.S. ex-vessel price

Applies to: Halibut, Salmon, King crabs, *C. bairdi* crabs

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AREA-TIME CLOSURES

(Refer to Map)

DOMESTIC FISHERY	FOREIGN FISHERY
In-season adjustment of Area-time closure by Regional Director	In-season adjustment of area-time closure by Regional Director
Area A: Year-round trawling permitted (Observer monitoring encouraged)	Area A: No fishing year round
Area B: Dec 1-May 31: Trawling permitted with onserver encouraged Longline permitted until catch reaches 2,000 mt Rest of Year: Fishing permitted	Area B: Dec 1-May 31: No fishing Rest of year: Fishing permitted
Area C: No closure	Area C: No trawling year-round Longline permitted to 3 miles
Area D: No closure	Area D: Longline permitted to 3 miles Jan 1-June 30: no trawling Rest of year : Trawling permitted to 3 miles
Area E: No closure	Area E: Longline permitted to 3 miles Jan 1-April 30: No trawling Rest of year : Trawling permitted to 3 miles
Area F: No closure	Area F: Year-roung fishing permitted to 3 miles

Rationale:
- Area A: Gear conflict of trawls vs crab pots; Incidental catch of juvenile halibut
- Area B: Incidental catch of juvenile halibut
- Area C: Gear conflict of trawls vs longlines
- Area D: Gear conflict of trawls vs crab pots; Incidental catch of king crab by trawls
- Area E: Same rationale as in Area D
- Area F: Open more areas for foreign fishing; No biological and gear conflicts

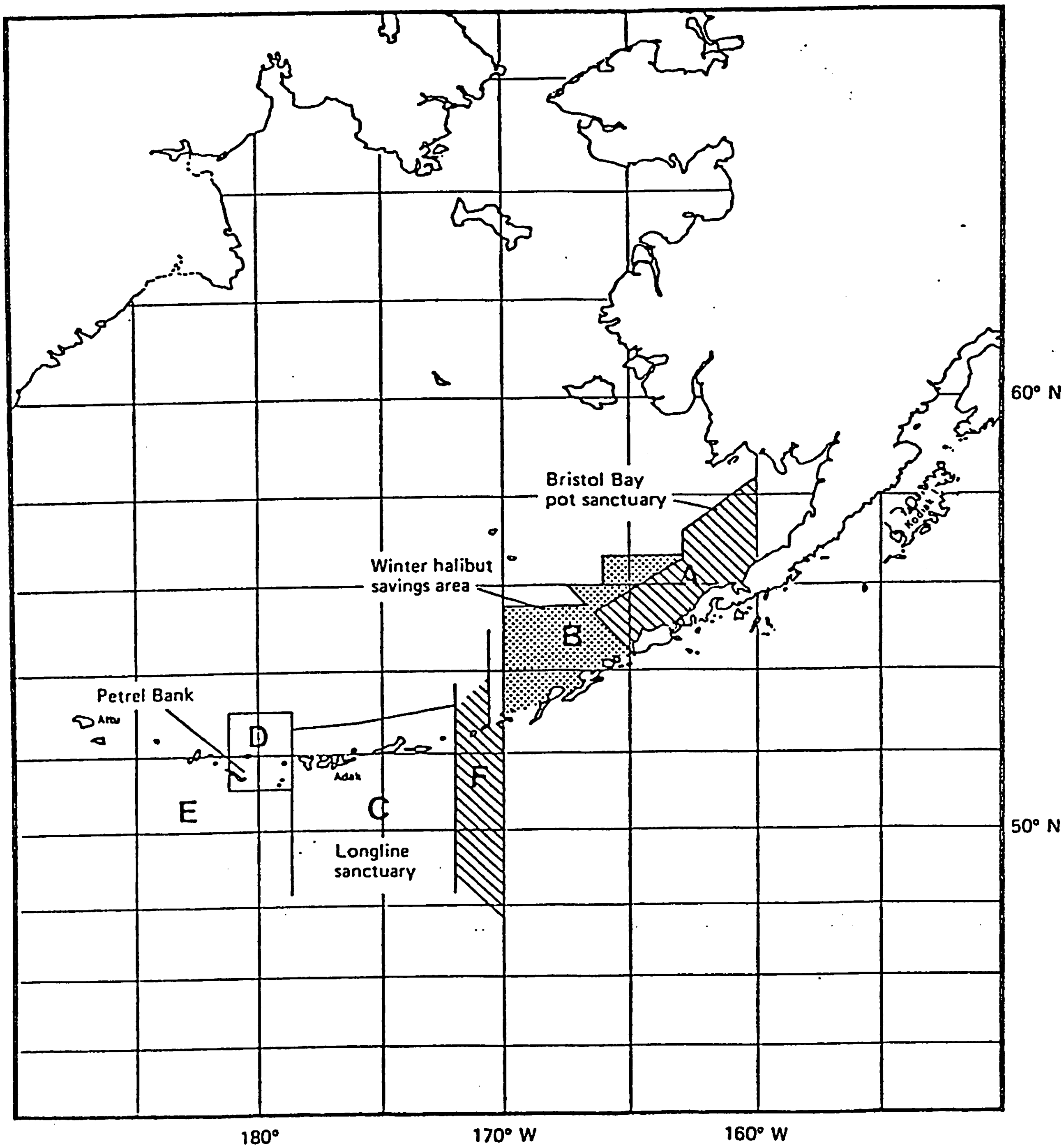

Figure 27. General location of areas described in management measures for the Bering Sea/Aleutians groundfish fisheries (see Appendix II for geographical coordinates).

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ANNEX I

DERIVATION OF ACCEPTABLE BIOLOGICAL CATCH

Annex I consists of stock assessment studies based on single-species management concepts. Due to the 50-page length, time and costs of duplicating this material, only the table reflecting the MSY, EY and ABC values is included here. The entire Annex I will be published with the final amendment and may be obtained from the Council office for study.

Table I - MSY, EY and ABC values for groundfish in the Bering Sea/Aleutian area during 1981 (1000s mt).

SPECIES	REGION 1/	MSY	EY	ABC	(1979 OY)	(1979 OY - 1981 ABC CHANGE
POLLOCK	BS	1,100-1,600	1,200	1,200	(1,000)	(+200)
	AL	?	?	100	(100)	(0)
YELLOWFIN SOLE	BS-AL	169-260	169	169	(117)	(+52.0)
TURBOTS	BS-AL	90	71	71	(90)	(-19)
OTHER FLATFISHES	BS-AL	42.9-76.8	60	60	(61)	(-1)
PACIFIC COD	BS-AL	58.7	160	120	(58.7)	(+61.3)
PACIFIC OCEAN PERCH	BS	32	5	1.0	(3.25)	(-2.25)
	AL	75	13	2.6	(7.50)	(-4.9)
OTHER ROCKFISH	BS	?	7.0	7.0	} (7.7)	(+6.6)
	AL	?	7.3	7.3		
SABLEFISH	BS	11.35	2.6	2.6	(3.5)	(-0.9)
	AL	1.85	1.1	1.1	(1.5)	(-0.4)
ATKA MACKEREL	BS-AL	33	?	24.8	(24.8)	(0)
SQUID	BS-AL	≥10	≥10	10	(10)	(0)
PACIFIC HALIBUT	BS-AL	5	0.3	2/	-	-
OTHER INCLUDED SPECIES	BS-AL	89.4	89.4	89.4	(74.2)	(+15.2)
TOTAL 3/		,713.2-2,338.1	1,755.4	1,865.8	(1,559.15)	(+306.65)

1/ BS - Eastern Bering Sea (Statistical Areas 1 & II).
AL - Aleutian Region (Statistical Area IV)

2/ Subject to separate FMP.

3/ Excluding Pacific halibut

STATUS OF STOCKS - Pacific cod

I.5 Pacific Cod

I.5.1 Maximum Sustainable Yield

Pacific cod are distributed widely over the Bering Sea continental shelf and slope, and have a distributional pattern similar to that of pollock. During the early 1960's, when a fairly large Japanese longline fishery operated on the continental slope, cod were harvested by longliners for the frozen fish market. Beginning in 1964, the Japanese North Pacific trawl fishery for pollock expanded, and cod became an important incidental catch in the pollock fishery. At present, cod are believed to be an occasional target species when high concentrations are detected during pollock fishing operations.

The annual catch of Pacific cod by all foreign nations in the eastern Bering Sea and Aleutians increased from 13,600 mt in 1964, to about 70,400 mt in 1970; since then, catches have varied between 36,600 and 63,800 mt (Table I-9). Japan has accounted for 66-99% of the catch since the U.S.S.R. began reporting their catches of cod in 1971.

The incidental occurrence of cod in foreign trawl catches makes questionable the use of CPUE trends from the commercial fishery. Moreover, the semi-demersal distribution of cod makes them difficult to assess with research vessel trawls. MSY for this species has, therefore, been estimated on the basis of commercial catch data. Because catches increased rapidly in the mid-1960's and then stabilized, the average catch during this period of stability (1968-76) was assumed to reflect at least a minimal estimate of MSY. The original estimate was 58,700 mt, but this figure includes catches from west of 180° which lies outside the U.S. FCZ. A more appropriate estimate, including only those catches within the FCZ from the eastern Bering Sea (east of 180°) and Aleutian Islands area, is 55,000 mt.

Table I-9.--Foreign calendar year catches (mt) of Pacific cod by area and nation, 1964-78.

Year	Eastern Bering Sea						Aleutian Island Area				Total	E. Bering Sea and Aleutian Comb. Total
	Japan		USSR	ROK[c]/	ROC[d]/	Total	Japan		USSR	ROK		
	MS-LG-NPT[a]/	LBD[b]/					MS-LG-NPT	LBD				
1964	13,408	-	-			13,408	241	-	-		241	13,649
1965	13,524	1,195	-			14,719	414	37	-		451	15,170
1966	17,178	1,022	-			18,200	103	51	-		154	18,354
1967	30,502	1,562	-	-		32,064	153	140	-	-	293	32,357
1968	52,135	5,767	-	-		57,902	121	168	-	-	289	58,191
1969	44,871	5,480	-	-		50,351	204	16	-	-	220	50,571
1970	61,015	9,079	-	-		70,094	221	62	-	-	283	70,377
1971	32,206	8,362	2,486	-		43,054	263	162	1,653	-	2,078	45,132
1972	33,715	2,162	7,028	-		42,905	233	202	-	-	435	43,340
1973	38,137	2,680	12,569	-		53,386	295	271	411	-	977	54,363
1974	42,741	3,174	16,547	-	-	62,462	651	683	45	-	1,379	63,841
1975	32,092	1,230	18,229	-	-	51,551	2,470	111	257	-	2,838	54,389
1976	29,627	2,382	17,756	716	-	50,481	3,688	174	312	16	4,190	54,671
1977	29,682	3,459	177	-	2	33,320	1,533	1,629	100	-	3,262	36,582
1978	36,513	4,721	419	859	-	42,512	1,460	1,705	120	6	3,291	45,803

a/ Mothership, North Pacific longline, and North Pacific trawl fisheries.

b/ Landbased dragnet fishery.

I.5.2 Equilibrium Yield

Accumulating evidence since 1978 indicates that the abundance of Pacific cod is increasing and that this increase may be substantial. The relative abundance of cod more than doubled between 1976 and 1978 based on NMFS research survey data, and in 1978 there appeared to be unusually high abundance of age 0 and age 1 cod (year-classes 1977 and 1978) in the research vessel catches (Bakkala et al., 1979). These year-classes as age 1 and age 2 fish were also abundant in research vessel catches during the large-scale survey of the eastern Bering Sea in 1979. Based on data from the large-scale OCSEAP survey in 1975 and using data from an equivalent area in 1979 indicates that the CPUE of cod apparently increased by a factor of approximately 7 between 1975 (2.7 kg/km) and 1979 (19.8 kg/km).

Age data from the commercial fishery indicates that the abundance of a cod cohort peaks in the fishery at age 3, contributes substantially to catches at age 4, but that abundance declines sharply at ages 5 and 6. The 1977 and 1978 year-classes will, therefore, make their greatest contribution to the fishery in 1980-82.

The estimated biomass of cod from the 1979 survey was 792,300 mt with a 95% confidence interval of 603,200-981,400 mt. About 81% of the total biomass was made up of age groups 1 and 2 which are only partially recruited to the fishery.

Using population estimates by age from the 1979 NMFS survey, historical growth rates, a range in instantaneous natural mortality rates of 0.5-0.7, and various possible fishing mortalities by age, the projected biomass of cod in 1980 and 1981 has been calculated. These projections indicate that the exploitable biomass (age group 2-5) in 1980 and 1981 may fall within the following ranges:

Year	Predicted Range in Biomass (mt)
1980	740,000-910,000
1981	803,000-1,248,000

Conservatively using the lower end of the projected range in biomass and an exploitation rate of 20%, the estimated EY is 148,000 mt in 1980 and 160,000 mt in 1981.

I.5.3 Acceptable Biological Catch

ABC will exceed estimates of MSY in 1981 due to the recruitment of the strong 1977 and 1978 year-classes. Since natural mortality will rapidly reduce the abundance of these year-classes after age 4, it is prudent to harvest the 1977 and 1978 year-classes during the short period they remain in the fishery. However, due to the possible inaccuracies in the 1979 biomass estimate and in the projections of this estimate to 1980-81, ABC is set at 75% of the projected EY for 1981--0.75 x 160,000 = 120,000 mt.

SCIENTIFIC & STATISTICAL COMMITTEE REPORT

BERING SEA PACIFIC COD

The SSC reviewed a report by Jay Hastings regarding the problem of the high incidental catch of Pacific Cod in the Bering Sea which will result in premature closure of the fishery. Mr. Hastings requested that the SSC review the biological aspects of increasing the OY of the species.

The SSC reviewed the biological data provided to us with the proposed amendments to the groundfish plan. We conclude that based upon these data that the abundance of Pacific cod has greatly increased. Using the procedure provided in the draft amendments, the 1980 ABC would be 111,000 mt. This will allow an increase of the current ABC by 52,000 mt without any harmful effect on the biology of the resource.

The SSC does express concern to the Council on how the allocation of this additional resource is made. For example, the effect of this large allocation on the Japanese ex-vessel price of Pacific cod is unknown. It is suggested that caution be exercised in granting this request, since Japan is a likely market for Pacific cod caught by U.S. fishermen.

AGENDA G-5
April 1980
Enclosure # 3 a

JAY D. HASTINGS
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PLEASE REPLY TO SEATTLE OFFICE

March 28, 1980

Mr. Jim H. Branson
Executive Director
North Pacific Fishery
Management Council
P.O. Box 3136 DT
Anchorage, Alaska 99510

Dear Jim:

This is to confirm my proposal on behalf of the Japanese fishing industry to increase the ABC and OY for Pacific cod in the eastern Bering Sea by amendment to the Bering Sea/Aleutian Island groundfish FMP for the 1980 season. In order to comply with the proper procedures for amending the plan, we would ask your assistance by noting our proposal on the April Council agenda for necessary review by the public and final action by the Council.

Although we recognize the additional burden in noting our proposal as a separate amendment from the current amendment package for 1981, the Japanese industry sincerely anticipates a problem during the 1980 season in the nature of a possible premature closure of the entire Bering Sea groundfish fishery due to an unexpected higher incidence of Pacific cod in the trawl fisheries. For this reason, we appreciate your assistance and efforts in treating our proposal as an amendment to the FMP for the 1980 fishery. By the April meeting, we will be prepared to demonstrate our problem more clearly in support of our proposed amendment.

Should the Council act favorably to our proposal at the April meeting, we anticipate that the amendment could be reviewed and implemented at the federal level within the minimum amount of time necessary in order to realize its benefits during the current season.

Sincerely,

Jay D. Hastings

cc: Dr. Roland Smith
Mr. Kumazawa

Agenda Item G-5
Attachment #4

April 1980

Appendix I—Section 611.20

Alaska fisheries	Species	Species code	Areas	Optimum yield (OY) mt.	Domestic harvest (DAH) mt	Joint venture (JVP)[1] mt	Reserve	TALFF
A. Bering Sea and Aleutian Islands Groundfish fishery.	Pollock	701	Bering sea[2]	1,000,000	19,550	9,050	50,000	930,450
			Aleutian[3]	100,000	0	0	0	100,000
	Yellowfin Sole	720		117,000	2,050	850	5,850	109,100
	Turbots	721, 118		90,000	1,075	75	4,500	84,425
	Other Flounders	129		61,000	1,300	100	3,050	56,650
	Pacific Ocean Perch[4]	780	Bering Sea	3,250	1,380	830	162	1,708
			Aleutian	7,500	1,380	830	375	5,745
	Other Rockfish	849		7,727	1,550	450	500	5,677
	Sablefish	703	Bearing Sea	3,500	700	200	350	2,450
			Aleutian	1,500	700	200	150	650
	Pacific Cod	702		58,700	24,265	17,055	2,935	31,500
*	Atka Mackerel	207		24,800	100	100	1,240	23,460
	Squid	509		10,000	50	50	500	9,450
	Other Species	499		74,249	2,000	200	3,712	68,537
B. Bering Sea and Aleutian Island Herring fishery.	Herring	209		41,200	33,200	6,000	2,000	6,000

[1] JVP is a subset of DAH.
[2] Bering Sea means fishing Areas I, II, and III in Figure 2, Appendix II of 50 CFR 611.9.
[3] Aleutian means fishing Area IV in Figure 2, Appendix II of 50 CFR 611.9.
[4] The category "Pacific Ocean perch" includes *Sebastes* species *S. alutus* (Pacific Ocean perch), *S. polyspinus* (northern rockfish), *S. aleutianus* (rougheye rockfish), *S. borealis* (shortraker rockfish), and *S. zacentrus* (sharpchin rockfish).

[FR Doc. 80-326 Filed 1-3-80; 8:45 am]

BILLING CODE 3510-22-M

* Atka Mackerel - A release of 25% (310 mt) was made on Feb. 14, 1980.

Atka Mackerel entries now read as follows:

OY	DAH	JVP	Reserve
24,800	410	410	930

The release of reserve schedule for the BS/A is:

- February 2
- April 2
- * June 2
- August 2

ANNEX I

DERIVATION OF ACCEPTABLE BIOLOGICAL CATCH

Stock assessment studies based on single species management concepts are reported in this Annex. These studies, leading to determinations of acceptable biological catch (ABC), pertain to the following Bering Sea/ Aleutian groundfish species categories.

I.1 Alaska pollock

I.2 Yellowfin sole

I.3 Turbots (Arrowtooth flounder and Greenland turbot)

I.4 Other flatfishes

I.5 Pacific cod

I.6 Pacific ocean perch and other rockfishes

I.7 Sablefish (Blackcod)

I.8 Atka mackerel

I.9 Squid

1.10 Pacific halibut

I.11 Other included species

A summary of these determinations is given in Table I.1.

The Bering Sea/Aleutians groundfish Management Team has initiated a proposal to manage groundfish stocks based on multi-species or ecosystem concepts. During the evolution of the multi-species concepts and the transition to this management approach, information in this annex based mainly on single species stock assessment studies will be used to manage the stocks. These single species assessments will also serve as guidelines to upper limits of harvest for individual species under multi-species management.

Table I.1--MSY, EY, and ABC values for Groundfish in the Bering Sea/Aleutian Region during 1981 (1000's mt).

Species	Region1/	MSY	EY	ABC	(1979 OY)	(1979 OY - 1981 ABC Change)
Pollock	BS	1,100-1,600	1,200	1,200	(1,000)	(+200)
	AL	?	?	100	(100)	(0)
Yellowfin sole	BS-AL	169-260	169	169	(117)	(+52.0)
Turbots	BS-AL	90	71	71	(90)	(-19)
Other flatfishes	BS-AL	42.9-76.8	60	60	(61)	(-1)
Pacific cod	BS-AL	58.7	160	120	(58.7)	(+61.3)
Pacific ocean perch	BS	32	5	1.0	(3.25)	(-2.25)
	AL	75	13	2.6	(7.50)	(-4.9)
Other rockfish	BS	?	7.0	7.0	(7.7)	(+6.6)
	AL	?	7.3	7.3		
Sablefish	BS	11.35	2.6	2.6	(3.5)	(-0.9)
	AL	1.85	1.1	1.1	(1.5)	(-0.4)
Atka mackerel	BS-AL	33	?	24.8	(24.8)	(0)
Squid	BS-AL	≥10	≥10	10	(10)	(0)
Pacific halibut	BS-AL	5	0.3	2/	-	-
Other included species	BS-AL	89.4	89.4	89.4	(74.2)	(+15.2)
Total3/		1,713.2-2,338.1	1,755.4	1,865.8	(1,559.15)	(+306.65)

1/ BS - Eastern Bering Sea (statistical areas I & II).
AL - Aleutian Region (statistical area IV).

2/ Subject to separate FMP.

3/ Excluding Pacific halibut.

I.1 Pollock

I.1.1 Maximum Sustainable Yield

Maximum sustainable yield for pollock has been estimated by two methods: the general production model of Pella and Tomlinson (1969), and the method of Alverson and Pereyra (1969) for obtaining first approximations of yield per exploitable biomass. Estimates thus derived, from data available prior to 1974, ranged from 1.11 to 1.58 million mt (Low, 1974). Incorporation of 1974-76 data, and using the procedure of Rivard and Bledsoe (1977), resulted in an estimated MSY of 1.5 million mt. Annual catches, ranging from 1.59-1.76 million mt in 1971-76 (Table I.2) exceeded estimates of MSY, and declines in relative abundance as shown by fishery statistics indicated that those higher levels of exploitation were not sustainable.

I.1.2. Equilibrium Yield

Relative Abundance

Four procedures as described by Low et al. (1977) have been used for estimating relative abundance (CPUE) of pollock. Although results differ in minor detail between procedures, the CPUE computed by the INPFC workshop procedure (Anon. 1978a) is generally indicative of results from other methods which use fishery statistics (Table I.3).

Table I.2--Annual catch of pollock in the eastern Bering Sea, 1964-78 (metric tons).

Year	Nation			ROC	TOTAL
	Japan 1/	U.S.S.R. 2/	R.O.K. 3/		
1964	174,792				174,792
1965	230,551				230,551
1966	261,678				261,678
1967	550,362				550,362
1968	700,981		1,200		702,181
1969	830,494	27,295	5,000		862,789
1970	1,231,145	20,420	5,000		1,256,555
1971	1,513,923	219,840	10,000		1,743,763
1972	1,651,438	213,896	9,200		1,874,534
1973	1,475,814	280,005	3,100		1,758,919
1974	1,252,777	309,613	26,000		1,588,390
1975	1,136,731	216,567	3,438		1,356,736
1976	913,279	179,212	85,331		1,177,822
1977	868,732	63,467	45,227	944	978,370
1978	821,306	92,714	62,371	3,040	979,424
1979 4/	779,050	60,617	18,230	1,929	943,963

1/ From Japan Fisheries Agency (conservation Areas A, B, C, DE, DW, and E.)
2/ U.S.S.R. trawl fishery east of 180° longitude in the Bering Sea.
3/ Estimates based on U.S. surveillance of R.O.K. fishing activities.
4/ Included 84,137 mt by Poland.

Table I.3--Relative indices of pollock stock abundance in the eastern Bering Sea, 1964-78.

Year	U.S. Procedures: Pair Trawl[1]	U.S. Procedures: Research Vessel[2]	Japanese Procedure[3]	INPFC Workshop Procedure[4]
1964	9.5	--	--	--
1965	18.3	--	--	--
1966	23.6	--	--	--
1967	21.3	--	--	--
1968	23.8	--	--	194
1969	31.5	--	--	154
1970	18.7	--	--	175
1971	14.2	59.2	--	172
1972	14.2	19.2	--	189
1973	8.6	29.2	12.4	166
1974	10.4	27.5	10.9	118
1975	9.3	21.1	9.5	100
1976	9.4	46.7	9.3	103
1977	8.6	37.7	9.3	98
1978	9.4	33.5	--	105

1/ mt per 1,000 pair trawl horsepower-hours trawled.

2/ kg per 10,000 m^2 in comparative area standardized to catch rates of R/V Oregon.

3/ mt per hour (pair trawl).

4/ expressed as percentage of 1975 pair trawl CPUE.

Results from the INPFC workshop procedure indicate that abundance declined rapidly from 1972 to 1975 and remained at about the lower level through 1978; there was a slight recovery, however, between 1977 and 1978:

Year	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
CPUE	194	154	175	172	189	166	118	100	103	98	105

Japanese scientists, relying on projected CPUE calculations, believe that pollock abundance will continue to increase through 1981 (Okada, et al. 1979). Their calculations show that in relation to 1976, abundance trends should be as follows:

Year	1976	1977	1978	1979	1980	1981
CPUE	100	86	93	113	116	122

Trends in CPUE shown by NMFS trawl surveys have not paralleled those shown by the commercial fishery data (Table I.3). This may be explained by the limited time-area coverage of most of the NMFS surveys and the limited vertical opening (1.7 m) of the trawl used which may not adequately sample the complete water column occupied by pollock. However, large-scale NMFS surveys in 1975 and 1979 which encompassed a large portion of the eastern Bering Sea continental shelf also show relative stability in the abundance of pollock since 1975. Catch rates from comparable areas of the eastern Bering Sea were 80.5 kg/km trawled in 1975 and 77.4 kg/km in 1979.

Absolute Abundance

The absolute abundance of pollock for the entire eastern Bering Sea has been estimated from commercial fishery data using a virtual population analysis (Bakkala et al., 1979).

The analysis shows (Table I.4) that five consecutive strong year-classes entered the fishery during 1970-73 as 3-5 year-olds: the 1965, 1966, 1967, 1968, and 1969 year-classes. They were followed by two weak year-classes (1970 and 1971) which were less than half the strength of previous year-classes. These weak year-classes were then followed by three consecutive stronger year-classes (1972, 1973, and 1974) which contributed to the fishery during 1975-78. The 1975 and 1976 year-classes also appear relatively strong, though not as strong as earlier year-classes.

The effects of large fluctuations in year-class strength are somewhat masked in the total biomass trend, since the population is made up of more than 12 age groups. The exploitable biomass (defined as ages 2-12) peaked at 7.8 million mt in 1972, declined to a low of 5.3 million mt in 1976, and has increased slightly to 6.2 million mt in 1978 (Table 1.4). This trend in biomass is consistent with the trend in CPUE from the commercial fishery. The increase from 1977 to 1978 is largely due to the strength of the 1972-74 year-classes, and to lowered catches in 1977 and 1978.

It is worthy to note that the exploitable biomass of pollock calculated by the virtual population analysis (average of 6.465 million mt for 1970-78) is comparable to the long-term minimum equilibrium biomass (6.444 million mt) calculated by the PROBUB ecosystem model (Granfeldt, 1979). The 1978 biomass (6.244 million mt) is 97% of the long-term minimum equilibrium biomass.

The strength of year-classes as predicted by the cohort analysis is supported by age data from the large-scale NMFS research vessel surveys, of 1975 and 1979 (Figure I.1). The 1979 survey data also provides information on the 1976, 1977, and 1978 year-classes which will form the major part of the exploitable biomass in 1980-82. The 1976 year-class appears less abundant than the 1972 year-class (now known to be a stronger than

4 8

Table I.4--Estimated numbers of pollock and biomass of the pollock population in the Bering Sea by virtual population analysis, 1970-78 (analysis with age specific natural mortality).

Population Size in Millions of Fish

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978
2	11,382	10,019	4,502	5,572	15,951	10,704	11,087	9,622	7,261
3	7,363	7,629	6,716	3,018	3,229	8,143	6,603	7,062	5,523
4	4,112	4,935	5,114	4,502	1,411	1,222	2,827	3,027	3,495
5	2,863	2,757	3,308	3,428	1,687	678	617	953	1,131
6	1,289	1,919	1,848	2,218	1,280	771	400	321	317
7	330	864	1,287	1,239	791	663	416	226	143
8	66	221	579	862	443	406	348	219	125
9	46	44	148	388	298	192	219	164	109
10	8	31	30	100	134	97	98	93	80
11	8	6	21	20	44	47	43	39	38
12	4	6	4	14	11	12	26	17	14
Total	27,471	28,431	23,557	21,361	25,279	22,935	22,684	21,743	18,236

Population Biomass in Hundreds of Metric Tons.

Age									
2	9,147	8,052	3,618	4,478	17,224	9,836	9,909	11,246	10,352
3	14,601	15,130	13,319	5,984	8,007	17,948	14,531	18,225	17,649
4	14,025	16,831	17,442	15,354	5,701	4,573	10,746	12,372	18,013
5	13,943	13,423	16,109	16,693	9,320	3,595	3,371	5,205	7,932
6	8,025	11,950	11,505	13,807	8,715	5,207	2,816	2,121	2,730
7	2,450	6,407	9,541	9,185	6,223	5,322	3,505	1,698	1,427
8	557	1,864	4,876	7,261	3,860	3,688	3,349	1,805	1,375
9	428	410	1,372	3,588	2,787	1,916	2,328	1,439	1,291
10	81	308	294	986	1,325	1,032	1,119	854	995
11	90	57	217	208	450	526	519	369	494
12	48	63	40	151	110	139	328	160	182
Total	63,396	74,496	78,332	77,694	63,722	53,782	52,520	55,493	62,440

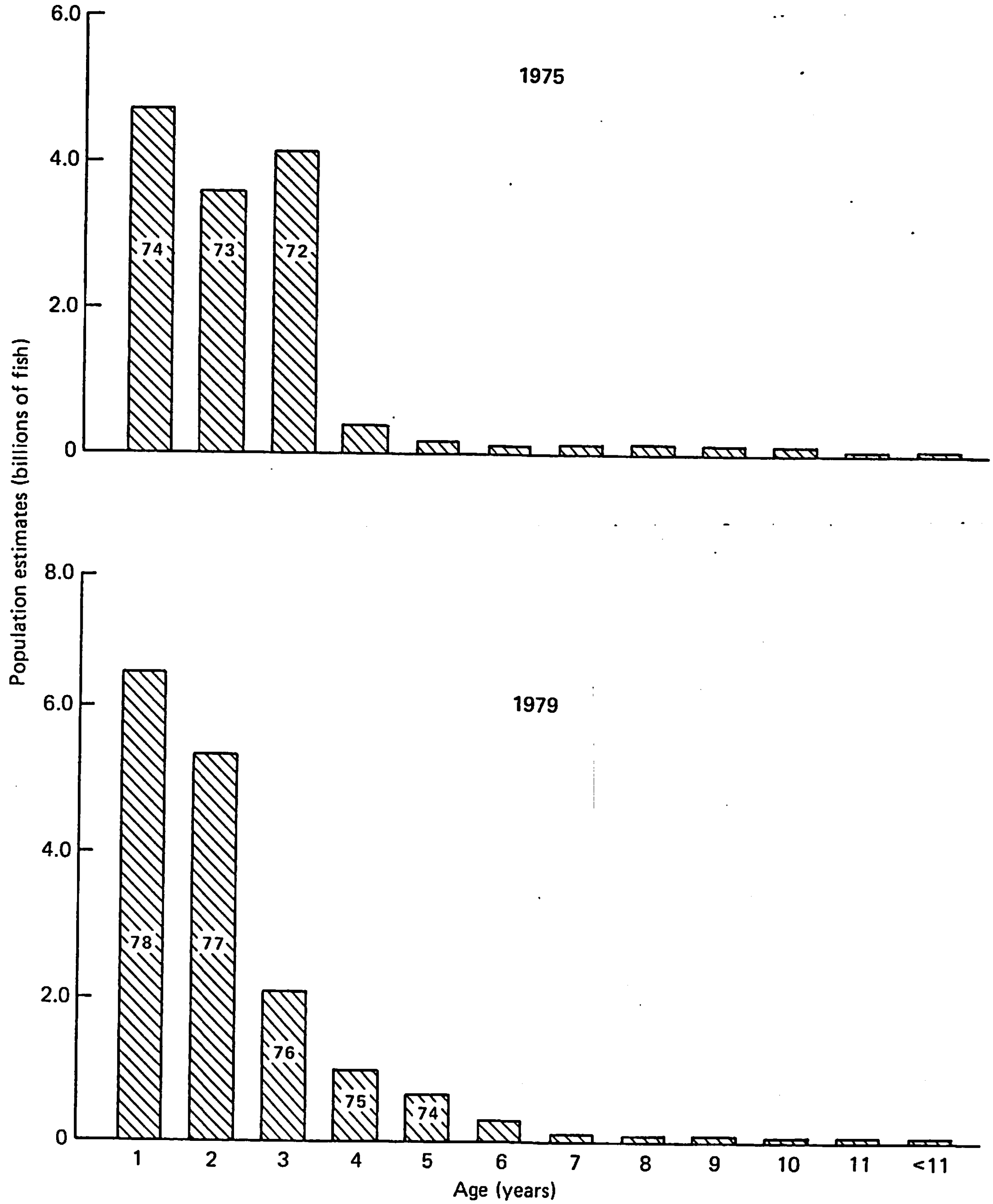

Figure I-1.--Pollock age composition as shown by comprehensive NMFS trawl surveys in 1975 and 1979. Year-classes are shown within bars for certain age groups.

average year-class), but the 1977 and 1978 year-classes appear to be stronger than the 1973 and 1974 year-classes (shown to be relatively strong by the cohort analysis). This comparison suggests that the strength of the 1977 and 1978 year-classes, along with that of other year-classes, should maintain the exploitable biomass of pollock in 1980-81 at least at the 1978 level of 6.2 million mt.

Following the decline in CPUE during 1972-75 when catches ranged from 1.4-1.9 million mt, CPUE stabilized in 1976-78 when catches of about 1 million mt were taken annually. These data suggest that an average catch of about 1 million mt was close to an equilibrium yield during that period.

From a comparison of catches (Table I.2), and biomass estimates from the virtual population analysis (Table I.4), it appears that exploitation rates for pollock since 1970 have been as follows:

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978
Exploitation rate (%)	20	23	24	23	25	25	22	18	16

The data suggest that the average exploitation rate of about 19% during 1976-78 did not reduce the population size and, in fact, allowed some increase in the population biomass during the period of recruitment of the relatively strong 1972-74 year-classes.

The biomass of pollock is expected to remain at least as high as 6.2 million mt in 1980-81 based on the strength of the 1977 and 1978 year-classes that will form the bulk of the exploitable biomass in that period. Based also on the relationship of exploitation rates and stock condition in 1976-78, an exploitation rate of 19% should keep the stock in equilibrium. Current EY is therefore considered to be 0.19 x 6.2 million mt, or 1.20 million mt.

I.1.3 Acceptable Biological Catch

The exploitable pollock biomass has been demonstrably subject to wide fluctuations in abundance caused by naturally induced variations in recruitment. As long as catch is maintained near EY--i.e., not permitted to aggravate a natural decline in abundance leading to an adverse spawner-recruit effect--signficant changes in standing stock will be determined by environmental and ecosystem factors rather than fishing. Even though EY is currently below or near the low end of the MSY range, "rebuilding" to the level of abundance that can produce MSY will have to await natural increases in recruitment. Setting OY 50,000 or 100,000 mt below EY will have little rebuilding effect because: (1) the high rate of natural mortality exhibited by this species will result in only part of that surplus accruing to the standing stock; and (2) at reasonably healthy levels of adult abundance, more spawners will probably not result in any significant enhancement of recruitment three or four years later.

Inasmuch as the decline in abundance noted during the mid-1970's has been arrested and current recruitment appears to be at least of average strength, ABC is considered equivalent to EY--1.20 million mt.

Pelagic Pollock in the Aleutian Basin

Research by the Japan Fishery Agency during the summers of 1977 and 1978 have identified a widely dispersed but substantial quantity of pollock in pelagic waters over the Bering Sea deep-water basin (Nunnallee, 1978; Okada, 1979a; 1979b). Mid-water trawl samples for both day and night tows were used by Nunnallee (1978) to conservatively estimate the biomass of the deep-water population in 1978 at 840,000 mt using the area swept technique ($q = 1.0$). Okada (1979b) using the relationship between echo-gram responses

50

and night catches of the mid-water trawl and applying this relationship to echo-gram responses from both day and night estimated the biomass of pollock in the deep-water basin to be 4,100,000 mt from 1977 survey data and 5,442,000 mt from 1978 survey data. These pelagic pollock have also been shown to be markedly larger in average size than the pollock on the continental shelf and slope taken by the commercial fishery (Figure I.2).

This difference in size composition leads to the hypothesis that the distribution of pollock changes with size, with the larger individuals tending to a pelagic existence beyond the continental slope and beyond the commercial fisheries as they currently operate.

The discovery of this deep-water component of the Bering Sea pollock population raises questions about the size of the exploitable biomass and estimates of MSY, EY and ABC/OY of the population as a whole.

Assuming that the deep-water and shallow-water pollock, i.e., those available to the commercial fishery, are both components of the same spawning population, and that recruitment to the deep-water component is via the exploited, shallow-water component, three inter-related considerations are germane.

(1) Once recruited to the deep-water component, pollock will no longer be subjected to exploitation by the slope/shelf fishery. Therefore, in any year, abundance of the deep-water component has no direct bearing on the ABC/OY of the exploitable portion of the population. If, however, the commercial fishery develops techniques for harvesting the deep-water component, a separate ABC/OY for that component might be appropriate (subject to consideration of 3, below).

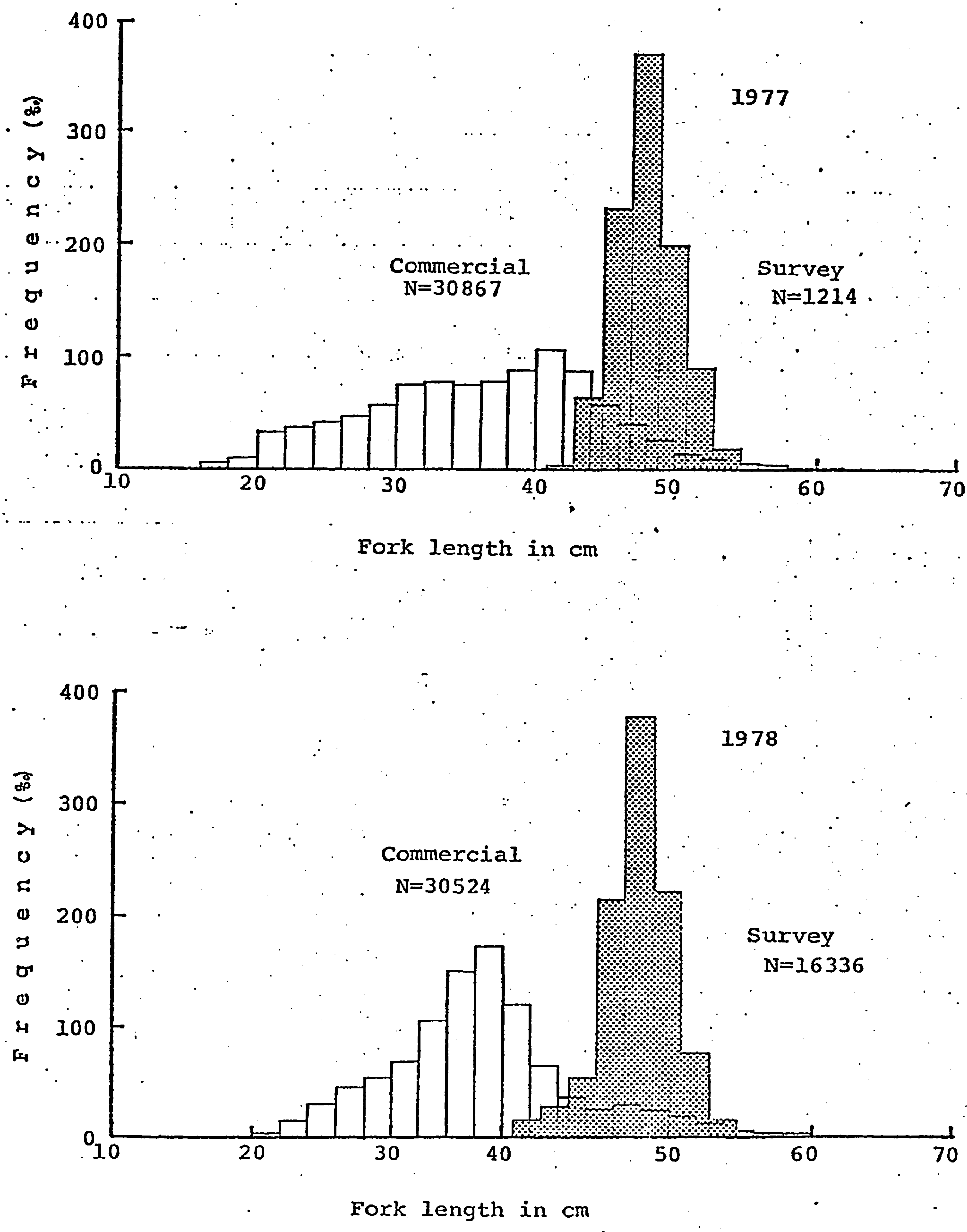

Figure I-2.--Comparison of pollock length distributions in the commercial fishery on the eastern Bering Sea shelf and slope and from research vessel surveys of pelagic pollock over the Bering Sea deep-water basin (from Okada, 1979a).

(2) If, prior to their recruitment to the deep-water component, individual pollock passed through the exploitable portion of the population, a higher fishing rate on the exploitable component might be considered in order to reduce the number of fish which would otherwise survive, move offshore, and be lost to further exploitation (subject to consideration of 3, below).

(3) Although no longer available to the fishery, the deep-water component presumably represents a substantial spawning potential for the population as a whole (especially in light of the exponential increase in fecundity which accompanies increases in length). Maintenance of a deep-water component (by not permitting all of the exploitable component to be taken and by limiting the development of fishing directly on the deep-water component) would seem desirable to assure adequate spawning potential regardless of fluctuations in the abundance of the exploitable component of the population. Such a reproductive "buffer" should allow utilization of the exploitable component without undue concern about the possibility of an adverse spawner-recruit relationship being caused or aggravated by the shelf/slope fishery.

Until: (1) it has been determined that the deep-water pollock are, in fact, a component of the same population which is exploited (at younger ages) over the continental shelf and slope; (2) it is clear that the deep-water component is made up only of older fish that are no longer available to the slope/shelf fishery; and (3) an empirically-derived model has been developed in which the relation between slope/shelf exploitation and abundance of the deep-water component can be demonstrated, the only change that will be considered in the Bering Sea pollock ABC/OY because of the discovery of the deep-water component is that of a separate ABC/OY for fishing in deep water.

In addition to the 1,200,000 mt ABC/OY for pollock in the traditional fishing areas where pollock are taken near bottom, a separate ABC/OY of 100,000 mt is designated for pollock in pelagic waters in deep-sea zones of more than 1,000 m. To simplify management regulations associated with these ocean depths, ABC is set at 1,200,000 mt for Bering Sea statistical Areas I and II (see Figure I.3 for location of statistical areas) combined, and at 100,000 mt for statistical Areas III and IV, combined. This ABC of 100,000 mt in Areas III and IV is provided to encourage exploratory or experimental fishing operation in the pelagic fishing zone. It would provide a substantial but controlled opportunity to expand the pollock fishery to an apparently unused segment of the population, and, if utilized, will produce further information about the deep-water component that can be used for future population evaluations and management decisions.1/

1/ Records of the Japanese research survey which identified the deep-water component of the pollock population showed highest concentrations within 50-150 miles of the Aleutian chain in water depths greater than 1,000 m. Most of that described region lies within statistical Area IV.

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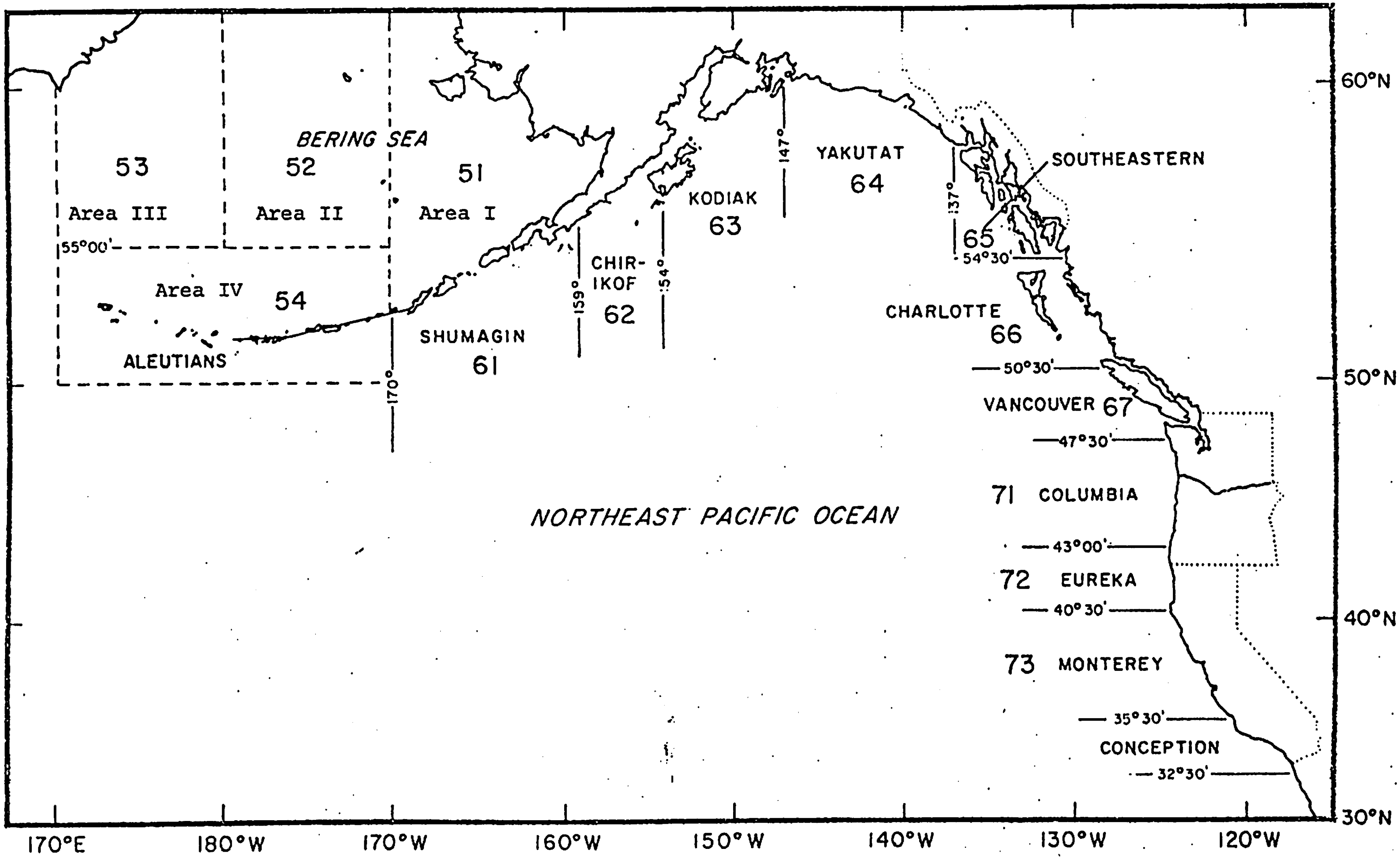

Figure I-3--U.S. statistical areas in the Bering Sea and northeastern Pacific Ocean.

I.2 Yellowfin sole

I.2.1 Maximum Sustainable Yield

Annual catches of yellowfin sole in the eastern Bering Sea given in Table I.5 can be summarized as follows:

Period	Number of years	Range in annual catches (mt)	Average annual catch (mt)
1954-58	5	12,562 - 44,153	24,049
1959-62	4	185,321 - 553,742	403,967
1963-68	6	53,810 - 162,228	99,928
1969-71	3	133,079 - 167,134	153,537
1972-77	6	42,235 - 78,240	57,950
1978-79	2	101,108 -138,433	119,770

Catches in the period of 1972-77 were relatively low due primarily to the absence of directed fishery for yellowfin sole by the U.S.S.R. The U.S.S.R. re-entered the yellowfin sole fishery in 1978-79, and catches more than doubled over the average annual levels of 1972-77.

Prior to 1963, virgin or near virgin biomass was estimated to be 1.3 to 2 million mt (Alverson and Pereyra, 1969; Wakabayashi, 1975). Applying the yield equation of Alverson and Pereyra (1969) (MSY - 0.5 MB_o, where B_o = virgin biomass and M = natural mortality) to the pre-1963 biomass estimate results in the following approximation:

MSY = 0.5 x 0.26 x 1,300,000 to 2,000,000 = 169,000 to 260,000 mt.

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TABLE I-5 . -- ANNUAL CATCHES OF YELLOWFIN SOLE IN THE EASTERN BERING SEA (EAST OF 180 AND NORTH OF 54N) IN METRIC TONS. A/

YEAR	JAPAN	USSR	ROK	TOTAL
1954	12,562	0	0	12,562
1955	14,690	0	0	14,690
1956	24,697	0	0	24,697
1957	24,145	0	0	24,145
1958	39,153	5,000	0	44,153
1959	123,121	62,200	0	185,321
1960	360,103	96,000	0	456,103
1961	399,542	154,200	0	553,742
1962	281,103	139,600	0	420,703
1963	20,504	65,306	0	85,810
1964	48,880	62,297	0	111,177
1965	26,039	27,771	0	53,810
1966	45,423	56,930	0	102,353
1967	60,429	101,799	0	162,228
1968	40,834	43,355	-	84,189
1969	81,449	85,685	-	167,134
1970	59,851	73,228	-	133,079
1971	82,179	78,220	-	160,399
1972	34,846	13,010	-	47,856
1973	75,724	2,516	-	78,240
1974	37,947	4,288	-	42,235
1975	59,715	4,975	-	64,690
1976	52,668	2,908	625	56,201
1977	58,090	283	-	58,373
1978	62,064	76,300	69	138,433
1979 B/	58,490	41,259	1356	101,108

A/ SOURCE: WAKABAUSHI AND BAKKALA (1978) FOR CATCHES THROUGH 1976; CATCH DATA FOR 1977 AND 1978 FROM DATA ON FILE, NORTHWEST AND ALASKA FISHERIES CENTER, SEATTLE, WA.

B/ INCLUDES 3MT BY TAIWAN

I.2.2 Equilibrium Yield

Relative Abundance

The two sources of information used to examine trends in relative abundance for yellowfin sole are pair trawl data from the Japanese commercial fishery and U.S. research vessel data from a comparative area (Bakkala et al., 1979) fished since 1973. The pair trawl catch and effort data used are those from 1° longitude by $1/2^{\circ}$ latitude statistical blocks and months in which yellowfin sole made up 50% or more of the total catch. Effort data is adjusted for changes in horsepower. CPUE values are calculated for two time periods, September-December and September-March. The first period represents the first half of the winter fishing season, and the second period the full winter fishing season. Because catch and effort data are reported by calendar year, the use of first-half season data allows trends in CPUE to be examined for one additional season compared to full-season data. Trends in first-half and full-season data are much the same.

The Japanese pair trawl data show a substantial increase in relative abundance of yellowfin sole between 1972 and 1977 (Figure I-4). Changes in fishing strategy between the 1973-74 and 1974-75 fishing seasons which increased the efficiency of the fleet (Bakkala et al., 1979) may have accounted for part of the increase between those seasons. First-half season data show a decline in CPUE in September-December 1978 from that in 1977. The 1978 CPUE, however, exceeded all other values since 1970 with the exception of the 1977 value.

U.S. research vessel data also show abundance of yellowfin sole increasing since 1973 (Figure I-4). The trend line is broken between 1976 and 1977 because a gear change was made in 1977 (Bakkala et al., 1979) and the influence of this change on the catchability of yellowfin

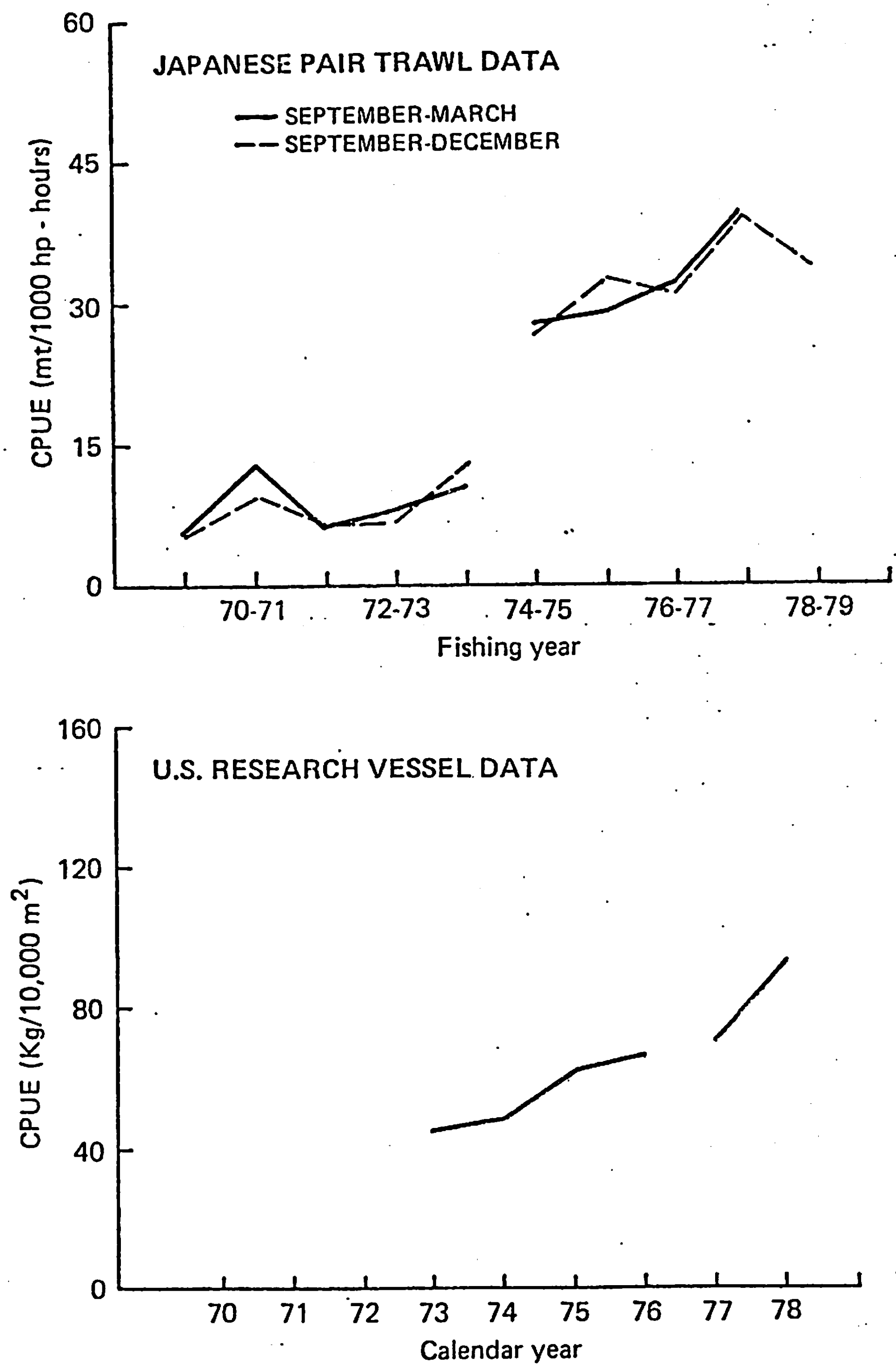

Figure I-4.--Relative abundance of yellowfin sole as shown by Japanese pair trawl data and by U.S. research vessel surveys. Breaks in the trend lines indicate changes in fishing gear or fishing techniques (see text). (from Bakkala et al., 1979).

sole is uncertain. Nevertheless, increases in abundance were shown by the old gear from 1973 to 1976, and by the new gear between 1977 and 1978.

Absolute Abundance

Biomass estimates based on the area-swept technique have been calculated from NMFS research vessel surveys since 1973. Surveys in most years have been limited to the southeastern Bering Sea. However, larger-scale surveys which sampled major portions of the eastern Bering Sea continental shelf were conducted in 1975, 1976, 1978, and 1979. Biomass estimates (mt) from these larger surveys, and 95% confidence intervals around the mean estimates are as follows:

Year	Mean Estimate	95% Confidence Interval
1975	1,038,400	870,800 - 1,206,400
1976	1,192,624	661,690 - 1,723,558
1978	1,523,429	1,103,294 - 1,943,564
1979	1,932,558	1,668,984 - 2,196,133

Like the CPUE trends, the biomass estimates show a substantial increase in abundance of yellowfin sole. This increase can be mainly attributed to a series of strong year-classes (the 1966-70 year-classes) which were recruited to the exploitable portion of the population in the mid-and late 1970's. Figure I.5 illustrates the progression of these year-classes into the exploitable population, and the accumulative affect of this recruitment on the total exploitable stock size through 1978.

The 1966-70 year-classes are now reaching an age (10 years and older) when natural mortality will have begun to substantially reduce their abundance. Moreover, the 1971 and 1972 year-classes appear less abundant than the

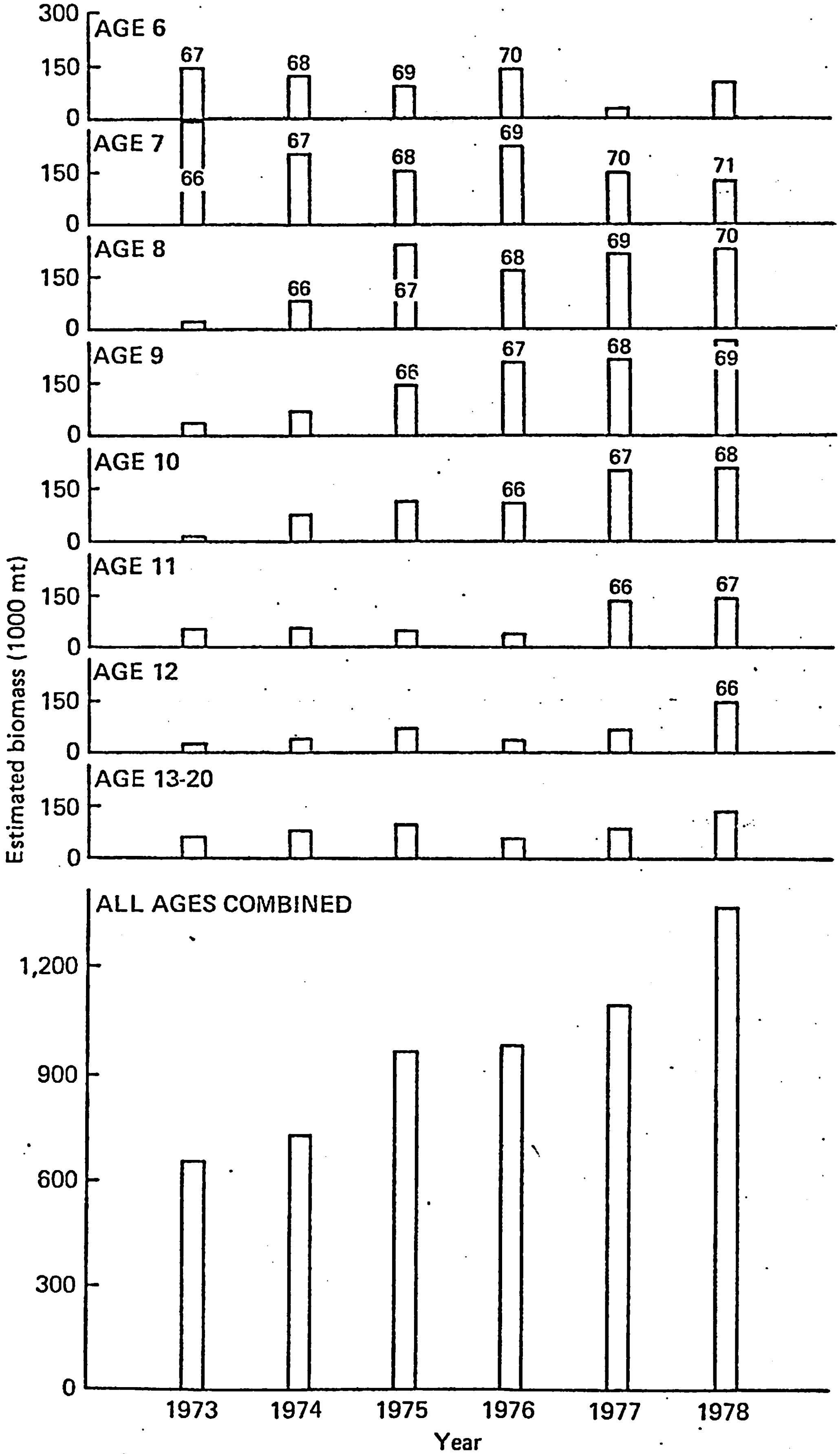

Figure I-5.-Biomass estimates for the exploitable population of yellowfin sole in the southeast Bering Sea. Year-classes for certain ages are shown with appropriate bars.

1966-70 year-classes, although the 1973 year-class appears relatively strong. Based on these considerations, the abundance of yellowfin sole would be expected to level off or even decline. The substantial increase in biomass as shown by the NMFS surveys between 1978 and 1979 was therefore unexpected. The 1979 survey more comprehensively sampled the eastern Bering Sea shelf than did the 1978 survey, and this greater coverage may be the principal reason for the large estimate in 1979. Nevertheless, biomass estimates for two consecutive years (the 1978 and 1979 surveys) indicate that yellowfin sole have recovered to a point where abundance falls within the estimated range of the virgin biomass (1.3 - 2.0 million mt). Consequently, EY is currently considered equivalent to at least the lower end of the MSY range or 169,000 mt.

1.2.3 Acceptable Biological Catch

This resource has recovered surprisingly well from a state of depletion in the mid-1960's. Current abundance is high and approximates estimates of virgin biomass. Accordingly, ABC is considered equivalent to EY--169,000 mt.

1.3 Turbots (Arrowtooth flounder and Greenland turbot)

The turbots (arrowtooth flounder and Greenland turbot) are large flatfishes which are distributed along the continental slope in deep water as adults; juvenile stages mainly occupy the continental shelf. By virtue of their biology and bathymetric distribution, the turbots are largely separated from the small flounders in the Bering Sea. Furthermore, the target fishery for turbots is quite distinct from that for other flounders. The turbot complex is, therefore, managed as an independent unit.

I.3.1 Maximum Sustainable Yield

After a long period of relatively small catches, turbot production in the eastern Bering Sea and Aleutians increased substantially in the early 1970's and reached about 103,000 mt in 1973 and 1974 (Table I-6). Since 1974, catches have declined and were 52,000 mt in 1978. Of the two species in this complex, Greenland turbot has accounted for 80% of the catch.

Since turbots are secondary or only occasional target species taken in the fisheries for pollock, sablefish, and yellowfin sole, it is difficult to estimate the MSY of this complex with standard production models which rely on commercial catch-effort statistics.

Although catches averaging 94,000 mt were sustained in the eastern Bering Sea and Aleutians during the period 1972-76, catch rates of Greenland turbot in the Japenese landbased trawl fleet decreased substantially during this period (see section 1.3.2, following). Accordingly, MSY for the turbot complex for the eastern Bering Sea and Aleutians is believed to be no more than 90,000 mt.

Table I-6.--Foreign calendar year catches (mt) of arrowtooth flounder and greenland turbot by area and nation, 1960-78.

Year	Eastern Bering Sea (east of 180°)					Aleutian Island Area					E. Bering Sea and Aleutian Combined Total
	Japan		USSR	ROK	Total	Japan		USSR	ROK	Total	
	MS LG-NPT[a]/	LBD[b]/				MS LG NPT	LBD				
ARROWTOOTH FLOUNDER AND GREENLAND TURBOT COMBINED.											
1960	36,843	-	-		36,843	-	-	-		-	36,843
1961	57,348	-	-		57,348	-	-	-		-	57,348
1962	58,226	-	-		58,226	-	-	-		-	58,226
1963	31,565	-	-		31,565	-	7	-		7	31,572
1964	33,726	3	-		33,729	475	29	-		504	34,233
1965	7,648	299	1,800		9,747	299	1	-		300	10,047
1966	10,752	90	2,200		13,042	63	0	-	-	63	13,105
1967	20,574	656	2,639	-	23,869	167	227	-		394	24,263
1968	17,702	2,278	15,252	-	35,232	106	107	-	-	213	35,445
1969	13,525	5,706	16,798	-	36,029	51	177	-	-	228	36,257
1970	14,212	9,857	8,220	-	32,289	278	281	-	-	559	32,848
1971	29,313	12,483	17,460	-	59,256	1,329	1,002	-	-	2,331	61,587
1972	25,949	27,687	23,998	-	77,634	900	13,030	267	-	14,197	91,831
1973	31,082	43,354	16,214	-	90,650	1,478	10,531	362	-	12,371	103,021
1974	38,824	22,833	29,470	-	91,127	2,281	9,663	39	-	11,983	103,110
1975	32,382	21,484	31,785	-	85,651	926	2,685	143	-	3,754	89,405
1976	34,221	19,109	24,999	-	78,329	933	2,392	112	-	3,437	81,766
1977	16,375	15,454	5,333	-	37,162	640	3,824	24	-	4,488	41,650
1978	21,299	20,244	4,119	119	45,781	1,182	5,363	2	1	6,548	52,329

Table I-6.--Foreign calendar year catches (mt) of arrowtooth flounder and greenland turbot by area and nation, 1960-78 (continued).

Year	Eastern Bering Sea (east of 180°) Japan MS LG-NPT[a]/	Eastern Bering Sea Japan LBD[b]/	Eastern Bering Sea USSR	Eastern Bering Sea ROK	Eastern Bering Sea Total	Aleutian Island Area Japan MS LG NPT	Aleutian Island Area Japan LBD	Aleutian Island Area USSR	Aleutian Island Area ROK	Aleutian Island Area Total	E. Bering Sea and Aleutian Combined Total
ARROWTOOTH FLOUNDER											
1970	9,047	307	3,244	-	12,598	274	0	-	-	274	12,872
1971	6,235	5,368	7,189	-	18,792	44	537	-	-	581	19,373
1972	1,261	2,562	9,300	-	13,124	194	1,023	106	-	1,323	14,447
1973	1,915	3,014	4,288	-	9,217	483	3,199	23	-	3,705	12,922
1974	1,221	1,602	18,650	-	21,473	1,378	1,817	0	-	3,195	24,668
1975	330	911	19,591	-	20,832	115	526	143	-	784	21,616
1976	139	1,535	16,132	-	17,806	96	1,274	-	-	1,370	19,176
1977	4,000	2,160	3,294	-	9,454	158	1,857	20	-	2,035	11,489
1978	4,598	1,093	2,576	91	8,358	524	1,256	2	0	1,782	10,140
GREENLAND TURBOT											
1970	5,165	9,550	4,976	-	19,691	4	281	-	-	285	19,976
1971	23,078	7,115	10,271	-	40,464	1,285	465	-	-	1,750	42,214
1972	24,688	25,125	14,697	-	64,510	706	12,007	161	-	12,874	77,384
1973	29,167	14,187	11,926	-	55,280	995	7,332	339	-	8,666	63,946
1974	37,603	21,231	10,820	-	69,654	903	7,846	39	-	8,788	78,442
1975	32,052	20,573	12,194	-	64,819	811	2,159	0	-	2,970	67,789
1976	34,082	17,574	8,867	-	60,523	837	1,118	112	-	2,067	62,590
1977	12,375	13.294	2,039	-	27,708	482	1,967	4	-	2,453	30,161
1978	16,701	19,151	1,543	28	37,423	658	4,107	0	1	4,766	42,189

a/ Mothership, North Pacific longline.
b/ Landbased dragnet trawl fishery.

1.3.2 Equilibrium Yield

Annual NMFS research vessel surveys in the southeastern Bering Sea only sample the juvenile populations of the two species and inadequately cover the range of Greenland turbot. Catch rates in the survey area have been relatively stable for Greenland turbot and have increased for arrowtooth flounder indicating that fishery removals have not impacted the recruitment of these species within the annual NMFS survey area (Bakkala et al., 1979). Catch-effort data from the Japanese landbased trawl fishery indicates that abundance of Greenland turbot declined substantially during 1972-76 when catches of this species averaged about 70,000 mt annually. The CPUE was relatively stable during 1976-78 when catches of Greenland turbot averaged about 45,000 mt annually. Fishery data is inadequate for assessing adult arrowtooth flounder because they are only an incidental part of the catch although there has been no indication of a decline in abundance of this species. Other evidence bearing on the condition of these resources comes from the large-scale NMFS surveys in the eastern Bering Sea in 1975 and 1979. Biomass estimates (mt) from the area surveyed in 1975 from the two years were as follows:

Species	1975	1979
Arrowtooth flounder	28,000	42,000
Greenland turbot	126,700	143,300
Total	154,700	185,300

These estimates suggest some increase in abundance, although not a substantial increase. Evidence from fishery and research vessel data are, therefore, supportive in indicating relative stability of this species group between

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1975 and 1979. Consequently, the present EY for Greenland turbot is considered equivalent to the average annual catch during 1975-78 of 51,000 mt. The EY for arrowtooth flounder is considered equivalent to 20,000 mt since catches of this magnitude have produced no indication of a decline in abundance. The combined EY for this species group is, therefore, 71,000 mt.

I.3.3 Acceptable Biological CAtch

ABC for the turbot complex is considered equivalent to EY--71,000 mt.

I.4 Other Flatfishes

The species complex is made up of the following small flatfish which have distributions that are almost entirely restricted to waters of the continental shelf: flathead sole, rock sole, Alaska plaice, and small amounts of rex sole, Dover sole, starry flounder, longhead dab, and butter sole. Catches of these species are almost entirely from the eastern Bering Sea with only trace amounts taken in the Aleutians (Table I-7). All-nation catches of these species in the eastern Bering Sea and Aleutians were relatively stable in the 1960's, ranging around 30,000 mt, but increased to about 92,000 mt in 1971. At least part of this increase is due to better species identification and reporting of catches in the 1970's. After 1971, catches declined to about 16,000 mt in 1977, but increased to 30,000 mt in 1978. Because these species are a by-catch of target fisheries for other species, the decline in catches are thought to be mainly a function of changes in fishing effort for target species, particularly yellowfin sole. The absence of a U.S.S.R. target fishery for yellowfin sole from 1973-77 may be the primary cause of the relatively low catches of "other flatfish" in this period.

Table I-7.--All-nation catches of other flatfishes in the eastern Bering Sea and Aleutian Island area in metric tons.

	E. Bering Sea (east of 1800-INPFC areas 1 & 2)				Aleutians (INPFC area 5)				Total - all areas			
Year	Rock Sole	Flathead Sole	Alaska Plaice	Total	Rock Sole	Flathead Sole	Alaska Plaice	Total	Rock Sole	Flathead Sole	Alaska Plaice	Total
1963	5,002	29,625	975	35,602	27	14	--	14	5,029	29,639	975	35,643
1964	3,238	25,288	1,838	30,364	152	43	45	240	3,390	25,331	1,883	30,604
1965	3,678	6,713	979	11,370	147	128	41	316	3,825	6,841	1,020	11,686
1966	9,104	11,020	4,633	24,757	82	25	--	107	9,186	11,045	4,633	24,864
1967	4,762	23,437	3,853	32,052	25	32	--	57	4,787	23,469	3,853	32,109
1968	5,250	21,575	2,619	29,444	17	186	--	203	5,267	21,761	2,619	29,647
1969	9,240	18,563	6,942	34,745	2	2	--	4	9,242	18,565	6,942	34,749
1970	20,123	41,152	3,402	64,677	2	11	--	13	20,125	41,163	3,402	64,690
1971	40,419	51,024	992	92,435	1	16	--	17	40,420	51,040	992	92,452
1972	60,824	15,690	290	76,304	5	4	--	9	60,829	15,694	290	76,813
1973	23,835	18,141	1,917	43,893	2	24	--	26	23,837	18,165	1,917	43,919
1974	19,975	14,917	2,388	37,280	36	41	--	77	20,011	14,958	2,388	37,357
1975	12,011	5,887	2,491	20,389	3	1	--	4	12,014	5,888	2,491	20,393
1976	9,940	8,155	3,620	21,715	24	7	--	31	9,964	8,162	3,620	21,746
1977	5,200	7,547	3,119	15,866	119	39	0	158	5,319	7,586	3,119	16,024
1978	6,224	14,363	9,467	30,054	814	240	1	1,055	7,038	14,603	9,468	31,109

Source: 1963-76 statistics -- Wakabayashi and Bakkala, 1978; 1977-78 statistics -- Data on File, Northwest and Alaska Fisheries Center, Seattle, WA.

Winter closed areas in the southeastern Bering Sea for the protection of Pacific halibut may have also contributed to the decline in catches of flounders.

I.4.1 Maximum Sustainable Yield

By assuming that the complex had been fully utilized prior to 1975, the average catch (42,900 mt) in 1963-74 for the eastern Bering Sea and Aleutians should approximate MSY. Furthermore, if the complex had been fully utilized prior to 1975, the Schaefer model indicates that by 1975 biomass would be about half of its virgin level. A NMFS trawl survey in 1975 (swept area technique) indicated a standing stock of 232,200-334,100 mt of flathead and rock sole (Table I-8) implying a virgin biomass of 462,400-668,200 mt. Inasmuch as Alaska plaice are virtually unutilized by the fisheries, they are excluded from the following computations. If m = 0.23 for this complex (Section 9.1; flathead sole 0.2, rock sole 0.26), the Alverson-Pereyra yield equation produces an estimate of MSY of 53,200-76,800 mt (0.5 x 0.23 x 462,400-668,200).

Therefore, estimates of MSY range from a low of 42,900 to 76,800 mt (the high end of the above range).

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Table I-8.--Estimated biomass of the "other flatfish" complex in the eastern Bering Sea from NMFS research surveys in 1975 and 1979.

Species	Mean Estimates (mt)		95% Confidence Limits (mt)	
	1975	1979[1]	1975	1979
Rock sole	170,300	182,800	138,300-202,000	137,400-228,200
Flathead sole	113,000	101,800	93,900-132,100	79,300-124,400
Alaska plaice	127,100	283,000	101,800-152,800	197,700-368,170
Total	410,400	567,600	---	---

1/ The 1979 survey covered a larger area than the 1975 survey, but the 1979 estimates are only from the area surveyed in 1975.

I.4.2 Equilibrium Yield

An evaluation of the condition of the "other flatfish" resource based on survey data through 1978 indicated that there may have been a decline in abundance of these species between 1975 and 1978 because of below average strength of the 1971 and 1972 year-classes of rock sole and flathead sole (Bakkala et al., 1979). Biomass estimates from the large-scale NMFS research vessel survey in 1979, however, indicate that there has been little or no change in the combined biomass of rock sole and flathead sole between 1975 and 1979 (Table I-8). Moreover, there has been an apparent increase in abundance of Alaska plaice between 1975 and 1979. The "other flatfish" resource is, therefore, considered to be in satisfactory condition, and the mid-point of the estimated MSY range (60,000 mt) is believed to be attainable.

I.4.3 Acceptable Biological Catch

This species complex appears to be in satisfactory condition and Alaska plaice, which is now the single most abundant species in the complex, are yet to come under full utilization. ABC is therefore considered equivalent to the mid-point of the MSY range--60,000 mt.

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I.5 Pacific Cod

I.5.1 Maximum Sustainable Yield

Pacific cod are distributed widely over the Bering Sea continental shelf and slope, and have a distributional pattern similar to that of pollock. During the early 1960's, when a fairly large Japanese longline fishery operated on the continental slope, cod were harvested by longliners for the frozen fish market. Beginning in 1964, the Japanese North Pacific trawl fishery for pollock expanded, and cod became an important incidental catch in the pollock fishery. At present, cod are believed to be an occasional target species when high concentrations are detected during pollock fishing operations.

The annual catch of Pacific cod by all foreign nations in the eastern Bering Sea and Aleutians increased from 13,600 mt in 1964, to about 70,400 mt in 1970; since then, catches have varied between 36,600 and 63,800 mt (Table I-9). Japan has accounted for 66-99% of the catch since the U.S.S.R. began reporting their catches of cod in 1971.

Table I-9.--Foreign calendar year catches (mt) of Pacific cod by area and nation, 1964-78.

Year	Eastern Bering Sea: Japan MS-LG-NPT[a]	Eastern Bering Sea: Japan LBD[b]	Eastern Bering Sea: USSR	Eastern Bering Sea: ROK[c]	Eastern Bering Sea: ROC[d]	Eastern Bering Sea: Total	Aleutian Island Area: Japan MS-LG-NPT	Aleutian Island Area: Japan LBD	Aleutian Island Area: USSR	Aleutian Island Area: ROK	Aleutian Island Area: Total	E. Bering Sea and Aleutian Comb. Total
1964	13,408	-	-			13,408	241	-	-		241	13,649
1965	13,524	1,195	-			14,719	414	37	-		451	15,170
1966	17,178	1,022	-			18,200	103	51	-		154	18,354
1967	30,502	1,562	-	-		32,064	153	140	-	-	293	32,357
1968	52,135	5,767	-	-		57,902	121	168	-	-	289	58,191
1969	44,871	5,480	-	-		50,351	204	16	-	-	220	50,571
1970	61,015	9,079	-	-		70,094	221	62	-	-	283	70,377
1971	32,206	8,362	2,486	-		43,054	263	162	1,653	-	2,078	45,132
1972	33,715	2,162	7,028	-		42,905	233	202	-	-	435	43,340
1973	38,137	2,680	12,569	-		53,386	295	271	411	-	977	54,363
1974	42,741	3,174	16,547	-	-	62,462	651	683	45	-	1,379	63,841
1975	32,092	1,230	18,229	-	-	51,551	2,470	111	257	-	2,838	54,389
1976	29,627	2,382	17,756	716	-	50,481	3,688	174	312	16	4,190	54,671
1977	29,682	3,459	177	-	2	33,320	1,533	1,629	100	-	3,262	36,582
1978	36,513	4,721	419	859	-	42,512	1,460	1,705	120	6	3,291	45,803

a/ Mothership, North Pacific longline, and North Pacific trawl fisheries.

b/ Landbased dragnet fishery.

The incidental occurrence of cod in foreign trawl catches makes questionable the use of CPUE trends from the commercial fishery. Moreover, the semi-demersal distribution of cod makes them difficult to assess with research vessel trawls. MSY for this species has, therefore, been estimated on the basis of commercial catch data. Because catches increased rapidly in the mid-1960's and then stabilized, the average catch during this period of stability (1968-76) was assumed to reflect at least a minimal estimate of MSY. The original estimate was 58,700 mt, but this figure includes catches from west of 180° which lies outside the U.S. FCZ. A more appropriate estimate, including only those catches within the FCZ from the eastern Bering Sea (east of 180°) and Aleutian Islands area, is 55,000 mt.

I.5.2 Equilibrium Yield

Accumulating evidence since 1978 indicates that the abundance of Pacific cod is increasing and that this increase may be substantial. The relative abundance of cod more than doubled between 1976 and 1978 based on NMFS research survey data, and in 1978 there appeared to be unusually high abundance of age 0 and age 1 cod (year-classes 1977 and 1978) in the research vessel catches (Bakkala et al., 1979). These year-classes as age 1 and age 2 fish were also abundant in research vessel catches during the large-scale survey of the eastern Bering Sea in 1979. Based on data from the large-scale OCSEAP survey in 1975 and using data from an equivalent area in 1979 indicates that the CPUE of cod apparently increased by a factor of approximately 7 between 1975 (2.7 kg/km) and 1979 (19.8 kg/km).

Age data from the commercial fishery indicates that the abundance of a cod cohort peaks in the fishery at age 3, contributes substantially to catches at age 4, but that abundance declines sharply at ages 5 and 6. The 1977 and 1978 year-classes will, therefore, make their greatest contribution to the fishery in 1980-82.

The estimated biomass of cod from the 1979 survey was 792,300 mt with a 95% confidence interval of 603,200-981,400 mt. About 81% of the total biomass was made up of age groups 1 and 2 which are only partially recruited to the fishery.

Using population estimates by age from the 1979 NMFS survey, historical growth rates, a range in instantaneous natural mortality rates of 0.5-0.7, and various possible fishing mortalities by age, the projected biomass of cod in 1980 and 1981 has been calculated. These projections indicate that the exploitable biomass (age group 2-5) in 1980 and 1981 may fall within the following ranges:

Year	Predicted Range in Biomass (mt)
1980	740,000-910,000
1981	803,000-1,248,000

Conservatively using the lower end of the projected range in biomass and an exploitation rate of 20%, the estimated EY is 148,000 mt in 1980 and 160,000 mt in 1981.

I.5.3 Acceptable Biological Catch

ABC will exceed estimates of MSY in 1981 due to the recruitment of the strong 1977 and 1978 year-classes. Since natural mortality will rapidly reduce the abundance of these year-classes after age 4, it is prudent to harvest the 1977 and 1978 year-classes during the short period they remain in the fishery. However, due to the possible inaccuracies in the 1979 biomass estimate and in the projections of this estimate to 1980-81, ABC is set at 75% of the projected EY for 1981--0.75 x 160,000 = 120,000 mt.

I.6 Pacific Ocean Perch and Other Rockfishes

I.6.1 Maximum Sustainable Yield

Pacific Ocean Perch

Pacific ocean perch is the most abundant rockfish species in the North Pacific Ocean. Chikuni (1975) identified two main stocks in the Bering Sea: an Eastern Slope stock in the southeastern Bering Sea, and an Aleutian stock distributed along both sides of the Aleutian Islands. Commercial catch statistics (Table I-10) indicate that the Aleutian stock is much larger than that of the Eastern Bering Sea Slope. Catches peaked at about 47,000 mt in the Eastern Slope Region in 1961, whereas they peaked at 109,000 mt in the Aleutian Region in 1965. Since then, catches have declined drastically in both regions. This decline is attributed mainly to lower stock abundance caused by the removal of larger, older fish.

Under ideal resource conditions, MSY has been estimated to be as high as 32,000 mt in the eastern Bering Sea and as high as 75,000 mt in the Aleutians (Chikuni 1975). However, an examination of catch statistics show that sustained exploitation of this magnitude was not possible. Low (1974), using a general production model, estimated the MSY of Pacific ocean perch for the eastern Bering Sea and Aleutians combined as 12,000-17,000 mt.

Other Rockfish

Ikeda (1979) has used Japanese research vessel data to estimate the biomass and MSY for "other rockfish" as follows:

Area	Estimated Biomass (mt)	Estimated Range in MSY (mt)
Eastern Bering Sea	55,000	7,000-15,000
Aleutians	167,000	23,000-45,000

In making these estimates, Ikeda (1979) had limited survey data to work with and used a number of assumptions which need verification. These estimates can therefore only be used as first approximations

TABLE I-10.--ANNUAL CATCH OF PACIFIC OCEAN PERCH IN THE BERING SEA IN THOUSAND METRIC TONS.

	JAPAN A/			U.S.S.R. B/			TOTAL		
YEAR	EASTERN SLOPE	ALEUTIAN	TOTAL	EASTERN SLOPE	ALEUTIAN	TOTAL	EASTERN SLOPE	ALEUTIAN	TOTAL
1960	1.1	----	1.1	5.0	----	5.0	6.1	----	6.1
1961	13.0	----	13.0	34.0	----	34.0	47.0	----	47.0
1962	12.9	0.2	13.1	7.0	----	7.0	19.9	0.2	20.1
1963	17.5	0.8	18.3	7.0	20.0	27.0	24.5	20.8	45.3
1964	14.4	29.3	43.7	11.5	61.0	72.5	25.9	90.3	116.2
1965	7.8	38.1	45.9	9.0	71.0	80.0	16.8	109.1	125.9
1966	17.5	28.2	45.7	2.7	57.7	60.4	20.2	85.9	106.1
1967	19.6	9.3	28.9	----	46.6	46.6	19.6	55.9	75.5
1968	28.4	18.3	46.7	3.1	26.6	29.7	31.5	44.9	76.4
1969	14.5	15.6	30.1	0.0	23.2	23.2	14.5	38.8	53.3
1970	9.9	13.6	23.5	0.0	53.3	53.3	9.9	66.9	76.8
1971	9.8	14.6	24.4	0.0	7.2	7.2	9.8	21.8	31.6
1972	5.5	8.6	14.1	0.2	24.6	24.8	5.7	33.2	38.9
1973	2.7	9.3	12.0	1.0	2.5	3.5	3.7	11.8	15.5
1974	6.6	21.7	28.3	7.4	0.8	8.2	14.0	22.4	36.5
1975	3.2	8.5	11.7	5.4	8.1	13.5	8.6	16.6	25.2
1976	2.8	10.3	13.1	12.1	3.7	15.8	14.9	14.0	28.9
1977 C/	2.7	5.7	8.4	3.5	0.1	3.6	6.2	5.8	12.0
1978 D/	1.9	4.8	6.7	0.1	0.2	0.3	2.2	5.3	7.5
1979 E/	1.6	5.3	6.9	T	T	T	1.7	5.5	7.2

A/ CATCHES OF MOTHERSHIP-LONGLINE NORTH PACIFIC TRAWL FISHERY AND LANDBASED DRAGNET FISHERY

B/ INCLUDING ROCKFISH OTHER THAN PACIFIC OCEAN PERCH(1976-77)

C/ INCLUDES R.O.K. CATCH OF 442MT FROM BERING SEA AND 83MT FROM ALEUTIANS.

D/ PRELIMINARY; INCLUDES R.O.K. CATCH OF 212MT FROM BERING SEA AND 271MT FROM ALEUTIAN ISLANDS AND 7MT CATCH BY TAIWAN IN THE BERING SEA

E/ INCLUDES ROK CATCH OF 123MT FROM BERING SEA AND 159MT FROM ALEUTIANS, TAIWAN CATCH OF 3MT FROM BERING SEA AND POLISH CATCH OF 2MT FROM BERING SEA, USSR CATCH OF 3MT FROM BERING SEA AND 18MT FROM ALEUTIONS.

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I.6.2 Equilibrium Yield

Pacific Ocean Perch

Since 1960, the Eastern Slope region has produced Pacific ocean perch catches in excess of 30,000 mt only twice (1961 and 1968). Following each such instance, catches fell substantially (Table I-10) and after the large 1968 catch, dropped to very low levels. An inspection of catch (Table I-10) and catch rates (Table I-11) indicate that perch stocks of the Eastern Slope Region could not support removals of even 10,000-15,000 mt annually without a further reduction of the already low stock abundance.

In the Aleutian Region, there have been more obvious signs of over-exploitation, particularly in early stages of the fishery when catches in excess of 90,000 mt were taken annually in 1964-66. Since 1970, catches have averaged 16,400 mt annually.

It was the concensus of Canadian, Japanese, and U.S. scientists at the 1975 annual meeting of INPFC that Pacific ocean perch stocks were at a low level of abundance, and generally in poor biological condition. This opinion was derived from various status of stock indicators including (i) a continuous decline in CPUE since 1968; (ii) drastic reductions in the availability of all sizes of ocean perch through the period 1969-72; (iii) a heavy dependence in the fishery after 1968 on young-small fish; and (iv) the lack of any evidence of strong incoming year-classes.

Eastern Bering Sea Slope Area

In the Eastern Slope Region, CPUE data indicate that stock abundance has declined severely from the 1960's and has fluctuated at a low level in the 1970's (Table I-11). Moreover, catch rates have declined to very low levels at depths greater than 125 m where most of the Pacific ocean perch grounds are found (Figure I-6).

TABLE I-11 -- PACIFIC OCEAN PERCH CATCH AND EFFORT DATA OF STERN TRAWLERS IN THE JAPANESE MOTHERSHIP-LONGLINE-NORTH PACIFIC TRAWL FISHERY BY VESSEL CLASS IN THE EASTERN BERING SEA SLOPE REGION, 1968-78.

YEAR	VESSEL CLASS A/ 3	4	5	6	7	8	9
(A) CATCH IN METRIC TONS.							
1968	895	3,847	695	1,938	378	10,012	1,776
1969	361	3,709	102	258	94	4,037	2,103
1970	77	215	78	55	301	3,168	1,495
1971	96	1,558	35	203	992	1,855	459
1972	--	1,005	317	7	410	313	1,276
1973	--	382	--	199	487	146	398
1974	--	640	90	520	700	609	735
1975	--	578	204	343	784	171	293
1976	--	323	188	152	772	70	545
1977	--	380	357	155	114	193	534
1978	--	531	154	178	54	130	545
(B) FISHING EFFORT IN HUNDRED HOURS TRAWLED.							
1968	104	298	26	18	1	67	46
1969	95	264	17	15	12	95	125
1970	103	293	18	2	34	122	139
1971	125	411	21	19	35	146	266
1972	120	348	29	13	49	140	198
1973	--	267	13	16	35	118	397
1974	--	290	27	39	37	171	391
1975	--	419	55	41	38	158	363
1976	--	502	41	5	19	147	360
1977	--	444	30	15	5	99	318
1978	--	594	56	38	5	99	353
(C) PERCENTAGE COMPOSITION IN TOTAL OCEAN PERCH CATCH BY VESSEL CLASS CATEGORY.							
1968	4	19	3	10	2	49	9
1969	3	31	1	2	1	34	18
1970	1	4	1	1	6	58	27
1971	2	30	1	4	19	35	9
1972	--	29	9	+	12	9	37
1973	--	22	--	12	28	9	23
1974	--	19	3	15	21	18	22
1975	--	23	8	14	32	7	12
1976	--	15	9	7	37	3	26
1977	--	21	19	8	6	11	29
1978	--	32	9	11	3	8	33
(D) CPUE IN MT PER HOUR TRAWLED.							
1968	.08	.13	.26	1.10	2.55	1.50	.39
1969	.03	.14	.06	.18	.08	.42	.17
1970	.01	.01	.04	.23	.09	.26	.11
1971	.01	.04	.02	.11	.28	.13	.02
1972	--	.03	.10	.01	.07	.02	.05
1973	--	.01	--	.12	.14	.01	.01
1974	--	.02	.03	.13	.19	.04	.02
1975	--	.01	.04	.08	.21	.01	.01
1976	--	.01	.05	.33	.41	.01	.02
1977	--	.01	.12	.10	.25	.02	.02
1978	--	.01	.03	.05	.12	.01	.02

A/ NO DATA FOR CLASSES 1 AND 2. 1973-1978 DATA CONVERTED TO PRE-1973 GROSS TONNAGE CLASSIFICATION OF

1 = 71-100	4 = 301-500	7 = 1501-2500
2 = 101-200	5 = 501-1000	8 = 2501-3500
3 = 201-300	6 = 1001-1500	9 = 3501 AND ABOVE

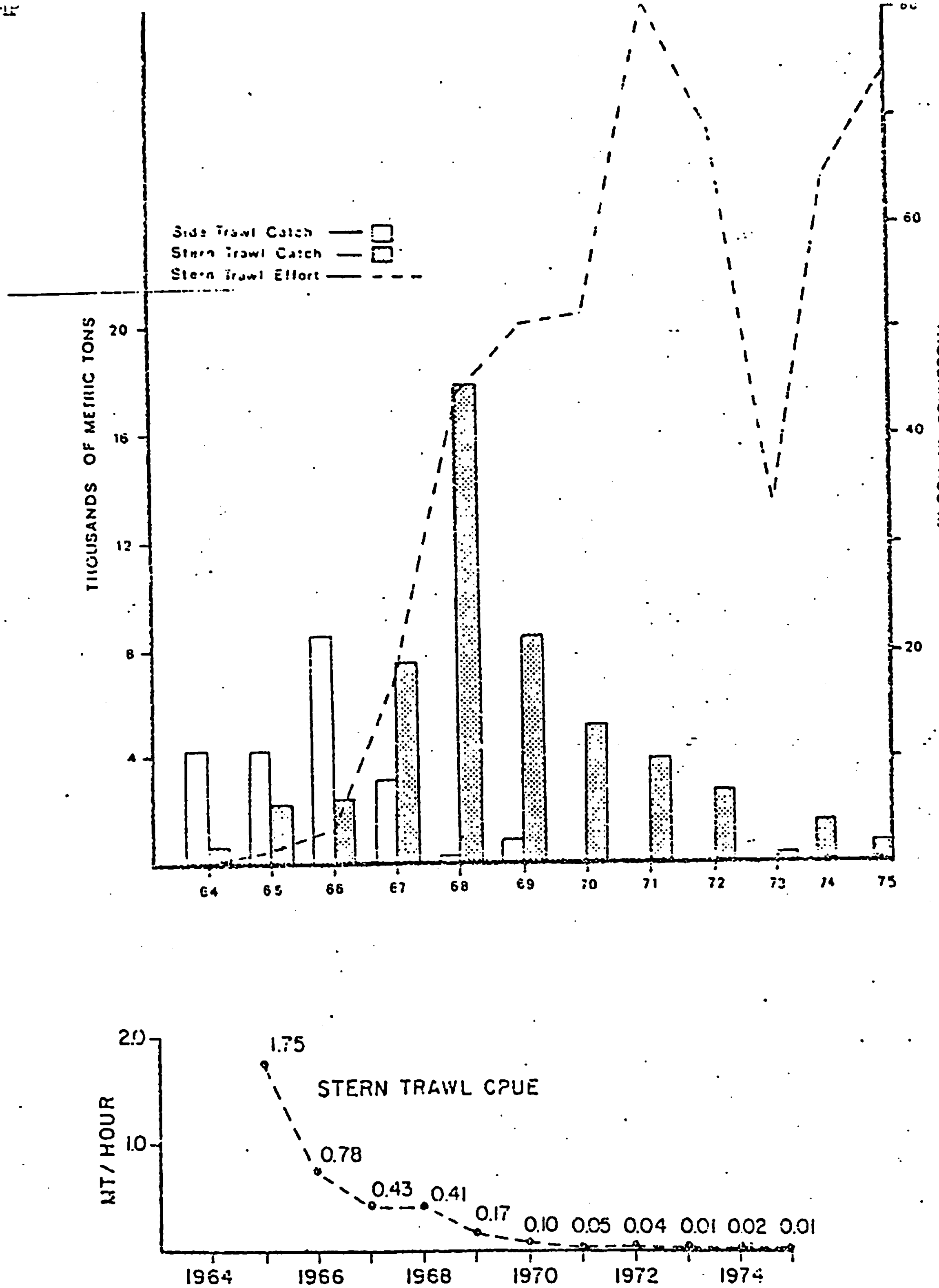

Figure I-6.—Annual catches of Pacific ocean perch by side and stern trawlers, and stern trawl effort by the Japanese mothership, longline, and North Pacific trawl fisheries, in areas of the Eastern Slope Region where depths exceed 125 meters.

A continuation of the decline in abundance between 1977 and 1978 is also indicated by CPUE data collected by U.S. observers aboard Japanese and Republic of Korea (R.O.K) trawlers as shown below:

Area	Type of Trawler	CPUE (Kg/hr)	
		1977	1978
East of 170°W	Japanese small trawler	13	2
	Japanese large trawler	42	11
	R.O.K. large trawler	12	7
170°W-180°	Japanese small trawler	3	8
	Japanese large trawler	25	11

The spawning stock of Pacific ocean perch in the Eastern Slope Region must also be reduced from levels of the 1960's. The large catches of ocean perch by Japan and the U.S.S.R. in the early 1960's appear to have removed the larger and older fish from the stock, which undoubtedly had an influence on the reproductive potential. Chikuni (1975) reported that the fecundity of ocean perch in this region was as follows: 10,000 eggs at age 7, 29,000 at age 10, 75,000 at age 15, 122,000 at age 20, and 162,000 at age 25.

It is clear that Pacific ocean perch stocks from the eastern Bering Sea are at an extremely low level of abundance. On the basis of fishery information through 1974, it was estimated in the 1977 Preliminary Management Plan for the Trawl Fishery of the Bering Sea that equilibrium yield for Pacific ocean perch was only 6,500 mt. However, the all-nation catch for 1978 was only 2,200 mt, and in view of continued declines in CPUE through 1978, it is doubtful that current EY is any higher than 5,000 mt.

Aleutian Area

CPUE data from both the Japanese independent stern trawl fishery (Table I-12) and the landbased dragnet fishery (Table I-12) indicate that abundance has been fluctuating at a very low level since 1971 relative to earlier years. The CPUE of vessel classes 4 and 7 (301-500 gross tons and 1,500-2,500 gross tons, respectively) which have accounted for most of the annual catches of ocean perch by stern trawlers, declined sharply from 1968 to 1977 (Table I-12). On the basis of catch trends, it is believed that stock abundance in 1968 was already reduced considerably below that of earlier years.

Catch rates (kg per hour) continued to decline from 1977 to 1978 based on U.S. observer data collected aboard Japanese and Soviet trawlers in the as shown below:

	1977	1978
Japanese small trawlers	648	58
U.S.S.R. large trawlers	196	61

Length-frequency information also illustrates the poor condition of ocean perch stocks in the Aleutian area (Figure I-7). In the early years of the fishery (1964-67), the size composition in the Japanese catches was relatively stable and dominated by fish greater than 28 cm. After 1967, there was a large increase in the proportion of fish smaller than 28 cm, due in part to recruitment into the fishery of the strong year-classes of 1961 and 1962, and in part to a considerable reduction in abundance of larger perch. The abundance of older fish remained low through 1975. The reduced abundance of older fish in the 1970's as compared to the 1960's (Figure I-7) must lead to a reduced reproductive potential of the Aleutian area

TABLE I-12.--PACIFIC OCEAN PERCH CATCH AND EFFORT DATA FOR STERN TRAWLERS OF THE JAPANESE MOTHERSHIP-LONGLINE NORTH PACIFIC TRAWL FISHERY BY VESSEL IN THE ALEUTIAN REGION, 1968-78.

YEAR	VESSEL CLASS A/ 4	5	6	7	8	9
(A) CATCH IN METRIC TONS.						
1968	12,157	280	32	2,711	6,787	532
1969	7,290	440	0	4,839	1,125	144
1970	2,384	1,227	0	7,741	249	82
1971	3,322	889	1,038	4,984	2,249	449
1972	3,527	1,318	645	2,035	188	135
1973	4,596	0	995	1,881	0	0
1974	10,679	1,564	1,326	2,507	25	16
1975	3,916	972	764	1,815	666	0
1976	4,862	838	786	1,600	83	0
1977	2,802	771	219	580	37	0
1978	2,342	480	140	855	183	0
(B) FISHING EFFORT IN NUMBER OF HOURS TRAWLED.						
1968	8,575	155	8	216	759	772
1969	1,952	333	0	910	178	38
1970	1,755	600	0	976	161	25
1971	4,543	634	383	720	785	174
1972	6,533	546	492	388	114	56
1973	3,989	0	658	530	36	0
1974	13,908	1,816	964	529	70	22
1975	12,333	1,233	543	521	509	0
1976	10,179	897	698	561	251	0
1977	7,594	1,095	248	400	89	0
1978	8,820	957	206	595	315	0
(C) PERCENTAGE COMPOSITION OF TOTAL OCEAN PERCH CATCH BY VESSEL CLASS. B/						
1968	54	1	+	12	30	2
1969	51	3	0	34	8	1
1970	20	10	0	66	2	1
1971	26	7	8	38	17	3
1972	45	17	8	26	2	2
1973	62	0	13	25	0	0
1974	66	10	8	16	0	+
1975	48	12	9	22	8	0
1976	60	10	10	20	1	0
1977	63	17	5	13	1	0
1978	58	12	3	21	5	0
(D) CATCH IN MT PER HOUR TRAWLED.						
1968	1.4	2.4	4.0	12.6	8.9	0.7
1969	3.7	1.3	--	5.3	6.3	3.8
1970	1.4	2.0	--	7.9	1.5	3.3
1971	0.7	1.4	2.7	6.9	2.9	2.6
1972	0.5	2.4	1.3	5.2	1.6	2.4
1973	1.2	--	1.5	3.5	--	--
1974	0.8	0.9	1.4	4.7	0.4	0.7
1975	0.3	0.8	1.4	3.5	1.3	--
1976	0.5	0.9	1.1	2.9	0.3	--
1977	0.4	0.7	0.9	1.5	0.4	--
1978	0.3	0.5	0.7	1.4	0.6	--

A/ NO DATA FOR CLASSES 1, 2, AND 3 WHICH ARE MAINLY SIDE AND PAIR TRAWLS. 1973-1978 DATA CONVERTED TO PRE-1973 GROSS TONNAGE CLASSIFICATION OF

1 = 71-100	4 = 301-500	7 = 1501-2500
2 = 101-200	5 = 501-1000	8 = 2501-3500
3 = 201-300	6 = 1001-1500	9 = 3501 AND ABOVE

B/ TOTALS MAY FALL SHORT OF 100% BECAUSE OF ROUNDING METHOD.

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TABLE I-13. -- PACIFIC OCEAN PERCH CATCH AND EFFORT DATA OF STERN TRAWLERS OF THE JAPANESE LANDBASED DRAGNET FISHERY IN THE ALEUTIAN REGION, 1969-78.

YEAR	CATCH OF ALL SPECIES IN MT	CATCH OF PACIFIC OCEAN PERCH IN MT	PERCENTAGE OF POP IN TOTAL CATCH	TOTAL EFFORT IN HOURS	CPUE OF POP IN MT PER HOUR
1969	5,292	1,194	23	3,578	.33
1970	4,439	1,949	44	4,855	.40
1971	5,952	1,664	28	6,520	.26
1972	17,636	647	4	16,941	.04
1973	16,090	1,871	12	12,657	.15
1974	24,843	5,571	22	22,568	.25
1975	8,105	1,268	16	8,627	.15
1976	8,546	2,640	31	9,622	.27
1977	27,418	1,326	5	41,048	.03
1978	25,128	769	3	41,902	.02

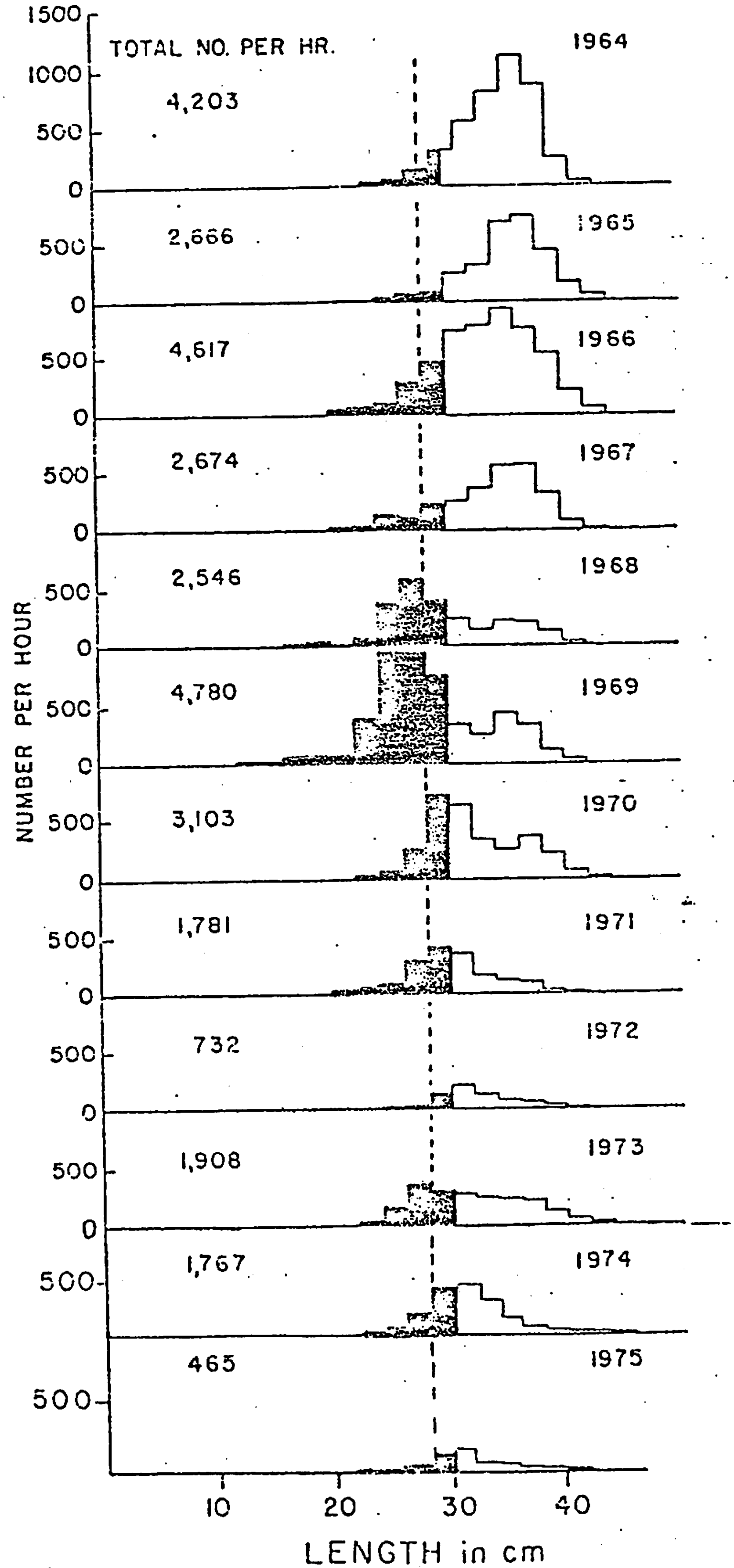

Figure I-7 .--Catch per unit effort by size increment for Pacific ocean perch harvested by stern trawlers of the Japanese mothership-longline North Pacific trawl fishery in the Aleutian Region, 1964-75.

perch stock. Recruitment of ocean perch to the fishery occurs at about 6-8 years of age; thus, year-classes spawned during the peak years of fishing (1964-66) would have appeared in catches beginning about 1970. As shown by CPUE values for small fish (less than 28 cm) in 1970-75, recruitment was relatively low with the 1975 catch rates the lowest on record (Figure I-7).

In summary, it is evident that Pacific ocean perch stocks in the Aleutian area are at an extremely low level of abundance with no evidence of strong recruitment in recent years. On the basis of fishery information through 1974, it was estimated in the 1977 PMP that EY is the Aleutians was 15,000 mt. Based on fishery information available since then, this EY appears too high. Both catch and CPUE have continued to decline through 1978 with no indication of strong year-classes coming into the fishery. It appears, therefore, that EY is currently no higher than 13,000 mt.

Other Rockfish

For this species category, there is little catch or biological information bearing on the condition of the stocks. Estimates of the foreign catch of "other rockfish" by U.S. observers (Nelson et al., 1978; 1979) for 1977 and 1978 are as follows:

Region	Catch (mt)	
	1977	1978
Eastern Bering Sea	47	12,155
Aleutians	7,680	8,737
Total	7,727	20,892

The much larger catch in 1978 over 1977 in the eastern Bering Sea undoubtedly represents an artifact of the sampling effort by observers rather than an increase of this magnitude in the actual catch. The 1978 estimate is based on coverage of vessels taking rockfish and is therefore assumed to be more representative of the actual catches taken in this region. The 1978 observer estimate of 12,000 mt also falls within the range of MSY (7,000-15,000 mt) estimated by Ikeda (1979) for the eatern Bering Sea slope region. It should be pointed out, however, that the all-nation catch of other rockfish as reported by foreign fisheries for the eastern Bering Sea was only about 4,900 mt in 1977 and 2,400 mt in 1978. Because of the limited and conflicting information available, it is difficult to estimate EY for other rockfish in the eastern Bering Sea. As a first approximation, the EY will be estimated as the lower end of the MSY range given by Ikeda (1979) or 7,000 mt.

For the Aleutian Island region, there is better agreement in catch data from the various sources. Respective observer and foreign reported catches of other rockfish were 7,700 and 7,000 mt in 1977 and 8,700 and 5,700 mt in 1978. All of these catch figures are well below estimates of MSY (23,000-45,000 mt) given by Ikeda (1979). The best estimate of EY for the Aleutian region is considered to be a mean of the above four catch figures or 7,300 mt.

I.6.3 Acceptable Biological catch

Pacific ocean perch

The Pacific ocean perch stocks of the Bering Sea/Aleutian Region are badly depleted, and current EY is believed to be no more than 5,000 mt in the eastern Bering Sea and 13,000 mt in the Aleutians. Since the stocks do not appear to be rebuilding at all at present catch levels, the ABC of Pacific ocean perch will be set at 20% of the current EY in order to begin an anticipated long rebuilding process and to balance that against severe economic dislocation in the foreign trawl fisheries. Therefore, ABC is 1,000 mt in the eastern Bering Sea (Statistical Areas I and II, combined) and 2,600 mt in the Aleutians (Statistical Area IV).

Other rockfish

Information is lacking to assess the condition of this resource. ABC will be considered equivalant to the rough estimates of EY--7,000 mt in the eastern Bering Sea and 7,300 mt in the Aleutian Island region.

I.7. Sablefish (Blackcod)

I.7.1 Maximum Sustainable Yield

The sablefish resource is found in waters off California, northward to the Gulf of Alaska, westward to the Aleutian Region, and into the Bering Sea. The sablefish found in these wide geographical regions are apparently genetically related in the sense that some migrations have been noted to occur between the regions. However, the degree of interchange between regions is noted to be small in relation to the stock size within each region which led Low et al. (1976) and Wespestad et al. (1977) to suggest that management of the resoruce be conducted by discrete geographical regions. These geographical regions are the eastern Bering Sea, the Aleutian Region, the Gulf of Alaska, waters off Canada, and waters off Washington to California.

Although the sablefish resource should be managed by regions, the long-term productivity in each region is probably related to the overall condition of the resource. Therefore, it is difficult to accurately estimate MSY within each region by using fishery information of that region alone. To reduce this problem, both Japanese and U.S. scientists have estimated MSY of the resource as a whole. The latest Japanese estimate of MSY for the entire resource from California to the Bering Sea was 69,600 mt (Anon. 1978). The current U.S. estimate of MSY, using essentaily the same general production model as the Japanese, but with a different weighting of data among regions is 50,300 mt (Low and Wespestad, 1979). The MSY estimate of 69,600 mt appears high in view of the fact that the highest catch of record is 65,500 mt (1972) and that average catches from 1968 to 1975 of 48,200 mt (Table I-13) have resulted in

TABLE I-13. -- HISTORICAL CATCHES OF SABLEFISH IN METRIC TONS BY AREA AND NATION, 1958-79.

	BERING SEA			ALEUTIAN REGION			
YEAR	JAPAN A/	USSR	TOTAL	JAPAN A/	ROK	USSR	TOTAL
1958	32	--	32	B/	--	--	B/
1959	393	--	393	B/	--	--	B/
1960	1,861	--	1,861	B/	--	--	B/
1961	26,182	--	26,182	B/	--	--	B/
1962	28,521	--	28,521	B/	--	--	B/
1963	18,404	--	18,404	B/	--	--	B/
1964	8,262	--	8,252	975	--	--	975
1965	8,240	--	8,240	360	--	--	360
1966	11,961	--	11,981	1,107	--	--	1,107
1967	13,457	274	13,731	1,383	--	--	1,383
1968	14,597	4,256	18,853	1,661	--	--	1,661
1969	17,009	1,579	18,588	1,804	--	--	1,804
1970	9,627	2,874	12,501	1,277	--	--	1,277
1971	12,410	2,830	15,240	2,571	--	170	2,741
1972	13,231	2,137	15,368	3,307	--	269	3,5[illegible]
1973	6,395	1,220	7,615	2,875	--	134	3,009
1974	5,081	77	5,158	2,506	--	14	2,520
1975	3,384	38	3,422	1,538	--	79	1,617
1976	3,267	29	3,296	1,573	--	61	1,634
1977	2,109	0	2,109	1,631	86	0	1,717
1978	1,007	0	1,139 C/	798	23	0	821
1979	1,071	49	1,389 D/	617	164	0	718

A/ JAPANESE CATCH IS REPORTED BY FISHING YEAR (NOVEMBER-OCTOBER); ALL OTHER CATCHES ARE REPORTED BY CALENDAR YEAR.
B/ INCLUDED IN THE BERING SEA CATCH TOTALS.
C/ INCLUDES 127MT BY ROK AND 5MT BY TAIWAN
D/ INCLUDES 6MT BY TAIWAN, 261MT BY ROK, AND 2MT BY POLAND
SOURCE: SASAKI, 1976 AND PERS. COMM., T. SASAKI, FAR SEAS FISHERY RESEARCH LAB., SHIMIZU, JAPAN. USSR DATA FROM U.S.-USSR FISHERY STATISTIC EXCHANGE.

continuing and rapid declines in CPUE (Table I-14); accordingly, the U.S. estimate of overall MSY is considered to be most appropriate--50,300 mt.

The U.S. estimate of MSY was apportioned to major regions according to historic catches: Bering Sea (25%), Aleutian region (4%), Gulf of Alaska (47%), and British Columbia-Washington region (25%). These apportioned MSY estimates were also compared to MSY estimates derived by applying general production models region by region. The comparisons show that MSY was 13,000 mt for the eastern Bering Sea and 2,100 mt for the Aleutian region (Low and Wespestad 1979).

TABLE I-14.-- SABLEFISH CATCH PER UNIT EFFORT TRENDS IN THE EASTERN BERING SEA AND ALEUTIAN REGION.

	EASTERN BERING SEA				ALEUTIAN REGION				
	CPUE 1	CPUE 2	CPUE 3	CPUE 5	CPUE 1	CPUE 2	CPUE 3	CPUE 4	CPUE 5
1964	61	93	2.4		139	141	3.1		
1965	54	105	3.0		110	183	4.1		
1966	139	166	4.5		229	233	6.3		
1967	210	216	6.2	151	277	275	7.1		154
1968	143	140	5.1	134	165	161	5.9		259
1969	189	187	6.9	142	184	183	7.1		318
1970	231	241	8.7	50	189	241	9.4		112
1971	120	185	5.6	76	165	202	9.4	4.5	222
1972	50	117	3.3	62	203	208	11.6	11.8	123
1973	47	148	6.0	41	192	204	7.7	4.6	115
1974	141	164	7.4	24	187	208	7.8	4.4	44
1975	68	131	4.9	13	98	168	6.0	1.8	30
1976	69	147	5.6	6	71	114	4.5		7
1977	73		5.4	4	70	108	4.0	1.1	4
1978	16			1	24				17

CPUE 1: U.S. ESTIMATE, KG PER 10 HACHI LONGLINE UNITS
CPUE 2: JAPANESE ESTIMATE, KG PER 10 HACHI LONGLINE UNITS
CPUE 3: JAPANESE ESTIMATE, MT PER VESSEL-DAY FISHING BY LONGLINERS
CPUE 4: U.S. ESTIMATE, MT PER VESSEL-DAY FISHING BY LONGLINERS
CPUE 5: U.S. ESTIMATE, KG PER HOUR TRAWLING BY LAND-BASED STERN TRAWLERS

DATA SOURCES: CPUE 1, CPUE 4, AND CPUE 5 FROM LOW(1977)

CPUE 2 AND CPUE 3 FROM ANONYMOUS(1978b)

I.7.2 Equilibrium Yield

Catch and CPUE trends clearly indicate that sablefish stocks in the eastern Bering Sea/Aleutian Region are considerably reduced in abundance when compared to earlier years of the fishery. CPUE data analyzed by different procedures by U.S. and Japanese scientists both show declining trends in catch rates (Table I-14) but the trends in the U.S. analysis are much more severe.

The main difference in CPUE computations was the interpretation and selection of appropriate fishing effort. U.S. scientists attributed all longline fishing effort to sablefish since that is the target species of the fishery. Japanese scientists selected only that portion of the time spent fishing by excluding time spent for traveling, loading, weathering storms, repairs, and other activites not considered to be associated with productive fishing.

Eastern Bering Sea

Although differences in U.S. and Japanese CPUE values have not been rectified, it is important to note that both catch (Table I-13) and longline CPUE (standardized to 100 units for 1970 from Table I-14) have declined substantially in the eastern Bering Sea since 1970:

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Catch	12,500	12,200	15,400	7,600	5,200	3,400	3,300	2,100	1,100
CPUE	100	64	36	50	71	46	52	48	---

A CPUE value is not calculated for 1978 because of major changes in the fishing pattern brought about by fishing regulations. Analysis of catch and CPUE trends for 1977, Low et al. (1978) determined that EY for sablefish in the Bering Sea was 3,500 mt--the average catch for 1974-77.

U.S. observer data show higher abundance of small sablefish (38-50 cm) in Area I (east of 170°W) of the Bering Sea in 1978 than in 1977 (Bakkala et al., 1979). This increase in abundance of juvenile fish has also been noted in U.S. and Japanese research vessel surveys (data on file, Northwest and Alaska Fisheries Center, Seattle; Sasaki, 1979). These observations suggest an improvement in the sablefish resource in the future.

Currently, however, long-term trends in catch and CPUE indicate that abundance of the adult stock remains low. Sablefish are not known to spawn in the Bering Sea, and most of the fish in the eastern Bering Sea are probably recruited from the Gulf of Alaska. Because EY in the Gulf of Alaska has declined 25% from 1976 to 1978, it is likely that EY in the Bering Sea has also declined correspondingly over the same period to 2,600 mt.

Aleutian Region

As in the eastern Bering Sea, both catch (Table I-13) and longline CPUE (Standardized to 100 units for 1972 from Table I-14) have declined:

	1972	1973	1974	1975	1976	1977	1978
Catch	3,600	3,200	2,500	1,600	1,600	1,700	800
CPUE	100	86	86	60	43	40	---

Comparable CPUE information for 1978 cannot be compiled, for the same reasons given for the eastern Bering Sea. However, data collected from Japanese longliners by U.S. observers show that CPUE declined by more than 50% from 1977 to 1978:

	1977 (September)	1978 (June-September)
Sablefish CPUE (kg/1,000 hooks/day)	6.814	3.116
Average depth per set (m)	593	509
Most abundatn species caught	Greenland turbot	Pacific cod
Second most abundant species	Sablefish	Sablefish

This decline in CPUE may not accurate reflect changes in overall sablefish abundance because the time period and average depths of fishing differed in the two years.

Although changes in fishing patterns brought about by U.S. fishing regulations may account for some of the recent decline in CPUE, the long-term nature of the decline indicates that abundance is reduced throughout the North Pacific. As in the case of the eastern Bering Sea, it is likely that EY in the Aleutian Area has declined 25% from 1,500 mt to 1,100 mt.

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I.7.3 Acceptable Biological catch

Sablefish stocks in this Region have been overfished and are not now capable of producing MSY. The source of recruitment to these stocks is not known; neither eggs nor larvae of sablefish have been detected in the Region. It is probable, therefore, that recruitment comes from reproduction in the Gulf of Alaska. Accordingly, because EY in the Gulf of Alaska declined 25% from 1976-78, a corresponding decline is assumed to have occurred in the eastern Bering Sea and Aleutians. ABC is, therefore, considered equivalent to EY-2,600 mt in the eastern Bering Sea and 1,100 mt in the Aleutian Area.

I.8 Atka Mackerel

1.8.1 Maximum Sustainable Yield

The fishery for Atka mackerel is relatively new and has been conducted primarily by the U.S.S.R. The main fishing area is the western Aleutian Islands, with small amounts taken in the eastern Bering Sea. Reported catches have been as follows:

Year		1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Catch(mt):	U.S.S.R.	949	---	5,907	1,712	1,377	13,326	13,126	20,975	22,600	20,277
	Japan									1,531	1,656
	R.O.K.									97	1,329
	Poland										2
	Total									24,228	23,264

MSY in the Bering Sea/Aleutian Region has been tentatively estimated at 33,000 mt by Soviet scientists. These estimtes were based on Soviet hydroacoustic-trawl surveys in the Aleutian area in 1974 and 1975 which produced biomass estimates of 35,000-110,000 mt, of which 30% or 10,500-33,000 was assumed to be exploitable. Because neither the Soviet data nor the analytical procedures used to estimate biomass and sustainable yield have been available to scientists of other countries, these estimates must be considered provisional.

I.8.2 Equilibrium Yield

Biological and catch and effort data collected by U.S. observers aboard Soviet vessels have revealed that mean length, weight, age and CPUE were similar in 1977 and 1978, but improved in 1979 (Table I-15). This improvement was partially due to the development of new fishing grounds in the vicinity of Seguam Island, in the eastern Aleutians. Fishing has previously been conducted principally in the western Aleutians. Because of the provisional nature of the MSY estimate and the limited fishery and biological data available for Atka mackerel, it is neither possible to estimate EY nor to determine whether current EY is equal to or less than MSY.

Table I-15.--Mean age, length, weight, and CPUE of Atka mackerel fisheries.

Parameter	YEAR				
	1977	1978	1979		
			(all areas)	(W. of 180°)	(E. of 180°)
Mean age	2.50	2.50	2.90a/	3.40	2.50
Mean length (cm)	29.30	29.40	32.90	31.20	33.30
Mean weight (kg)	0.27	0.27	0.46	0.35	0.49
CPUE (mt/hr)	5.30	4.50	7.80	--	--
Sample size	14,529	12,474	7,290	1,515	5,775

I.8.3 Acceptable Biological Catch

In the PMP for 1977 and 1978, the allowable catch of this species was set at 24,800 mt, 75 per cent of the unverified Soviet estimate of MSY of 33,000 mt. The information currently available provides no biological basis for changing this allowable catch; accordingly ABC is equivalent to the 1977-78 allowable catch of 24,800 mt.

I.9 Squid

I.9.1 Maximum Sustainable Yield

Virtually nothing is known about the distribution and abundance of squid in the eastern Bering Sea and Aleutians. Some elements of the Japanese fishery have targeted on squid with the principal species in catches Gonatus magister and Onychoteuthis borealijaponicus. G. magister is the principal species taken in the eastern Bering Sea and O. borealijaponicus the principal species in the Aleutians. Combined all-nation catches from the eastern Bering Sea and Aleutians in 1977 and 1978 were as follows:

Nation	1977	1978	1979
Japan	8,316	9,138	5,739
R.O.K.		215	1,233
Taiwan		35	14
U.S.S.R.		23	6
Poland			25
Total	8,316	9,411	7,017

I.9.2 Equilibrium Yield

Catches of 10,000 mt are believed to be sustainable.

I.9.3 Aceptable Biological Catch (ABC)

ABC is equivalent to the minimal estimate of MSY--10,000 mt.

I.10 Pacific Halibut

I.10.1 Maximum Sustainable Yield

Dunlop et al. (1964) estimated that MSY was about 3,000 mt (round weight) in the southeastern Bering Sea (IPHC Areas 4A and 4B).

Historically, this area has been the most productive for the North American setline fishery, and the MSY for the entire eastern Bering Sea (east of 175°W) probably is no more than 5,000 mt. Estimates of MSY are not available for the western Bering Sea as the North American setline catch in this area has been minor (less than 300 mt). Relatively large catches of halibut (over 3,000 mt) in the western Bering Sea were reported by the Japanese setline fishery in the early 1960's. MSY has not been estimated for the Aleutian area; stocks are small relative to those in the Bering Sea and are considered to be a component of stocks in the Gulf of Alaska.

I.10.1 Equilibrium Yield

Halibut stocks have declined sharply in the eastern Bering Sea since the early 1960's. This is indicated by a decline in CPUE in the North American setline fishery (IPHC 1977) and by IPHC surveys of juvenile halibut (Best 1977). Since 1970, stocks of adult halibut appear to have stabalized at a low level and the North American setline catch has averaged about 300mt. The incidental catch of juvenile halibut in the eastern Bering Sea peaked in 1971 at about 7,000 mt but has declined since then. Recent surveys indicate an increase in the abundance of juveniles, but abundance is still below that in the early 1960's, and the increase will not benefit the setline fishery for several years. Therefore, the equilibrium yield available to the North American

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setline fishery probably is about the same as the present level of catch, and is well below MSY.

The EY in the western Bering Sea and Aleutians is unknown but probably substantially below MSY.

I.10.3 Acceptable biological Catch

ABC and OY for Pacific halibut are not applicable to this Plan.

I.11.1 Other Included Species ("Others")

This category includes all species of finfishes taken by trawls and setlines <u>except</u>: pollock, rockfishes, soles and flounders, sablefish, cod, Atka mackerel, herring, and salmon.

Virtually nothing is known of the population structure, biological attributes, or potential yield of the individual components of this category; therefore, only a pragmatic appraisal of "MSY" is possible.

During the last 5 years of record, the catch of this category has averaged about 4% with highs of 5-8% of the combined catch of the other, specified groundfish species. During that period, no indication of declining abundance has been noted; accordingly, it is assumed that the aggregation of stocks in the "others" category can sustain removals equal to at least 4% of the total catch of the specified species as long as that catch remains less than the 1972 peak of 2,234,500 mt.

Accordingly, "MSY" of this category is considered to be - 0.04 x 2,234,500 - 89,400 mt.

I.11.2 Equilibrium Yield

"MSY" is believed attainable.

I.11.3 Acceptable Biological Catch

ABC is considered equal to MSY = 89,400 mt.

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STATUS OF STOCKS - Pacific cod

I.5 Pacific Cod

I.5.1 Maximum Sustainable Yield

Pacific cod are distributed widely over the Bering Sea continental shelf and slope, and have a distributional pattern similar to that of pollock. During the early 1960's, when a fairly large Japanese longline fishery operated on the continental slope, cod were harvested by longliners for the frozen fish market. Beginning in 1964, the Japanese North Pacific trawl fishery for pollock expanded, and cod became an important incidental catch in the pollock fishery. At present, cod are believed to be an occasional target species when high concentrations are detected during pollock fishing operations.

The annual catch of Pacific cod by all foreign nations in the eastern Bering Sea and Aleutians increased from 13,600 mt in 1964, to about 70,400 mt in 1970; since then, catches have varied between 36,600 and 63,800 mt (Table I-9). Japan has accounted for 66-99% of the catch since the U.S.S.R. began reporting their catches of cod in 1971.

The incidental occurrence of cod in foreign trawl catches makes questionable the use of CPUE trends from the commercial fishery. Moreover, the semi-demersal distribution of cod makes them difficult to assess with research vessel trawls. MSY for this species has, therefore, been estimated on the basis of commercial catch data. Because catches increased rapidly in the mid-1960's and then stabilized, the average catch during this period of stability (1968-76) was assumed to reflect at least a minimal estimate of MSY. The original estimate was 58,700 mt, but this figure includes catches from west of 180° which lies outside the U.S. FCZ. A more appropriate estimate, including only those catches within the FCZ from the eastern Bering Sea (east of 180°) and Aleutian Islands area, is 55,000 mt.

Table I-9.--Foreign calendar year catches (mt) of Pacific cod by area and nation, 1964-78.

Year	Eastern Bering Sea						Aleutian Island Area					E. Bering Sea and Aleutian Comb. Total
	Japan		USSR	ROK[c]	ROC[d]	Total	Japan		USSR	ROK	Total	
	MS-LG-NPT[a]	LBD[b]					MS-LG-NPT	LBD				
1964	13,408	-	-			13,408	241	-	-		241	13,649
1965	13,524	1,195	-			14,719	414	37	-		451	15,170
1966	17,178	1,022	-			18,200	103	51	-		154	18,354
1967	30,502	1,562	-	-		32,064	153	140	-	-	293	32,357
1968	52,135	5,767	-	-		57,902	121	168	-	-	289	58,191
1969	44,871	5,480	-	-		50,351	204	16	-	-	220	50,571
1970	61,015	9,079	-	-		70,094	221	62	-	-	283	70,377
1971	32,206	8,362	2,486	-		43,054	263	162	1,653	-	2,078	45,132
1972	33,715	2,162	7,028	-		42,905	233	202	-	-	435	43,340
1973	38,137	2,680	12,569	-		53,386	295	271	411	-	977	54,363
1974	42,741	3,174	16,547	-	-	62,462	651	683	45	-	1,379	63,841
1975	32,092	1,230	18,229	-	-	51,551	2,470	111	257	-	2,838	54,389
1976	29,627	2,382	17,756	716	-	50,481	3,688	174	312	16	4,190	54,671
1977	29,682	3,459	177	-	2	33,320	1,533	1,629	100	-	3,262	36,582
1978	36,513	4,721	419	859	-	42,512	1,460	1,705	120	6	3,291	45,803

a/ Mothership, North Pacific longline, and North Pacific trawl fisheries.

b/ Landbased dragnet fishery.

I.5.2 Equilibrium Yield

Accumulating evidence since 1978 indicates that the abundance of Pacific cod is increasing and that this increase may be substantial. The relative abundance of cod more than doubled between 1976 and 1978 based on NMFS research survey data, and in 1978 there appeared to be unusually high abundance of age 0 and age 1 cod (year-classes 1977 and 1978) in the research vessel catches (Bakkala et al., 1979). These year-classes as age 1 and age 2 fish were also abundant in research vessel catches during the large-scale survey of the eastern Bering Sea in 1979. Based on data from the large-scale OCSEAP survey in 1975 and using data from an equivalent area in 1979 indicates that the CPUE of cod apparently increased by a factor of approximately 7 between 1975 (2.7 kg/km) and 1979 (19.8 kg/km).

Age data from the commercial fishery indicates that the abundance of a cod cohort peaks in the fishery at age 3, contributes substantially to catches at age 4, but that abundance declines sharply at ages 5 and 6. The 1977 and 1978 year-classes will, therefore, make their greatest contribution to the fishery in 1980-82.

The estimated biomass of cod from the 1979 survey was 792,300 mt with a 95% confidence interval of 603,200-981,400 mt. About 81% of the total biomass was made up of age groups 1 and 2 which are only partially recruited to the fishery.

Using population estimates by age from the 1979 NMFS survey, historical growth rates, a range in instantaneous natural mortality rates of 0.5-0.7, and various possible fishing mortalities by age, the projected biomass of cod in 1980 and 1981 has been calculated. These projections indicate that the exploitable biomass (age group 2-5) in 1980 and 1981 may fall within the following ranges:

Year	Predicted Range in Biomass (mt)
1980	740,000-910,000
1981	803,000-1,248,000

Conservatively using the lower end of the projected range in biomass and an exploitation rate of 20%, the estimated EY is 148,000 mt in 1980 and 160,000 mt in 1981.

I.5.3 Acceptable Biological Catch

ABC will exceed estimates of MSY in 1981 due to the recruitment of the strong 1977 and 1978 year-classes. Since natural mortality will rapidly reduce the abundance of these year-classes after age 4, it is prudent to harvest the 1977 and 1978 year-classes during the short period they remain in the fishery. However, due to the possible inaccuracies in the 1979 biomass estimate and in the projections of this estimate to 1980-81, ABC is set at 75% of the projected EY for 1981--0.75 x 160,000 = 120,000 mt.

SCIENTIFIC & STATISTICAL COMMITTEE REPORT

BERING SEA PACIFIC COD

The SSC reviewed a report by Jay Hastings regarding the problem of the high incidental catch of Pacific Cod in the Bering Sea which will result in premature closure of the fishery. Mr. Hastings requested that the SSC review the biological aspects of increasing the OY of the species.

The SSC reviewed the biological data provided to us with the proposed amendments to the groundfish plan. We conclude that based upon these data that the abundance of Pacific cod has greatly increased. Using the procedure provided in the draft amendments, the 1980 ABC would be 111,000 mt. This will allow an increase of the current ABC by 52,000 mt without any harmful effect on the biology of the resource.

The SSC does express concern to the Council on how the allocation of this additional resource is made. For example, the effect of this large allocation on the Japanese ex-vessel price of Pacific cod is unknown. It is suggested that caution be exercised in granting this request, since Japan is a likely market for Pacific cod caught by U.S. fishermen.